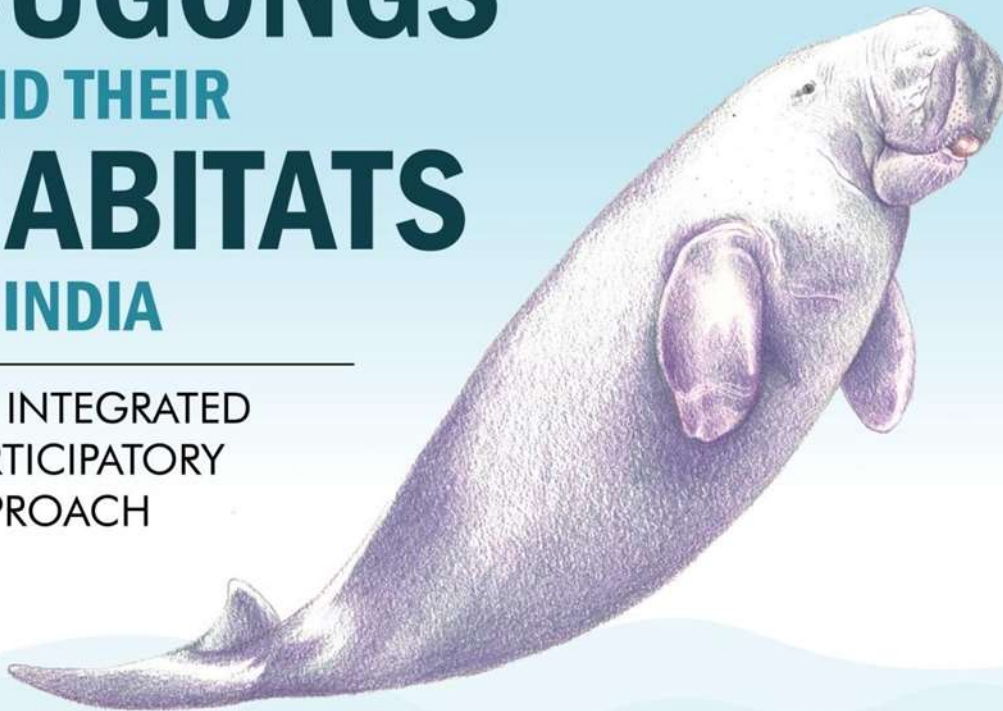


ANNUAL
PROGRESS
REPORT III

RECOVERY OF
DUGONGS
AND THEIR
HABITATS
IN INDIA

AN INTEGRATED
PARTICIPATORY
APPROACH



JUNE 2018 - JULY 2019

**Recovery of Dugongs and their habitats
in India An integrated participatory
approach**

Project Duration:	5 years (2016 – 2020)
Total Budget (5-year):	23.58 crore INR
Year 1 release:	5.17 crore INR
Implementing agencies:	Tamil Nadu Forest Department (TNFD) Department of Environment & Forest, Andaman & Nicobar (ANFD) Gujarat Forest Department (GFD) Indian Coast Guards (ICGS) Indian Navy
National Partners:	Zoological Survey of India (ZSI) Indian Institute of Science, Education and Research, Kolkata (IISER-K) National Centre for Sustainable Coastal Management (NCSCM), Central Marine Fisheries Research Institute (CMFRI), Kochi Bombay Natural History Society, Mumbai
Regional Partners:	State Fisheries Department GEER Foundation Centre for Environment Education (CEE) Wildlife Trust of India (WTI) OMCAR Foundation Suganthi Devadasan Marine Research Institute (SDMRI) Andaman Nicobar Environment Team (ANET) Marine Police
International Partner:	Memorandum of Understanding on the Conservation and Management of Dugongs and their Habitats (Dugong MoU) Signatories
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An update of the Project

Executive Summary

1. **Dugong** (*Dugong dugon*), also called 'Sea Cow', occurs in Andaman and Nicobar Islands, Gulf of Mannar, Palk Bay, and Gulf of Kutch in India. These marine mammals are herbivores which spend their full life in the sea. They are the only extant species of the family Dugongidae. All existing members of the order Sirenia (including the Dugong) are listed as vulnerable to extinction. All populations of Dugong are also listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and Appendix II of the Convention on Migratory Species (CMS). Several reasons have been attributed to their population decline, some of which include seagrass habitat loss and degradation, gill netting, disease, chemical pollutants, consumptive use, and hunting.

2. **Major objectives** of this program is to a) Assess dugong population status through advanced census techniques and determine its abundance and distribution, identify critical habitats, classify threats and develop site-specific monitoring plan to reduce poaching and incidental entanglements, b) Characterize the critical dugong habitats, reduce direct and indirect threats, c) Raise awareness on the species and encourage the participation of the local communities; and d) Enhance the capacity of the State Forest Department staff and develop/implement smart patrolling tools to improve protection enforcement; train forest staff and local communities in underwater surveys for long-term habitat monitoring.

3. **A participatory approach** to recover dugongs and their habitat in India: Year 2018-19 was excellent because of active involvements of major stakeholders in this project. All state Forest Departments, Indian Navy, Coast Guard, Marine Police, State Fisheries Departments, State Education Departments, local universities and NGOs could actively participate in implementing this project in the field that not only helped to minimise the dugong mortalities and helped to conserve overall marine biodiversity of the region. We involved the Indian Navy, the Coast Guard, Fisheries and Marine Police personals in our volunteering network by conducting several short orientation workshops with them on dugongs and seagrasses. For example, 15 Indian Navy officers from INS-Utkrosh participated in the program where the CAMPA-Dugong team (ANI) briefed them about basic data documentation on sighting a dugong and other marine mammals in the logbooks distributed. Similarly, integrated trainings towards marine biodiversity monitoring and management was given to group of frontline staff from Forest, Fisheries, Marine Police and local youths in all three regions. An orientation program was conducted with the glass bottom boat operators, to sensitize them about the importance of this stretch for dugongs in terms of controlled boat speeds when a dugong is spotted. Further, these operators were included as a part of the dugong monitoring network. All these efforts helped us in reporting of dugongs by these trainees including fishermen from these regions otherwise those sightings were never reported earlier. Further, volunteer release of incidentally captured dugong by fishermen, identification of leaking site of dugong in Palk Bay, sightings of dugongs by Navy and Coast Guard are all few examples for the outcomes of this participatory approach.

4. **Partnership** with the Indian Navy, the Indian Coast Guard, and Marine Police, in the monitoring of dugongs and their habitat in India: Several meetings and orientation trainings were organized at field site offices of the Indian Coast Guard and Indian Navy at Andaman, Gujarat and Tamil Nadu. Sightings of dugongs by these organizations have been compiled and filed. Dugong monitoring logbook has been developed for involving stakeholders to help to generate ground information on marine megafauna in and around critical Dugong habitats. Orientation workshop with the Indian Navy INS-Utkrosh was conducted

in Port Blair. Our team did a follow-up program with the Navy unit at Port Blair, INS Utkrosh. We briefed them about basic dugong biology, threats, and critical areas for dugong distribution. INS-Utkrosh and ships of local Flotilla under the naval component have been involved in our dugong volunteering program.

5. Dugong Scholarship Programme: One of the best components of the project that helped us to reach out the parents of school going children of fishing communities. Under the Project's **outreach and awareness** component, a unique participatory program, the Dugong Scholarship Scheme was started to engage local fisherfolk communities at the grass-root level. This program targets school-going children of local communities (most of them are fisherfolk) and provides them with a scholarship of Rs. 500 / month for two years to support their education. We have identified a total of 253 school students at Tamil Nadu, Gujarat, and Andaman & Nicobar Islands, through a competitive written examination followed by several participatory programs conducted at schools to raise awareness about Dugong and seagrass conservation. The students selected through the process have been identified as Dugong Ambassadors and have become part of an extensive Dugong Volunteer Network, alternatively known as Friends of Dugong network. This multi-pronged strategy involves school children in Dugong conservation awareness activities. It integrates their families as part of the broader network of forest department frontline staff, divers, tourist boat operators, and coastal village communities. This network provides us with information on dugong sightings/stranding as well as participates in outreach events for generating awareness in the areas of Dugong occurrence. With continuous streaming of data on dugong distribution or stranding, the field team and forest department are enabled to respond swiftly and initiate necessary action on the ground.

A total of 153 students were selected under this program in the Phase-I starting from July 2017. Out of these, 57 from Andaman & Nicobar Islands, 53 from Tamil Nadu, and 40 students were selected from Gujarat field sites. Under the phase-II, 100 more students from Tamil Nadu and 46 students from Andaman & Nicobar Islands and 22 students from Gujrat have been selected as Dugong Ambassadors in 2019.

Outcomes of this programme include the volunteer release of entangled dugongs into the sea, reporting of dugong sightings from the sea, reporting of dugong stranding by fishermen, reduction in the poaching incidents of dugongs, reporting of poaching by fishermen, reduction in the illegal collection of other protected marine animals, etc. Thanks for all three State Forest, Fisheries and Education Departments especially the frontline officers at Gulf of Kutch NP, Gulf of Mannar BR, Palk Bay, Andaman and Nicobar Islands that helped the WII Team to successfully implement this programme.

6. Capacity building: The Dugong recovery program has been supported by multiple stakeholders across the country. As part of the participatory management initiatives, the capacity of concerned stakeholders must be enhanced to actively partake in conservation activities in progress throughout the dugong range states. In 2017-19, a total of 20 training programs was conducted; about 400 forest department staff were trained for underwater marine biodiversity programs. The course included **illegal Trade in Wildlife and Role of Wildlife Forensics in Dealing with Wildlife Crime and SCUBA diving** and underwater marine biodiversity monitoring, **Orientation workshop on importance, and conservation implications of marine life in the Islands, Dugong ambassador Refresher Course, Orientation workshop for handling marine mammal stranding. The training mainly involves an introduction to tools and techniques (snorkelling, boat survey methods, and handling equipment and seagrass mapping by random quadrat method,** forest management practices in protected marine areas and identifying living organisms in the sea), used to carry out research and monitoring in the coastal environment. Common animals and shore types were shown and explained to them, such as sandy shores, coral reefs, and seagrass beds. The effective capacity building benefits both the partners and

local stakeholders by generating inclusive processes that strengthen trust and build commitment and good relationships. With continuous streaming of information on dugong distribution and stranding, the WII field team and forest department have been enabled to respond swiftly and initiate necessary action on the ground. **The project has also supported the one week refresher training courses of IFS officers on 'Marine Biodiversity Management in India' with support from R&T Division, MoEFFCC**

8. Creating awareness about Dugong and their habitats: The outreach programs consisted of a community workshop, presentations, street plays, rallies, beach clean-up activities, exhibitions, TV shows, radio programs, etc. total of 127 outreach programs were conducted during 2018-19 in all three sites and covered over 10,000 people. With continuous streaming of information on dugong distribution and stranding by this network helped the field team and forest department have been enabled to respond swiftly and initiate necessary action on the ground.

Dugong monitoring logbook has been developed for involving state forest department, Indian Coast Guard, Indian Navy, State Fisheries Department, Marine Police, fisherfolks to generate ground information on marine megafauna in and around critical Dugong habitats.

The comic book, My friend Dugong written by Shri. Chanchal Singha Roy, a school teacher in the Andaman & Nicobar Islands, we shared a heart-warming *story* of the friendship between a *boy* Lingaraju and a Dugong from the Andaman Islands. We have translated the comic book into six languages; this book will be distributed in every school library of the three dugong ranging states.

The seagrass field guide for India will be developed and published. This Guide will be a fundamental step forward in understanding and managing seagrass species and habitats.

9. Friends of Dugong: Under the Friends of Dugong initiative, several coastal communities have become part of this integrated participatory effort to conserve dugongs. Various community-level initiatives have been undertaken to involve villagers, fisherfolk and other resident stakeholders in the project activities for dugong conservation. These activities include awareness presentations/talks at community centers, schools and colleges, beach clean-up rallies, snorkelling/SCUBA diving orientation sessions, community workshops on dugong conservation, consultations with fisherfolk representatives and village heads, felicitation programs for proactive volunteers and field visits.

10. Rescue and release of Dugongs: Continuous coordination and awareness meetings with fishermen community by CAMPA Dugong team and Tamil Nadu State Forest Department (TNSFD) led to a successful rescue of three Dugong, which was entangled in a fishing net by fishermen on 26th July 2018 and 1st November 2018 in Keezhathottam, Rajamadam, Palk Bay Ammapattinam on 14th March 2019. Incentives to compensate the fishing net and one day labour of five fishermen costing about Rs.6000 would be paid to those fishermen who rescued and released back Dugong, from the CAMPA Project. So far, Ten dugongs have been successfully rescued and released back by fishermen with the help of CAMPA-Dugong Team, Tamil Nadu Coastal Security Group, State Forest Department, Marine Police, OMCAR Foundation, etc

11. Field activities at the Gujarat coast: Seagrass surveys were conducted from pre-winter (November) to pre-monsoon (May) season of 2019. Several new meadows, homogenous as well as patchy, were located at islands Pagar (Hadkiwala and Betiwala reefs), Chusna (Chepri reef) Nakya reef, Bhaidar, and

Noru (Tam reef). Total of 43 Awareness programmes was carried out in Gujarat. Around 3000 personnel participated in the awareness programmes.

A drifting dead dugong was found near Maan and Marudi Island in November 2018. The information was received from a fisherman who is a part of the Dugong volunteer network. Boats were set out in a strategic manner to access the stranding prone areas for the animal.

Trials for interview surveys using an unstructured questionnaire were carried out with fishers of village Balapur, Beyt Dwarka, to understand the technicalities of their fishing ways, their direct or indirect contact with regional marine fauna and their perception towards dugongs and their current status in the Gulf of Kutch.

Based on current understanding, concentrations of pollutants detected in sediments and seagrasses need further study and monitoring. Sediment and seagrass samples were collected from seven Islands from the Gulf of Kutch region in March-April 2019 and analysed for residues of 12 Polychlorinated biphenyls (PCB) congeners. Σ PCBs concentration in the sites ranged from 3.105-57.175 ng/g dw @ 1% TOC in sediments were found to be higher than the threshold limit (29 ng/g dw @ 1% TOC) set by the standard guidelines in coastal sediment. Four species of seagrasses were analysed across the seven islands. The concentration of total PCB in seagrasses were found to be between 6.568251.751 ng/g dw in *Halophila ovalis* species, 8.608-23.232 ng/g dw in *Halodule uninervis*, 12.002 ng g/1 dw in *Halophila decipiens* and 48.744 ng/g dw in *Halophila beccarii*, which is higher than permissible threshold (same as sediment). Of all the PCBs congeners detected, PCB52 was found to be in the highest concentration followed by PCB28, PCB77, PCB101, PCB153, PCB138, PCB187, PCB126, PCB180, PCB118, PCB44 and PCB105. Since the dugongs mostly feed on seagrass, the higher levels of PCB congeners in seagrass species, especially higher accumulation capacity of PCBs in *Halophila ovalis* species is a matter of concern. It is likely that PCBs may be moving up the food chain and accumulating in dugongs and thus may pose a threat to the health and population of this species.

During the exploratory seagrass surveys, the team discovered feeding trails of dugongs, as they move whilst excavating seagrasses along with the rhizomes and roots. The length, width, and depth of the trails were measured on the field. The first feeding grounds that were found on a Chepri reef. Feeding grounds and seagrass composition found on Bhaidar Islands' reef confirm their prediction made via qualitative analysis of last year's dead dugong stranding (n=2). Waypoints were taken separately for individual trails (<3) and multiple trails (>3). All of the foraging grounds have young stands of *Halophila* and *Halodule* sp. of seagrasses growing. A comparative habitat analysis shall inform more on the preference of meadow characteristics of dugongs in the GoK.

Boat surveys were conducted in the sampled grids, which strategically covered the surveyed seagrass beds around Beyt Dwarka, Pagar, Chusna, Bhaider, Ajad, and Noru islands. The main objective was to identify the threats for Seagrass meadows, dugongs, and other marine megafauna.

12. Field activities at Andaman and Nicobar Islands: We carried out questionnaire-based surveys with the local fisher communities of Shaheed dweep and Swaraj dweep from 8th march to 25th March 2019 to understand their perception towards dugongs and seagrasses, gain secondary information on the distribution and fisheries aspect of their profession.

We used the systematic Line Intercept Technique (LIT) to assess seagrass meadow characteristics such as species composition, seagrass cover, shoot density, shoot height, biomass, and algal cover. We conducted seven transects near four islands and recorded the presence of 3 seagrass species, namely *Halophila ovalis*, *Thalassia hemprichii*, and *Halodule uninervis*. The highest number of seagrass species were found at Tarmugli.

Boat surveys were conducted in Mahatma Gandhi Marine National Park and critical dugong habitat in Ritchie's Archipelago, South Andaman in March to April 2019 to map the threats in terms of boat traffic and plastic pollution as few islands in the region are known to have healthy seagrass meadows forming an important habitat for dugongs. The information generated through these surveys will highlight the areas where boat traffic and dugong habitats overlap, giving us an idea of critical areas to be managed. We sampled 25 grids inside the Mahatma Gandhi Marine National Park, out of which 12 were near shore and 13 offshore. Plastic was mostly found in near-shore grids, and fishing vessels sighted were passing through the National Park boundaries to fish in the deeper waters beyond the Park boundaries.

The methodology to assess fish fauna associated with seagrass was standardized. In August 2018, a sub-adult dugong was stranded ashore in Laxmanpur Beach of Shaheed Island. After taking morphometric measurements and conducting a necropsy to understand the cause of death, tissue samples were collected by the project team in ANI for genetic analysis. This is the first study on dugong genetics from the Islands.

Aerial surveys are the most efficient way of estimating the population of marine mammals. Pilot drone surveys were conducted for understanding distribution of dugongs and seagrasses at two critical dugong habitats viz; Mahatma Gandhi Marine national park and Rani Jhansi marine national park.

13. Field activities at Tamil Nadu: Three mass boat surveys were conducted in Mandapam, Ammapattinam, and in North Palk Bay. Each boat was led by a researcher from our team, a forest guard, a boatman, and one or 2 others from the fishing community to help in an efficient sighting of marine megafauna and plastic. Sea state was not favourable during this survey. No Marine mammals were sighted during this survey.

A total of nine endoparasites specimens were recovered from two stranded Dugong's stomachs, foregut and hindgut. The further parasitological examination will be conducted.

During an exploratory survey at Mandapam, Palk Bay, the WII team observed bleached corals in the region. This was reported to the Forest Department as a possible bleaching event. The same was confirmed by Suganthi Devadasan Marine Research Institute (a Tuticorin-based NGO) during their surveys.

24 fishing villages in Thanjavur district, 30 in Pudukottai and 11 villages in Ramanathapuram District were surveyed for basic information about each villages (names of Village Headman, Fishery Society Head, number of fishers, number of fishing families, number of traditional, motorized and mechanized boats) and to initiate the creation of a database for all the coastal villages of the Tamil Nadu field site.

To understand diversity and usage seagrass meadows by fish, point counts were conducted in Palk Bay at a depth of 1-2 meters by the standardized method mentioned above (n=38).

An entangled Dugong was rescued from by Fishermen, volunteers from the NGO- OMCAR, and the Tamil Nadu Coastal Security Group in

A dugong that was entangled in fishing net was rescued by the fishermen, the WII team, the Tamil Nadu Coastal Security Group, Forest Department, and OMCAR foundation overnight at Ammapattinam. The rescue was successful, resulting in the release of an adult dugong.

In order to start aerial surveys to sight dugongs and other marine mammals, the Phantom Pro+ drone was tested by Mr. Krishna and Mr. Prathap, under Dr. K. Ramesh's (Scientist E, Wildlife Institute of India, Dehradun) permission and guidance, and under the supervision of Dr. K. Sivakumar. The test allowed us to understand and analyse the constraints and advantages of the drone. It included 25 members of the fishing community who helped carry out this successfully. The drone was tested from a moving boat, as well as from the beach.

14. Current status of Seagrass habitat in the Gulf of Kachchh, Gujarat coast: Seagrass habitat assessment was carried out between December to May 2019. It included the spatial coverage, Species richness of individual islands, and seagrass biomass. Subtidal meadows were identified in Balapur, Bhaidar, Noru, and Pagar reef. During the summertime, turbidity, currents, and high wave action does not allow us to sample seagrasses via skin-dives in the sub-tidal habitats. The identified meadows will be sampled for seagrass parameters and extent in the next season with the help of Van Veen grab. Moreover, crucial seagrass habitat and dugong movement data will be gathered by employing SCUBA divers in the more transparent winter waters during varying tidal regime. Exploratory surveys were done for seagrass mapping on reefs and islands of South West of GoK. Continuous seagrasses beds spread over 119 hectares were found in the surveyed intertidal zones of five islands, Pagar, Bhaidar, Noru, Chusna, and Ajad, within the Gulf of Kachchh Marine National Park. The curious spatial heterogeneity in this region gives each meadow a unique infrastructure. Thus, mapping benthic features like rocks, rubbles, mudflats, seagrass meadows, channels, photophilous algae covering rocks, sand, etc. gives an elaborate account of site-specific habitat characteristics. For this purpose, more than 200 waypoints and tracks were fixed for these seafloor features, which were used to develop a key depicting the benthic features. This key shall be useful as a reference key during the aerial survey's photogrammetry of seagrass meadows to estimate a meadows extent and differentiating types of submerged vegetation from other non-vegetated seagrass-absent areas during low tide.

15. Seagrass habitat assessment of Ritchie's archipelago: Rani Jhansi Marine National Park and Mahatma Gandhi Marine National Park harbour seagrass habitats that support the relict population of dugongs in the Islands. We carried out seagrass habitat assessment in the mentioned regions, to study the meadow characteristics like species composition, shoot density, shoot height, and biomass. To highlight the habitat importance of seagrass meadows used by dugongs, we also assessed seagrass associated macro-benthic and fish diversity in the study sites (both the studies were conducted in the islands for the first time).

Nine seagrass meadows were sampled (26 transects) at non-protected islands of Swaraj Dweep and Shaheed Dweep, and five meadows (eight transects) at protected islands of Henry Lawrence, Hugh Ross and John Lawrence was sampled. We recorded 10 species belonging to six genera during the survey period, namely *Halophila ovalis*, *Halophila minor*, *Halophila decipiens*, *Halodule pinifolia*, *Halodule uninervis*, *Thalassia hemprichii*, *Cymodocea rotundata*, *Cymodocea serrulata*, *Enhalus acoroides*, and *Syringodium isoetifolium*. The highest number of seagrass species were recorded at Swaraj dweep (n=7). The sampled meadows were across a depth gradient of 2 to 20meters. We found that the species richness was negatively correlated to depth. We found dense multi-specific meadows at a depth range of 0-5meters, and the meadows became sparse as we sampled up to 20meters.

16. Seagrass surveys for habitat characterization in Tamil Nadu: Seagrass surveys were conducted in 12 sites in Palk Bay and three sites in the Gulf of Mannar. Line-intercept transect (LIT) and Quadrat method were used for our seagrass surveys. Each transect was 100 meters in length, intercepted at intervals of 0, 25, 50, and 75 meters, by a 0.5 x 0.5 m quadrat. We laid 87 transects perpendicular to the land and recorded algal cover, seagrass cover, and seagrass shoot density from 348 quadrats. Cover and shoot density were recorded specifically for seven commonly occurring species, namely, *Cymodocea serrulata*, *Cymodocea rotundata*, *Halophila ovalis*, *Halodule uninervis*, *Syringodium isoetifolium*, *Enhalus accoroides* and *Thalassia hemprichii*. From the surveys, percentage seagrass cover was found to be highest in North Palk Bay (90.47%), moderate in Central Palk Bay (79.61%), and lowest in the South Palk Bay region (44.56%). *Cymodocea serrulata* was found to be the most abundant seagrass in Palk Bay. The most commonly occurring seagrass in North Palk Bay was *Halophila ovalis* (32.42%), followed by *Cymodocea rotundata* (22.92%) and *Halodule uninervis* (20.85%). In Central Palk Bay, *Syringodium isoetifolium* (29.62%) was found to be the most abundant after *Cymodocea serrulata* (32.39%); and, in South Palk Bay, *Cymodocea serrulata* (30.48%) and *Syringodium isoetifolium* (28.8%) were most abundant, followed by *Halophila ovalis* (18.7%). Shoot density of *Syringodium isoetifolium* and *Thalassia hemprichii* was found to be the highest and lowest, respectively, among the seven observed species in all three sites. Data was collected for the non-epiphytic algal cover in every quadrat that was sampled for seagrass presence and composition. The algal cover was found to be highest in North Palk Bay, where beds of *Caulerpa* sp. were found growing in seagrass meadows. The least algal cover was at South Palk Bay.

17. Capacity building of Project Personnel: It is important to build the capacity of researchers to orient them towards the project activities for the successful implementation of the Project, in this context, Ms. Himani Saini and Ms. Astha Walia obtained their PADI Open water diving training and certification. Mr. Prem Jothi also attended the National Workshop on Rapid Response Plan for Managing Coral Reef Ecosystems of India to mitigate threats of coral bleaching and Disease outbreak workshop, where several aspects of coral reef conservation and the needs for a rapid action plan to save our reefs were discussed.

18. Publications and Awareness Materials: Various awareness materials, including posters, pamphlets, etc. have been printed. Further, awareness materials for the seagrass ecosystem and have also been prepared to reiterate the importance of dugong conservation in India. Moreover, seagrass of India, a field guide is being developed during this period. Ms. Astha Walia submitted her master's degree dissertation entitled 'Assessing Polychlorinated-bi-phenyls contamination in the critical dugong habitat: a case study from the Gulf of Kutch.' Two articles have been published in Sirenews issues 69 and 70, Newsletter of the IUCN Sirenia specialist group. First in April 2019 "Dugong Scholarship Program' in India: a positive incentivization of wildlife conservation values in fisher communities" and second in October 2019, An update on the "Recovery of Dugongs and their Habitats in India: An Integrated Participatory Approach" program. In December 2019, Mitochondrial phylogeography reveals high diversity and unique divergent lineage in Indian Dugongs (*Dugong dugon*) in BioRxiv -The preprint server for Biology.

19. Marine Mammal Occurrence Database: In order to understand the past distribution of dugong and other marine mammals in Indian waters, records of marine mammals from published and online accessible databases were compiled. Publications were searched using Google Scholar search engine and were collated based on year of record. In total, marine mammals' occurrence data from India was compiled dating from 1748 - 2017 from about 84 research papers, 1 PhD thesis, report by Sivakumar and Nair 2013, and informant network at current study sites - ANI, GUJ and TN, and several newspaper and media articles. A total of 1674 records have been gathered and are being processed which comprises

of a dataset of about 26 marine mammal species. Since some of these records could be misidentifications, a complete verification and standardization of the records is currently under progress and will be later merged with already existing information on the marine mammal research and conservation network of India (MMRCNI) (<http://marinemammals.in>). Once ready, this database will provide us with time series information on marine mammal occurrence along the Indian coast and help the scientific community at large to prepare research and management strategies at local scales. A comprehensive map of the marine megafauna occurrence along the Indian coast will then be created for dissemination to wildlife managers, researchers and academic community. Marine mammal species recorded from Indian coastline reported in the literature are: Blue Whale, Bryde's Whale, Common Dolphin, Cuvier's Beaked Whale, Dugong, Dwarf Sperm Whale, False Killer Whale, Fin Whale, Indian Ocean Humpback Dolphin, Indo-Pacific Bottlenose Dolphin, Irrawaddy Dolphin, Killer Whale, Long Beaked Common Dolphin, Minke Whale, Pan Tropical Spotted Dolphin, Pygmy Killer Whale, Pygmy Sperm Whale, Risso's Dolphin, Rough Toothed Dolphin, Sei Whale, Short Finned Pilot Whale, Southern Right Whale, Sperm Whale, Spinner Dolphin, Striped Dolphin.

20. Marine Mammal Stranding Response: Marine animals like cetaceans, dugongs, sea turtles, etc. are found stranded regularly across the coastline of India. Understanding their health status, causes of stranding/mortality, genetics and pollutant load is required to formulate strategies for their population management. A dedicated stranding programme is thus required for systematic collection of marine species data along the Indian coastline. CAMPA-Dugong Recovery Program has formed Friends of Dugong network at all the dugong range states. With inputs from the network members, our team responds to each marine species stranding event and collects data on species, number, location, causes of mortality (wherever necropsies are conducted in presence of a veterinarian). Through this rapid response action on ground, invaluable data on dugongs and co-occurring species has been collected to fill up the gaps related to their biological parameters (age, health, diet, pollutant load, genetic structure etc.). The Project aims to continue this participatory monitoring over a sustained period and utilize this data in formulating surgical interventions to minimize the threats and causative agents of marine vertebrate species mortality. Several standings have been reported in time by various stakeholder groups and proper response was subsequently initiated by the field teams on the ground. Marine mammal stranding protocol manual is being developed.

21. South Andaman IMMA stakeholders meeting: The Southern Andaman Islands has recently been recognized as an Important Marine Mammal Area (IMMA) for dolphins, whales, and dugongs. Acknowledging this importance, a meeting of key stakeholders was held in Van Sadan; Port Blair on 16th November 2018 jointly organized by the Wildlife Institute of India (WII) and key local research experts. Attending the meeting were representatives of the Department of Environment and Forests, Indian Navy, Indian Coastguard, Chamber of Commerce, Directorate of Shipping Services, Port Management Board, Directorate of Fisheries, Nature Conservation Foundation, Andaman and Nicobar Environmental Team, Botanical Survey of India, Zoological Survey of India, Dive shops and game fishers. The primary objective of this meeting was to inform stakeholders about the IMMA and discuss the future sustainable use of the area. The meeting strongly acknowledged the importance of marine mammals and the need for effective management to maintain these important values.

22. South Andaman declared as first Important Marine Mammal Area (IMMA) in India: Based on the classification scheme developed to identify Important Marine Mammal Areas (IMMA) in the world, by the IUCN Joint SSC/WCPA Marine Mammal Protected Areas Task Force, an international working group of marine mammal experts, Southern Andamans was proposed as a potential IMMA during the 'North-East

Indian Ocean and South-East Asian Seas' IMMA expert workshop held in Kota Kinabalu, Malaysia in March 2018. The work was presented by Dr. K. Sivakumar (Wildlife Institute of India) and Ms. Dipani Sutaria (Marine mammal researcher) to highlight the importance of Southern Andamans as a potential IMMA which forms critical habitats for dugongs and 15 species of cetaceans. The proposal was peer-reviewed and was later approved the status of an IMMA site, making Southern Andaman as the first IMMA in Indian waters.

23. Nutrients in the sediments and seagrasses of Andaman and Nicobar Islands, Gujarat, and Tamil Nadu: A total of 53 sediment samples from Gujarat and 92 from Andaman & Nicobar Islands were analysed for the nutrient content. The results show that the sediment samples of Gujarat were rich in nutrients as compared to Andaman Islands. The factors governing the release of nutrients from the sediments are yet to be understood among all the selected sites

24. Genetic study on Dugongs in India: First time in India, after obtaining the permissions of PCCF & CWLW, Tamil Nadu, Gujarat and Andaman Islands genetic samples of a total of seven dugongs have been collected and submitted to Wildlife Forensic Department for Genetic assessment to find out the connectivity of the dugong populations of India with that of Sri Lanka and the Arabian Gulf. Considering the lack of information on population genetic structure and phylogeny of dugong populations in India, non-invasive sample collection was initiated in the last three years of the Project. These samples were collected from stranded individuals, museum specimen (skeleton) and were analysed to retrieve genetic information of Dugong populations in India. This information is generated in context with understanding genetic diversities, identifying Evolutionary Significant Units (esus), identification of populations structuring, and assessing gene flow between populations, if any. With an understanding of the population-level ecological needs and genetic structure, this information would be immensely crucial to develop conservation strategies and plan population-specific management actions for dugongs. Indian dugong alignment consisting of 21 sequences (789 bp) of mitochondrial DNA control region sequences generated in this study. These sequences were obtained from samples collected from Gulf of Kutch (n=5), Gulf of Mannar (n=8), Palk Bay (n=4) and Andaman & Nicobar Islands (n=4). The Bayesian clustering, phylogeographic and phylogenetic analyses of the global dugong dataset revealed five major genetic clusters corresponding to a) three clusters grouped in the Pacific region (Australia, New Caledonia, Palau, and Papua New Guinea); b) one cluster in southeast Asia (Thailand, Philippines, Japan, Malaysia/Sabah and Indonesia) and c) one cluster comprising of south Asia (Mauritius, Sri Lanka, and India), northwest Indian Ocean (Red sea, UAE, Egypt, Sudan, Djibouti and Bahrain) and southwest Indian Ocean (East Africa, Tanzania, Madagascar, Mozambique, Comoros and Kenya). While reporting our results, we now use the same nomenclature (Pacific, southeast Asia, South Asia, the northwest Indian Ocean, and the southwest Indian Ocean) in this paper. In total, 76 haplotypes were identified from 537 dugong sequences (Supplementary Table 3). The highest numbers of unique haplotypes were identified from the Pacific region (n = 39) followed by Southeast Asia (n =20), south Asia (n=8), northwest Indian Ocean (n=6), and southwest Indian Ocean (n=2). Only two haplotypes were shared between these regions; one between Pacific, southeast Asia, and South Asia and, another between Pacific, south Asia, northwest Indian Ocean, and the southwest Indian Ocean. We generated a longer 789 bp sequence for the Indian dugong samples collected in this study (n=21). A total of eight unique haplotypes were identified from these samples. Palk Bay, Gulf of Kutch, and Andaman & Nicobar Islands samples showed two haplotypes each, whereas the Gulf of Mannar showed four haplotypes. One haplotype was shared between Gulf of Mannar, Palk Bay and Gulf of Kutch. Overall, three haplotypes were unique to Gulf of Mannar, two were unique to Andaman & Nicobar Islands and one each for Gulf of Kutch and Palk Bay, respectively. Being the most genetically unique population within south Asia, Indian dugong populations

are globally significant. We recommend that Indian Dugong populations should be managed as a Conservation Unit to ensure population recovery and long-term survival of the species.

25. Population Status of Dugongs in India: Various methods such as boat survey, opportunity aerial survey using aircraft by the Indian Navy and Coast Guard, fishermen sightings, drone survey, etc were used to assess the population status of dugongs in India. However, none of these surveys could help us to assess the population systematically. Therefore, this season we are conducting a systematic drone survey in all three sites to estimate the population in the coming years. So far, based on stranding and opportunistic sightings of dugongs from July 2016 to 2019, it is believed that the population of the Dugong is higher than what was predicted earlier at least in the Gulf of Kutch and the same may be true for Palk Bay and the Andaman Islands but less in Gulf of Mannar. It is predicted that the dugong population in the Gulf of Kutch is about 25 individuals and 100-150 individuals in Palk Bay. Northern Palk Bay is probably a lekking site of dugongs that use the Palk Bay and Gulf of Mannar regions including the Sri Lanka part of sea, as more dugongs (high number of males) either stranded or incidentally capture along this coast. Based on drone surveys, preliminary analysis revealed that the encounter rate of dugongs per drone flight was higher in Andamans than other regions of India. It is planned to intensify the drone survey with help of Forest Departments coming year and planned to build capacities of frontline force of Forest Department to use the drone technology to monitor the dugongs and their associated species with providing training as well as equipment from the project. Through drone surveys this year, we will be able to give more information on the Dugongs population by the end of 2020.

26. Immediate Future Plans: Project could successfully minimize the illegal intake of dugongs and degradation of their habitat through participatory approach and various awareness programs. Further, the dugongs genetic study revealed that the dugong population in India was observed with high genetic heterogeneity and the population is seems to be genetically safe. However, assessing the status of Dugong in India using various tools (aircraft, drone, underwater vehicle, etc.) in collaboration with the Indian Navy, Indian Coast Guard, State Forest Departments, and other institutions will continue. Identification of critical dugong habitat in Palk Bay as 'Conservation Reserve' for community-based management was another milestone of the project and the project will assist Tamil Nadu Forest Department to declare this site as Conservation Reserve. It is planned to establish and build capacity for mobile 'Dugong Rescue and Rehabilitation Facilities' in three regions. Seeking supports of fishers in the conservation of dugongs in India will continue. It is planned to further enhance the network of 'Dugong Ambassadors' and 'Friends of Dugongs.' After the drone surveys get underway, there are plans to tag with telemetry at least 10 Dugongs so that they will be closely monitored.

We thank the CAMPA-MoEFCC and Wildlife Division of MoEFCC for funding as well as guidance support. We thank Chief Wildlife Wardens, officials and frontline staff of Forest Departments of Tamil Nadu, Gujarat and Andaman and Nicobar Islands for their active supports and guidance. We thank, all fishermen, dugong volunteers, dugong ambassadors, CMS-Dugong MoU Secretariat, Indian Navy, Coast Guard, Marine Police, State Fisheries and Education Departments, Universities, NGOs, etc.

1 INTRODUCTION

Dugong (*Dugong dugon*), also known as Sea Cow, is one of the four surviving species in the order Sirenia and the only existing species of herbivorous mammal that lives exclusively in the sea (Heinsohn, 1972). Dugongs are naturally found in calm sheltered, nutrient-rich water, generally in bays, shallow island and reef areas which are protected from strong winds and heavy seas (Heinsohn et al. 1977) and which coincide with extensive seagrass beds (Marsh et al., 2002). In India, seagrass habitats are present in Gulf of Mannar, Palk Bay, Gulf of Kutch and Andaman and Nicobar Islands (Kannan et al., 1999). The population of dugongs in India is expected to be less than 250 individuals in highly fragmented habitats. Several threats contribute to their continuous population decline, which include seagrass habitat loss and degradation, fishnet entanglement, indigenous use and hunting and coastal pollution among others.

In 2015, the MoEFCC entrusted the Wildlife Institute of India to prepare and implement Endangered Species Recovery Plans (ESRP) of Dugong along with 3 other wild animal species (Great Indian Bustard, Gangetic Dolphin and Sangai) under the National Compensatory Afforestation Fund Management and Planning Advisory Council (NCAC). The Dugong ESRP includes research and management actions imperative to stop the population decline and support the recovery of this highly threatened species. With substantial funding under this program, necessary ground interventions have been initiated to ensure the long-term survival of dugongs in the wild through multi-stakeholder partnerships and support of the local communities. This project aims at implementing the “National Action Plan for Dugong Conservation in India” jointly with various stakeholders such as State Forest Departments, other line agencies and local communities to recover the population and habitat of dugong in India within next two decades.

Major objectives of the Dugong Recovery Program is to a) Assess dugong population status through advanced census techniques and determine its abundance and distribution, identify critical habitats, classify threats and develop site-specific monitoring plan to reduce poaching and incidental entanglements, b) Characterize the critical dugong habitats, reduce direct and indirect threats by implementing site-specific interventions c) Raise awareness on the species at local, regional and national level and encourage the participation of the local communities as well as other stakeholders and d) Enhance the capacity of the State Forest Department staff, develop/implement smart patrolling tools to improve protection enforcement and train forest staff as well as local communities for long-term habitat monitoring.

In the first two years of project, state-level Stakeholders Consultation Workshops were held in each Dugong range state for finalizing the modalities related to project implementation. Several consultation

meetings were conducted with Principal Chief Conservator of Forest & Head of Forest Force, under the Chairmanship of the Principal Chief Conservator of Forests and Chief Wildlife Warden of concerned states during July and August 2016. Conservation actions were deliberated upon and field activities were planned at these consultations. Stakeholders such as the Indian Navy and the Indian Coast Guard as well as Marine Police were sensitized during multiple orientation workshops conducted across the field sites as well at regional and national headquarters. Further, marine biodiversity monitoring training was provided to 60 frontline forest staff of Tamil Nadu Forest Department. Successful rescues of 09 dugongs entangled in fishing net were done by fishermen at Tamil Nadu, Gujarat and Andaman & Nicobar Islands. Detailed surveys were carried out to determine the quality and the extent of distribution of the seagrasses in the Gulf of Kutch, Gujarat. Several seagrass meads with extensive dugong feeding trails were located at these meadows indicating a remnant dugong population a Gulf of Kutch. Social Surveys of traditional fishermen, boat operators and game fishers at Andaman Islands revealed hunting pressure in north Andaman and new areas of dugong distribution. Awareness programs targeted at school children were carried out in several schools at all the field sites. Awareness meetings cum workshop with local fisher-folk were conducted at various villages to establish Friends of Dugong program.

1.1 Objectives

Species conservation and management

Assess dugong population status through advanced census techniques and determine its abundance and distribution, identify critical habitats, classify threats and develop site-specific monitoring plan to reduce poaching and incidental entanglements.

Habitat conservation and management

Characterize the critical dugong habitats, reduce direct and indirect threats, control modifications in and around the habitat and improve habitat quality through management interventions and participatory approaches.

Participatory management of dugong and their habitats

Raise awareness on the species and encourage the participation of the local communities; include other stakeholders like fisheries department and religious heads in conservation efforts; enhance Dugong conservation program by spreading awareness on a national scale.

Capacity-building of State Forest Departments & local communities

Enhance the capacity of the State Forest Department staff and develop/implement smart patrolling tools to improve protection enforcement; train forest staff and local communities in underwater surveys for long-term habitat monitoring.



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2 GUJARAT

Dugong population in the Gulf of Kachchh (GoK) is very small, estimated up to only about 10-15 individuals (Sivakumar & Nair, 2013). The high tidal range and high turbidity in the region make it very difficult to visually monitor this population. Thus, a bottom-up approach was used to track the *Dugong dugon* in the gulf by monitoring seagrass beds in the area and interviewing local fishermen using an unstructured questionnaire. Potential threats to dugongs and their habitat in the south-western Gulf of Kachchh were mapped through boat surveys using point count method. Workshops and seminars were conducted for raising awareness on the species and to encourage participation of general public, local fisher communities and school children in conservation efforts. State forest department frontline staff was trained in field techniques and SCUBA diving to enhance their capacity for long-term habitat monitoring and develop smart patrolling tools to improve protection enforcement.

The Gulf of Kachchh
Gujarat



**Image 2.1. Area surveyed for the season November-May, 2019, in South-Western GoK, Gujarat
Image courtesy- ESRI**

2.1 Research and monitoring

2.1.1 Seagrass surveys

Seagrass surveys were conducted from pre-winter (November) to pre-monsoon (May) season of 2019. Several new meadows, homogenous as well as patchy, were located at islands Pagar (Hadkiwala and Betiwala reefs), Chusna (Chepri reef) Nakya reef, Bhaidar, and Noru (Tam reef). Considering the macro-tidal regime of mixed-semidiurnal tides in the gulf, seagrasses were mapped through exploratory surveys and mapping efforts were made in inter-tidal zones during minus to ebbing tide slot. Techniques like meadow-perimeter walking were used for mapping meadow extents and random quadrat method was employed at each station to study seagrass characteristics. Permanent survey sites were identified and shall be revisited fortnightly in forthcoming seasons to understand the following ecological and phenotypical parameters: sediment type, % seagrass cover, % algal cover, seagrass canopy height, seagrass shoot density, % seagrass epiphytic cover, biomass, nutrients, depth, pH, salinity and temperature. A total of 137 quadrats were cast for the season at seven different locations; Beyt Dwarka, Hadkiwala and Betiwala reefs, Chepri reef, Bhaidar, Tam reef, and Ajad. Seagrass habitats at zero-tide were surveyed on-foot and in places where the tides did not ebb, skin dives were made for sample collection.

Percentage cover of macroalgae associated with meadows, for example, *Ulva lactuca*, *Turbinara* spp, *Ulva reticulata*, *Sargassum* sp. and brown filamentous algae were observed. The % cover of these algae is expected to change in each season. Blooms of macroalgae were also mapped.

Extent mapping of seagrasses and seagrass absent areas was done for each new station. Range finders were used to estimate the extent of a benthic feature in the landscape for each direction. This method was only possible for intertidal meadows.



Image 2.2. Random quadrat being cast during a seagrass survey



Image 2.3. A ghost net found wound up in rocks and macroalgae

Site specific details of habitat description, seagrass meadow characters, and conservation priority are given below:

2.1.1.1 BALAPUR

Habitat type- Mud-flat.

Area surveyed- Central Balapur. Seagrass survey sampling and mapping efforts were made during the minus to ebbing tide slot.

Habitat description-Seagrass meadow is a continuous homogenous which only gets exposed during the spring low tide. The meadow is dominated by *Halophila ovalis*. A lot of bioturbation in the meadow is contributed by blue swimmer crab population. The meadow experiences mixed-semidiurnal tides, i.e. two high and low tides with different sizes each lunar day.

Seagrass composition is *Halophila ovalis*. Number of quadrats; 6 quadrats for nutrient estimation in the sub-tidal zone of the meadow.

Dominant sediment type- mud

Results- An area of perimeter of roughly 4.82 kms was surveyed and mapped.

This is a very popular dugong foraging habitat amongst local villagers. Exhaustive reports of dugong sightings come from this area. Also, the presence of lush seagrass meadow is a source of sustenance for many fishermen as they depend on crab fishing.

Conservation priority- **Very High**



Image 2.4. Skin dives during sample collection in sub-tidal seagrass habitats where the tides do not ebb

2.1.1.2 BETIWALA REEF

Habitat type- Patch reef, submerges in high tide.

Area surveyed- North-eastern edge of Pagar Reef, 6.4 kms south west edge of Bhaidar coastline. Seagrass survey sampling and mapping efforts were made during the minus to ebbing tide slot.

Habitat description- The seagrass meadow here grows in a lagoon like area. Fossilised coral reef flats act as a physical wave-breaker as they form a rim around the meadow. These coral reef flats are mainly composed of *Montipora*, *Goniopora* etc. Several nudibranchs, *Elysia* sp. were found to be abundant in *Ulva* stands and in regions with sparse seagrass growth. The meadow experiences mixed-semidiurnal tides, i.e. two high and low tides with different sizes each lunar day.

Seagrass composition- *Halophila ovalis*, *Halodule uninervis*. Number of quadrats plotted for the season were 10.

Dominant sediment type- Coarse sand and silt

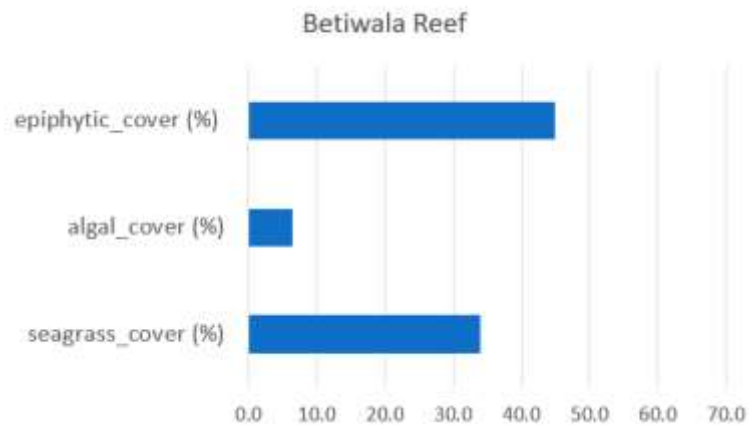
Results- An area of perimeter of roughly 2.06kms was surveyed and mapped.

Patch reefs are natural nurseries to various juveniles of invertebrates and commercial fishes and reef fishes too. Moreover, the reef is home to hydroids, polyzoans, nudibranchs and poriferans. It is a part of the greater Pagar reef whose hard-coral reef flats and rocks become natural substratum for macroalgae which are foraged on by resident and migratory green sea turtles. Green sea turtles and dugongs also forage on the seagrass meadows found here as reported by the local fishermen.

Conservation priority- **High**



Image 2.5. Mapped seagrass beds



Graph 2.1. Graph depicting %cover of seagrasses, macroalgae and epiphytes in comparison



Image 2.6.A. *H. uninervis* meadow at Betiwala reef, Pagar; B. *H. uninervis* with growing CCA on the blades



Image 2.7. *H. uninervis* in coarse substrate

2.1.1.3 HADKIWALA REEF

Habitat type- Patch reef, submerges in high tide.

Area surveyed- North-western edge of Pagar reef; east of Betiwala reef. Seagrass survey sampling and mapping efforts were made during the minus to ebbing tide slot.

Habitat description-This reef is a seagrass habitat that harbours dense stands of seagrasses of both Cymodoceaceae and Hydrocharitaceae family. The seagrass meadow here grows in a lagoon like area might be the oldest seagrass meadow in the area. Fossil coral reef flats acts as a physical wave-breaker as they form a rim around the meadow. These coral reef flats are mainly composed of *Montipora*, *Goniopora* etc. The meadow experiences mixed-semidiurnal tides, i.e. two high and low tides with different sizes each lunar day.

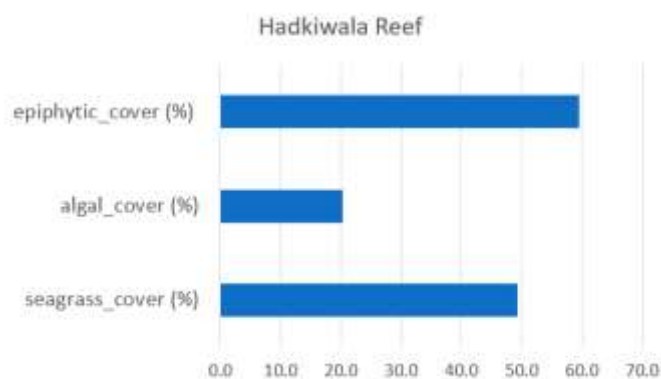
Seagrass composition- *Halophila ovalis*, *Halodule uninervis*. Number of quadrats plotted for the season were 14 in total.

Dominant sediment type- Coarse sand and silt

Results- An area of perimeter of roughly 1.97 kms was surveyed and mapped.

Topographical heterogeneity on the sea-floor is augmented by the east-west flowing high tidal influx, the effects of which are partially broken down by reef flats and thick fibrous stands of *Halodule* and *Halophila*. This role of the seagrass meadow makes the substratum unique habitat for Blue swimmer crab, wolf crab, crenate swimming crab, red egg crab and smooth swimmer crab. Moreover, seasonal bloom of sargassum near the meadows edge creates opportunistic refuges for several smaller invertebrates. It is too, a part of the greater Pagar reef whose hard-coral reef flats and rocks becomes natural substratum for macroalgae which are foraged on by resident and migratory green sea turtles.

Conservation priority- **High**



Graph 2.2. Graph depicting %cover of seagrasses, macroalgae and epiphytes in comparison



Image 2.8 A. Puddles covered with algae at Hadkiwala; B. Lagoon at Hadkiwala



Image 2.9 Dead *Favia* species



Image 2.10.A. *Halodule* with its tips covered with epiphytes; B. *Halophila* completely covered with epiphytes

2.1.1.4 CHEPRI REEF

Habitat type- Fringing reef.

Area surveyed-North-western reef off the coast of Chusna island.

Habitat description-This is a fringing reef flat which is an extension of the island Chusna. Large extensions of sandy/muddy substrate are lined by coral reef flats along the seaward side. The site is tide prone and the meadow experiences mixed-semidiurnal tides, i.e. two high and low tides with different sizes each lunar day. But owing to its slight elevation, the meadow remains exposed for a relatively longer time.

Seagrass habitat type-young stands of seagrass of two genera *Halophila* and *Halodule* grow in vast mixed meadows, making it an important dugong foraging area. Seagrass composition in the area is *Halophila ovalis*, *Halodule uninervis*, *Halophila beccarii*. Number of quadrats done for the season were 34 in total.

Dominant sediment type- Coarse sand and silt.

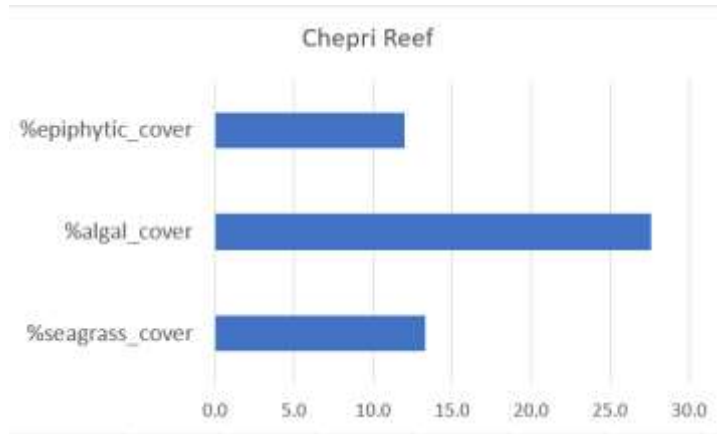
Results- An area of perimeter of roughly 3.39 kms was surveyed and mapped. Seagrass survey sampling and mapping efforts were made during the minus to ebbing tide slot.

The meadow is fairly homogenous and vast. Several direct dugong sightings and feeding trails found in the meadow by fishermen is evidence of the fact that Chepri reef is an importance dugong foraging habitat

Conservation priority- **Very High**



Image 2.11. Mapped seagrass beds and dugong trail locations at Chepri



Graph 2.3. Graph depicting %cover of seagrasses, macroalgae and epiphytes in comparison



Image 2.12.A. Seagrass Sample Collection; B. *Halodule uninervis* with a thick load of epiphytes on blades

2.1.1.5 NAKYA REEF

Habitat type- fringing reef.

Area surveyed- South western reef off the coast of Noru island.

Habitat description-No continuous seagrass meadow was found here. This area is intersected by numerous large channels during the high tide. *Halophila ovalis* was found growing in two scanty patches of perimeter not greater than 3 meters. The meadow experiences mixed-semidiurnal tides, i.e. two high and low tides with different sizes each lunar day.

Seagrass composition- *Halophila ovalis*. No quadrats were plotted. Seagrass do not form a meadow. Invasive harvesting method for sampling seagrasses wasn't favoured as the patches were few and scanty.

Dominant sediment type; fine sand and Rubble

Results- An area of perimeter of roughly 3.29 kms was surveyed and mapped.

Reflective sand makes the water appear clear during the winters. This along with the channels gives this area a unique conservation importance as many mega-faunas like turtle, dolphins and dugongs might use these as waterways to travel.

Conservation priority- **High**



Image: 2.13.A. Sparse *H. ovalis* at Nakya; B. *H. ovalis* in sandy sediment at Nakya



Image 2.14. Ghost net found at Nakya

BHAIDAR ISLAND

Habitat type- Continental- Mangrove island with fringing reef

Area surveyed- North-western to western off the coast of Bhaidar islands fringing reef

Habitat description- This mangrove island has a thin sandy coastline of approx. 2.61 kms stretching from north-east to south western rim of the islands shore above the high tide mark. Several narrow creeks lined by mangroves is an important roosting habitat for several water-birds like egrets, painted storks, cormorants etc. The fringing reef is greatly irregular in nature with varying spatial heterogeneity. Rocks, coral rubble, sandy shoals, vast flats of mud-mounds and seagrass meadows compose the intertidal. Tide prone site; the meadow experiences mixed-semidiurnal tides, i.e. two high and low tides with different sizes each lunar day.

Seagrass habitat type-Young stands of seagrass of two genera *Halophila* and *Halodule* grow in vast mixed meadows, making it an important dugong foraging area. Seagrass composition; *Halophila ovalis*, *Halodule uninervis*, *Halophila beccarii*. Number of quadrats done- 41 quadrats.

Dominant sediment type- Coarse sand and mud

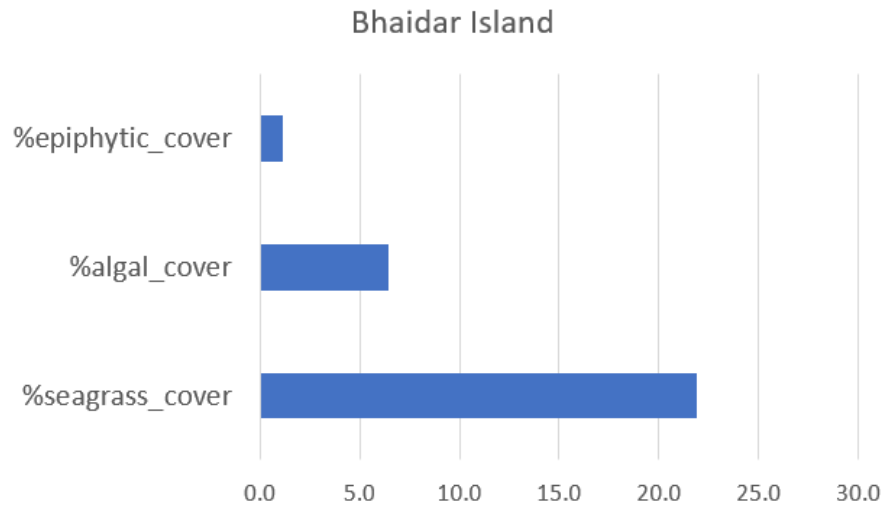
Results- An area of perimeter of roughly 5.7 kms was surveyed and mapped during varying tidal regime. Seagrass survey sampling and mapping efforts were made during the minus to ebbing tide slot.

This area supports the survival and sustenance of various unique invertebrates, fishes and marine mammals, owing to its heterogenous topography and seasonal changes in macrophytes. It is a critical dugong foraging habitat.

Conservation priority- **High**



Image 2.15. Mapped seagrass beds and Dugong trail locations



Graph 2.4. Graph depicting % cover of seagrasses, macroalgae and epiphytes in comparison



Image 2.16.A. *Ulva reticulata*, soft corals and anemone in a rocky bed; B. A random quadrat placed for sampling

2.1.1.6 TAM REEF

Habitat type- fringing reef.

Area surveyed- Western reef off the coast of Noru island.

Habitat description-Tam's spatial topography is fairly heterogenous in nature. It is situated on the outer rim of the western part of reef making it closer to off-shore open sea of the gulf. The fossilised coral reef acts as a barrier between the meadow and the high energy currents as they cover a significant area of the very reef itself. Seagrass meadows are located towards the inner sheltered part of the reef. Seagrass composition-*Halophila ovalis*, *Halophila beccarii*. Number of quadrats plotted for the season were 11 quadrats.

Dominant sediment type- no particular sediment type dominates the seagrass meadow. It varies from fine sand, silt to rocks and mud.

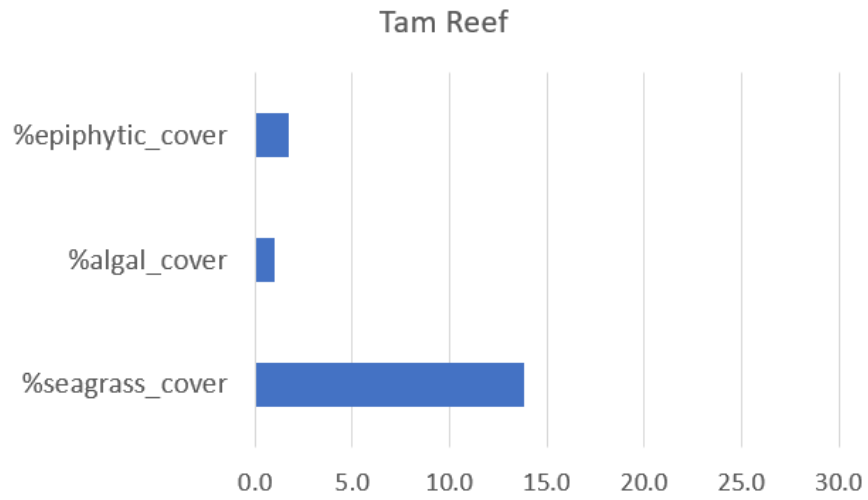
Results- An area of perimeter of roughly 4.82 kms was surveyed and mapped.

Tam reef, similar to Bhaidar island harbours the two species of Hydrocharitaceae in abundance. Also, it was found that Tam might support more macro-fauna that to have previously thought. Upcoming shallow water dives in the winters, when the waters are clearer and the meadow is submerged, will reveal more information about the meadow. This reef is an important dugong foraging habitat.

Conservation priority- **Very High**



Image 2.17. Mapped seagrass beds and dugong trail locations



Graph 2.5. Graph depicting %cover of seagrasses, macroalgae and epiphytes in comparison



Image2.18.A. Seagrass sampling by a channel in clayey substrate; B. Water channel and mounds covered with seagrasses



Image 2.19. *Penaeus monodon* with *H. ovalis*

2.1.1.7 AJAD ISLAND

Habitat type- Continental island with Mangrove groves and fringing reef.

Area surveyed- North and north-eastern region of the islands reef was surveyed and mapped during the season. The meadow is low in elevation here, mainly growing on vast mud-flats. Seagrass survey sampling and mapping efforts were made during the minus to ebbing tide slot.

Habitat description; *Enteromorpha* sp., *Ulva lactuca* etc, both covered the homogenous meadows of *H. beccarii*. The substratum had no rock, rubble or gravel onto which the algae could anchor. The algae were drifted due to currents towards the meadows. And had settled on top of the small leaved *H. beccarii*. The meadow experiences mixed-semidiurnal tides, i.e. two high and low tides with different sizes each lunar day.

Seagrass composition-*Halophila ovalis*, *Halophila beccarii*. Number of quadrats done for the season 20 in total.

Dominant sediment type- Mud

Results- An area of perimeter of roughly 2.57 kms was surveyed and mapped.

This island, being a hotspot for mineral ore extraction, is a usually a target of many private fuel companies. Moreover, the vicinity of the meadow is scoped by fishermen using the destructive poison fishing method. This area is also a valuable tourism spot.

Conservation priority- **High**

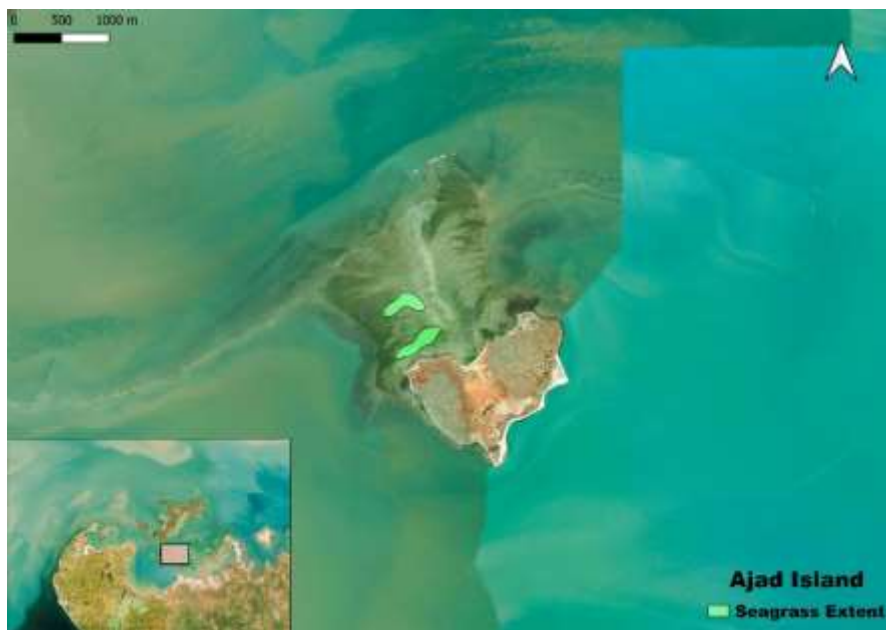


Image 2.20. Mapped seagrass beds at Ajad



Image 2.21.A. Quadrat being laid over an *H. beccarii* meadow covered with *Ulva reticulata*; B. Channel with *H. ovalis* growing within and *H. beccarii* growing along its edges



Image 2.22.A. Seagrass sampling being done in a channel; B. Ghost net found during sampling

2.1.2 Dugong Stranding

A drifting dead dugong was found near Maan and Marudi Is. in November, 2018. The information was received from a fisherman who is a part of the Dugong volunteer network. Boats were set out in a strategic manner to access the stranding prone areas for the animal. Unfortunately, the animal was not found. Direct sighting information is crucial in predicting movements of dugongs between foraging areas and the direct threats in their ways.



Image 2.23. Drifting carcass of a Dugong. Gender: unknown due to post mortal evisceration in the abdomen

2.1.3 Threat Mapping

The studied dugong habitat in the Gulf of Kutch includes areas which are traditional fishing grounds, port channels and waterways. A considerable portion of this habitat is in close proximity of industries, viz, chemical plants, oil refineries, bauxite mines etc., and coastal residential areas, which makes industrial and domestic wastes worthy candidates for being a threat to this critical habitat. In order to identify the probable scenarios that have greatest potential impact on the well being of dugongs, visual observations through distance sampling were used.

2.1.3.1 Methodology

Boat surveys were used for point count observations at centroids of a predesigned overlay of grids (2x2 Kilometers). The surveyed areas could be classified as around inhabited islands/mainland and around uninhabited islands. The sampled grids strategically cover the surveyed seagrass beds around Beyt Dwarka, Pagar, Chusna, Bhaider, Ajad and Noru islands. As the tidal amplitude in this part of the country is considerably high, the intertidal areas get submerged with a flooding tide and get exposed with an ebbing tide. Hence, high tides which fall during days were chosen for the surveys. Boats, deployed fishing gear, jetties, underwater construction sites, drifting buoy/floats and plastic waste have been listed as

potential threats. Animals sighted at the point of observation have been noted. Physical parameters, like, depth, temperature, salinity and pH have been also recorded.



**Image 2.24. Map depicting the region and grids samples through boat surveys
Image Courtesy: Google Earth**



**Image 2.25.A. Estimation of physical parameters of water were done from a dinghy;
B. Observations being done for distance sampling from a high vantage point**

2.1.3.2 Results

Point count observations were made at a total of 68 grids covering an area of ~280 sqkm, 30 km into the south-western region of Gulf of Kutch.

AROUND INHABITED ISLANDS/MAINLAND

Areas Covered: Coastal regions of Okha and Positra islands of Beyt Dwarka and Ajad
Number of Grids Sampled: 24

AROUND UNINHABITED ISLANDS

Areas Covered: Islands of Paga, Khara Chusna, Meetha Chusna, Bhaidar and Noru
Number of Grids Sampled:

Table 2.1: Number of sightings/observations during boat surveys

	Animals	Vessels	Litter/Waste
Uninhabited Areas	56	38	22
Inhabited Areas	7	110	26
Total	63	148	48

As the table depicts, despite the lesser number of grids covered around inhabited areas, the number of vessels observed (110) are considerably more than what was observed around uninhabited areas (38). The surveys were conducted in the pre-monsoon season, March-May. It was observed in this season that more boats were docked at jetties/port than being operational. This also coincided with the nearing of off fishing season as winds pick up, bringing monsoon. Further extensive surveys are expected to present a detailed picture of relations between seasons and boat traffic.

Additionally, the number of animal sightings were extremely low around the inhabited areas (7) as compared to the uninhabited areas (56). Furthermore, it was noticed that there were multiple operational crab nets between Beyt Dwarka and Paga islands. However, the maximum number of operational gill netters and shore seines were recorded around the uninhabited islands. Plausibly, further surveys in upcoming seasons will paint a clearer picture of most frequented fishing sites in the region and the credibility of boat traffic and fishing pressure on local marine life.



Image 2.26 Two Indo-Pacific humpback dolphins spotted during a threat mapping effort



Image 2.27.A. Trawlers spotted during a survey; B. Carcass of a dead *Chelonia mydas* encountered during a point observation

2.1.4 Interview Surveys

As seagrass meadows are known as nurseries and habitats for an overwhelming number of marine faunae, in the south-western region of Gulf of Kachchh, they are used as grounds for fishing, crab fishing and jelly fish fishing. This makes these fishermen frequent visitors of such areas and thus, direct observers of the Dugongs. Trials for interview surveys using an unstructured questionnaire were carried out with fishermen of village Balapur, Beyt Dwarka, to understand the technicalities of their fishing ways, their direct or indirect contact with regional marine fauna and their perception towards dugongs and their current status in the gulf.

The questionnaire was set to target fishermen to gain information about their fishing gears, most frequented fishing spots, megafauna generally sighted, their knowledge about the megafauna, and their perception of the current status of these animals. A total of 20 interviews were completed as a part of the trial run.

Two reports of Dugongs, a mother and a calf were recorded from Noru Island through these interviews. Extremely enthusiastic response from the fishermen marked as the cornerstone for the fisher volunteer network in GoK. The fishermen were also made aware of steps to follow if encountered with a dugong or other marine megafauna dead, stranded or stuck in a net. All the fishermen interviewed enrolled themselves in the Dugong Volunteer Programme.



Image 2.28. Family of fisherman Mr. Ilias Sattar after an interview



Image 2.29 Fisherman Mr. Sattar Aadam during an interview



Image 2.30 Fishermen answering questions during initial phases of trials

2.2 Outreach and awareness activities

2.2.1 Awareness Seminars and Workshop

Date: 31/01/2019 - 01/02/2019

Venue: Dwarka

Attendees: B. Sc. Students from Ruparel College and SIES College, Mumbai

Workshop, which included seminars and intertidal walk, was conducted for about 50 students pursuing B. Sc. Zoology. Seminar covered marine mammal diversity in Gujarat, Dugongs and their habitat and plastic pollution in the oceans. Students were introduced to the intertidal realm and its biodiversity through walks along Dwarka rocky shore, where seaweeds were collected for making herbariums.



Image 2.31 Awareness Seminar and Workshop at Jamnagar

Date: 04/02/2019

Venue: MNP Office, Forest Department, Dwarka

Attendees: Forest Department Trainees for SCUBA Diving Course

Workshop, which included a seminar and documentary screening, was conducted for 5 Forest Department officials who were being trained for SCUBA Diving. Seminar covered marine mammal diversity in Gujarat, Dugongs and their habitat and plastic pollution in the oceans.



Image 2.32 Awareness Seminar and Workshop at Dwarka

Date: 13/02/2019 & 18/02/2019

Venue: Dwarka

Attendees: Students of IX and XI standards from PVM Girls' High School, Dwarka

Seminars were conducted for students where marine mammal diversity in Gujarat, Dugongs and their habitat and plastic pollution in the oceans were covered. Documentaries depicting sea life in the shallows and depths of tropical as well as temperate waters were also screened.



Image 2.33 Awareness Seminar and Workshop with school children

Date: 29/03/2019

Venue: Okha

Attendees: School kids from V - XII from government Schools of Bhavnagar, Amreli, Bharuch, Gandhinagar

Seminars were conducted for 62 students from 13 schools of four districts in Gujarat, where marine mammal diversity in Gujarat, Dugongs and their habitat and plastic pollution in the oceans were covered.



Image 2.34 Awareness Seminar and Workshop with school children

Date: 20/01/2019 - 22/01/2019

Venue: Poshitra

Attendees: Students from High School, Poshitra

First Year, B. Sc. Zoology, Botany and Chemistry, College, Jamnagar

B. Ed. and Nursing Diploma, Kamdar College, Rajkot

Workshop, which included seminars, documentary screening and intertidal walks, for over 200 school and college students was organised at Forest Department Basecamp, Poshitra, as a part of their Summer Nature Camp Programme. Seminars covered marine mammal diversity in Gujarat, Dugongs and their habitat and plastic pollution in the oceans. Students were introduced to the intertidal realm and its biodiversity through walks along the nearby rocky shores.



Image 2.35 Awareness Seminar and Workshop at Poshitra

2.2.2 Community Participation and Integration

Date: 22/12/2018 & 01/01/2019

Venue: Okha Jetty

Attendees: Boat commuters between Okha and Beyt Dwarka

An interactive session was conducted at the Okha Jetty, where around 350 commuters were informed about Dugongs, their habitat and anthropogenic impacts on the concerned animal. They were also made aware of the effects of single use plastic on marine fauna and its health through public talks.



Image 2.36 Awareness drive at Okha Jetty

Date: 04/04/2019

Venue: Arambada Fishing Village

Attendees: Craftswomen from Wagher community

An effort to increase the participation of locals in conservation was made by collaborating with craftswomen from Wagher community, who specialise in traditional mud art, tapestry work etc. An enthusiastic response from the women marked the inception of a possible collaboration for using their artwork as outreach and awareness material.



Image 2.37 Awareness drive at with Wagher community

2.2.3 Fisher Community Awareness Workshop

Date: 11/04/2019 & 18/04/2019

Venue: Balapur, Beyt Dwarka

Attendees: Fisher Community from Balapur

About 100 fishermen were introduced to the Dugong project; marine mammals, Seagrasses and their importance, threats to their existence and conservation and mitigation measures through presentations and documentaries. Notebooks were also distributed to fishermen children who responded enthusiastically, leaving mark on our conversation initiative. Interviews using a pre-set questionnaire were also conducted with fishermen for understanding their perception about dugongs and marine mammals. The fishers here have showed concerns over illegal trawler operations and docking in Beyt area, which is an important feeding ground for dugongs. The older age class in the group is concerned over the effects of these Illegal, Uncontrolled and Unreported (IUU) fishing practices prevalent in the area.



Image 2.38 Awareness Seminar and Workshop at village Balapur

2.2.4..Dugong Scholarship Programme

Date: 28/06/2019 - 04/07/2019

Venue: Swaminarayan High School, Beyt Dwarka
Government Senior Secondary School, Okha
PVM Girls' Senior Secondary School, Dwarka
Government High School, Mithapur

Attendees: Over 850 students from classes VII to XII

Workshop, which included seminars and documentary screening, for over 850 school children was organised at four schools in the district Devbhumi Dwarka at different occasions. Students from VII to XII standards were made aware of marine mammal diversity in Gujarat, Dugongs and their habitat and plastic pollution in the oceans.

After qualifying in the phase-II (2019-20) written examination, 22 students from classes IX and XI of the aforementioned schools were enrolled in the Dugong Scholarship Programme. These students, along with 5 Dugong Scholars from phase-I (2018-19), will receive a monthly scholarship of ₹ 500 for two academic years. In the phase-I of Dugong Scholarship Programme, GoK, 40 students from 6 schools were enrolled for the scholarship for academic years 2018-2019 and 2019-2020. However, only 5 continued with education for the year 2019-2020. Such a high number of dropouts from schools (35) is a grave concern in this region of the state.



Image 2.39 Seminars being conducted for Dugong Scholarship Programme

2.3 Capacity Building

2.3.1 Marine Biodiversity Monitoring and SCUBA Diving Training

Date: 28/02/2019 - 26/03/2019

Venue: Dwarka

Attendees: Frontline staff of Forest Department, Gujarat

Training programme, which included seminars, documentary screening, intertidal walk, beach clean-up and SCUBA diving training, was conducted for 10 frontline forest officials. The participants were briefed about the project, status of Dugongs and other marine mammals in the Gulf of Kutch and were also familiarised with field methodology generally used for monitoring marine biodiversity in intertidal as well as sub tidal areas. The participants were then trained as Open Water SCUBA Divers by Dive India, Dwarka to enhance their capacity to effectively manage marine natural resources.



Image 2.40 Capacity building training of frontline forest staff

2.4 Outputs and accomplishments

2.4.1 Seagrass meadows of the subtidal and intertidal zones

Subtidal meadows were identified in Balapur, Bhaidar, Noru and Pagar reef. During the summertime, turbidity, currents and high wave action does not allow us to sample seagrasses via skin-dives in the subtidal habitats. The identified meadows will be sampled for seagrass parameters and extent in the next season with the help of Van Veen grab. Moreover, crucial seagrass habitat and dugong movement data will be gathered by employing SCUBA divers in the clearer winter waters during varying tidal regime.

2.4.2 Mapping new seagrass meadows and associated landscapes found in the southwestern islands, GoK.

Exploratory surveys were made for seagrass mapping on reefs and islands of SW-GoK. Continuous seagrasses beds spread over 119 hectares were found in the surveyed intertidal zones of five islands, Pagar, Bhaidar, Noru, Chusna and Ajad, within the Gulf of Kachchh Marine National Park. The curious spatial heterogeneity in this region gives each meadow a unique infrastructure. Thus, mapping benthic features like rocks, rubbles, mud flats, seagrass meadows, channels, photophilous algae covering rocks, sand, etc. give an elaborate account of site-specific habitat characteristics. For this purpose, more than 200 waypoints and tracks were fixed for these sea-floor features which were used to develop a key depicting the benthic features. This key shall be useful as a reference key during the aerial survey's photogrammetry of seagrass meadows to estimate a meadows extent and differentiating types of submerged vegetation from other non-vegetated seagrass-absent areas during low tide.



Image 2.41. Photo-identification key of benthic features in Gulf of Kutch's insular seagrass habitat. Left panel (from top left) seagrass meadow, sand, reef flat (*Favia*), reef flat (*Porites*, *Montipora*), Mangrove swamp, Rubble. Right panel- (Top) Channel, (Bottom) Mud mound

2.4.3 Dugong foraging grounds

During the seagrass exploratory surveys, the team discovered feeding trails; which are trails made by sea-cows as they move whilst excavating seagrasses along with the rhizomes and roots. Length, width and depth of the trails were measured on field. The first feeding grounds that were found on a Chepri reef. Feeding grounds and seagrass composition found on Bhaidar Islands' reef confirms their prediction made via qualitative analysis of last year's dead dugong stranding (n=2). Waypoints were taken separately for individual trails (<3) and multiple trails (>3). All of the foraging grounds have young stands of *Halophila* and *Halodule sp.* of seagrasses growing. A comparative habitat analysis shall inform more on the preference of meadow characteristics of dugongs in the GoK.

Aerial surveys in these areas during high tide will increase the chance of direct sighting of the animal and in finding more foraging grounds during the low tides via trails.



Image 2.42. Dugong feeding trails in *Halodule* meadow at Chepri island



Image 2.43. Dugong feeding trails, as observed in the intertidal seagrass meadows of GoK

2.4.4 First record of *Halophila decipiens* meadows in the GoK

H. decipiens is a seagrass of the family Hydrocharitaceae, the meadows of which have been confirmed growing in GoK for the first time. They were found growing in either monospecific meadows or in mixed-meadows growing along with *H. ovalis*. Samples were collected using random quadrat method. Specimens were identified using Kuo and den Hartog (2001). Reefs where *H. decipiens* were found growing are Balapur area of Beyt-Dwarka island and Bhaidar Islands subtidal meadow 4-15 ft deep and in the intertidal zones of Tam & Nakya reef.



Image 2.44. *Halophila decipiens* ramets

2.4.5 *Halophila* sp. fruits

Inspection of samples in lab and in meadows revealed that the plants of *Halophila* genus were fruiting. Male and female flowers grow on separate plants i.e. *Halophila ovalis*. This finding presses on the importance of conserving healthy dugong habitats in a focussed manner.



Image 2.45. *Halophila* sp. fruits growing on the nodes of the rhizome

2.4.6 Threat Mapping

Boat surveys were used for point count observations at a total of 68 grids 30 km into the south-western region of Gulf of Kutch. The number of vessels observed at/around inhabited areas (110) was found out to be considerably more than what was observed around uninhabited areas (38). It was observed in this season that more boats were docked at jetties/port than being operational. The surveys were conducted in the pre-monsoon season, March-May, which also coincided with the nearing of off fishing season as winds pick up, bringing monsoon. Further extensive surveys are expected to present a detailed picture of relations between seasons and boat traffic.

Additionally, the number of animal sightings were extremely low around the inhabited areas (7) as compared to the uninhabited areas (56). Furthermore, it was noticed that there were operational crab nets between Beyt Dwarka and Paga islands. However, the maximum number of operational gill netters and shore seines were recorded around the uninhabited islands. Plausibly, further surveys in upcoming seasons will paint a clearer picture of most frequented fishing sites in the region and the credibility of boat traffic and fishing pressure on local marine life.



Image 2.46. A *Sousa plumbea* carcass found during an off effort observation of boat surveys

2.4.7 Awareness and Capacity Building

Awareness seminars and workshops were completed with >1600. ~500 locals were made aware of CAMPA- Dugong Project, and of anthropogenic impacts on marine flora and fauna at various occasions such as New Year's Eve, and Hanuman Dandi Mela, a local fair.

Workshops with about 100 fishermen were conducted to introduce them to the Dugong project; marine mammals, seagrasses and their importance, threats to their existence and conservation and mitigation measures through presentations and documentaries. Fishermen responded enthusiastically, leaving mark on our conversation initiative. All the attendees eagerly became a part of Dugong Volunteer Programme in the region establishing trust between both the parties. Moreover, the fishers here have shown concerns over illegal trawler operations and docking in Beyt area, which is an important feeding ground for dugongs. The older age class in the group is concerned over the effects of these Illegal, Uncontrolled and Unreported (IUU) fishing practices prevalent in the area.

22 students from classes IX and XI from schools in district Devbhumi Dwarka were enrolled in the phase-II (2019-21) of Dugong Scholarship Programme. However, there have been considerable dropouts from schools as observed in phase-II. Of 40 students enrolled for the programme in phase-I (2018-2020), only 5 continued with education for the year 2019-2020. Such a high number of dropouts from schools (35) is a grave concern in this region of the state.

SCUBA Diving courses and training in ecological monitoring enabled building field capacity of 8 frontline forest officials. The officials were briefed about the project and were familiarised with field methodology generally used for monitoring marine biodiversity in intertidal as well as sub tidal areas. The participants were then trained as Open Water SCUBA Divers by Dive India, Dwarka to enhance their capacity to effectively manage marine natural resources.

2.4.8 Interview Surveys

A questionnaire was standardised to target fishermen to gain information about their fishing gears, most frequented fishing spots, megafauna generally sighted, their knowledge about the megafauna, and their perception of the current status of these animals. A total of 20 interviews were completed as a part of the trial run.

Two reports of Dugongs, a mother and a calf, were recorded from Noru island through these interviews. Extremely enthusiastic response from the fishermen marked as the cornerstone for the fisher volunteer network in GoK. The fishermen were also made aware of steps to follow if encountered with a dugong or other marine megafauna dead, stranded or stuck in a net. All the fishermen interviewed fervently enrolled in the Dugong Volunteer Programme.

2.4.9. Assessing polychlorinated-bi-phenyls contamination in the critical dugong habitat

The current study is undertaken to quantify and assess a rarely studied region, the Gulf of Kutch, (near Okha), Gujarat, India, for PCB contamination in the sediment and seagrass samples. This is an important study due to the fact that this region is the habitat for the critically endangered dugongs which are facing the risk of population decline due to several reasons. In this study we are trying to ascertain if the habitat is contaminated by persistent pollutant like Polychlorinated biphenyls (PCBs) which are highly toxic, bioaccumulative and persistent. These chemicals are known for their toxic effects on reproduction, immunity, hormones, physiology, metabolism and other health parameters which affect their health, in short term and survival and population in long term. Sediment and seagrass samples were collected from 7 Islands from Gulf of Kutch region in March-April 2019 and analysed for residues of 12 polychlorinated biphenyls (PCB) congeners. Σ PCBs concentration in the sites ranged from 3.105-57.175 ng/g dw @ 1% TOC in sediments were found to be higher than the threshold limit (29 ng/g dw@ 1% TOC) set by the standard guidelines in coastal sediment. Four species of sea grasses were analysed across the 7 islands. Concentration of total PCB in seagrasses were found to be between 6.568-251.751 ng/g dw in *Halophila ovalis* species, 8.608-23.232 ng/g dw in *Halodule uninervis*, 12.002 ng/g dw in *Halophila decipiens* and 48.744 ng/g dw in *Halophila beccarii*, which is higher than permissible threshold (same as sediment). Of all the PCBs congeners detected, PCB52 was found to be in the highest concentration followed by PCB28, PCB77, PCB101, PCB153, PCB138, PCB187, PCB126, PCB180, PCB118, PCB44 and PCB105. Since the dugongs mostly feed on seagrass, the higher levels of PCB congeners in sea grass species, especially higher accumulation capacity of PCBs in *Halophila ovalis* species is a matter of concern. It is likely that PCBs may be moving up the food chain and accumulating in dugongs and thus may pose threat to the health and population of this species. Based on current understanding, concentrations of pollutant detected in sediments and seagrasses need further study and monitoring. This study provides the baseline data on the levels of PCB contamination in the abiotic and biotic component of GoK and suggests that further research studies should be taken up to understand the fate and transport of these pollutants. Such studies including the current research is going to help the stakeholders and policy makers to formulate appropriate strategies for the management and conservation of protected habitats and prevention of marine pollution so as to also abide by the national and international conventions on prevention and control of marine pollution.

2.4.10. Media Coverage

2.4.10.1 Newspaper Publications

05th January 2019: Community interaction and awareness programme at Okha in Desh Parsesh ni Aajkal

ઓખા બંદરે વાઈલ્ડ લાઈફ ઈન્સ્ટીટ્યુના સંશોધકો દ્વારા લુપ્ત થતી દરીયાઈ ગાયને બચાવવા અનોખું અભિયાન

ઓખા બંદરે પસીજર જટી પર વાઈલ્ડ લાઈફ ઈન્સ્ટીટ્યુટ ઈન્ડીયા દ્વારા લુપ્ત થતી દરીયાઈ જીવ સૃષ્ટિને બચવવા લોકોમાં જાગૃતતા લાવવા અનોખું અભિયાન ચલાવવામાં આવેલ, જેમાં સંકટગ્રસ્ત જાહેર ક્ષેત્રે પ્રાણીઓમાંથી એવા દરિયાઈ ગાય (ડુગોંગ)ને બચાવવાના સંદેશ સાથે ઓખા બંદરે દરિયાઈ ગાયનું ટેડીબીયર સ્વરૂપ ધારણ કરી યાત્રીકોને દરિયાઈ જીવો માટે ખુબ જ જરૂરી એવા દરિયાઈ ઘાસના મહત્વ અને તેમને નુકશાન કરતા ઘસીબળો વિશે માહિતગાર કર્યા હતાં તથા દરિયાઈ ગાય અને લુપ્ત થતી દરિયાઈ જીવસૃષ્ટિને બચાવવા અનુરોધ કર્યો હતો.

09th March 2019: SCUBA Diving and Marine Biodiversity Monitoring Training at Dwarka, in NavGujarat Samay

જવાનોને જ્વાનોને દ્રેશીંગ

દરિયાઈ ગાયને બચાવવા 15 જવાનોને તાલીમ અપાશે

15 દિવસ અંતર બેટર ક્ષમણસીકી ટ્રેનિંગ અપાશે

નવગુજરાત સમય - કાઠરા

વનવિજ્ઞાનના ૧૫ જેટલા કર્મચોરોને CAMPA ક્ષમણસીકી પ્રોગ્રામ અંતર્ગત બુટકામ પન વિષયક હાથ સંપૂર્ણ આયોજન કરી જટીમ પેલેસ અને ડુગોંગ અને દરીયાઈ જીવસૃષ્ટિના અભ્યાસ અને સંરક્ષણની તાલીમ હાથ આપવામાં આવી રહી છે.

કાઠરા ખાતે વનવિજ્ઞાનના ઈન્સ્ટીટ્યુટ ઓફ ઈન્ડિયા હાથસુધુ તરફ પિનિમીટી ઓફ સેલેબરેશન તેમજ ઈરેક્ટ એન્ડ કોર્ડિનેટ નેચર જાનના સંરક્ષણના CAMPA એલેવે કે ડુગોંગ વિષયકી પ્રોગ્રામ અંતર્ગત બુટકામ વનવનના નવવિજ્ઞાનના હાથ પડીન સીલેન્સના ૧૫ જવાનોને કન્ટ્રાક્ટીંગ સ્ટાફ માટે સુધુ ટ્રેનિંગ અને બેટર ક્ષમણસીકી ટ્રેનિંગનું આયોજન કરવામાં આવ્યું છે. જેમાં ડુગોંગની ઇકોલોજી વિષે તેના જીવસૃષ્ટિની જીવસૃષ્ટી માટે અને જાલ કાપીને તેને જટવી આઠાર મળી રહે તે માટેની તાલીમ અપાઈ રહી છે. ડુગોંગ ખાસ પ્રકારની દરિયાઈ ગાય છે અને તેને અહાર માટે દરિયાઈ પાલવજાની જટર પડે છે. ડુગોંગ ગાય દર ૨ થી ૩ મિનિટ આઠ માસ લેવા માટે જામીન પર અથવા તો સમુદ્રના પાણીની તપાટી પર અને છે. તેમાં તે આસીધરી કરવા ઉપરોચ્ચ એવી રહી છે.

2.4.10.2 News Channel Coverage:

07th March 2019: SCUBA Diving and Marine Biodiversity Monitoring Training at Dwarka, on ABP Asmita



Dr. Sanjay Kumar Srivastava, IFS, PCCF and Chief Wildlife Warden, TNFD

Mr. T.K Ashok Kumar, IFS, Wildlife warden, GoMNP, Ramnathapuram

Mr. Manivannan, ACF, Ramnathapuram

Mr. Rajkumar, former ACF, Ramanathapuram

Mr. S. Gurusamy, IFS, DFO, Thanjavur

Mr. Anand Kumar, IFS, DFO, Pudukottai

Mr. Satish, RFO, Ramnathapuram

Mr. Sikkandar Batcha, RFO, Kilakarai

Mr. Venkatesh, RFO, Mandapam

Mr. Raguvaran, RFO, Tuticorin

Mr. Mohan, RFO, Thanjavur

Mr. Rajashekar, RFO, Pudukottai

Mr. Mathivanan, Forester, Ramnathapuram

Mr. P. Sudhakar, Forester, Ramnathapuram

Mr. K. Sudhakar, Forester, Ramnathapuram

Mr. Gunasekaran, Forester, Ramnathapuram
Mr. Anand, Forester, Ramnathapuram
Mr. Kalidasan, Forest Guard, Ramnathapuram
Mr. Joseph, Forest Guard, Ramnathapuram
Mr. Senthil, APW, Ramnathapuram
Mr. Malairaj, APW, Ramnathapuram
Mr. Baskaran, APW, Ramnathapuram
TN-Coastal Security Group
TN- Fishery Department
Temple Adventure, Puducherry
OMCAR Foundation, Palk Bay

3. TAMIL NADU

3.1 Research and Monitoring

3.1.1 Seagrass surveys for habitat characterization

Seagrass surveys were conducted in 12 sites in Palk Bay and 3 sites in the Gulf of Mannar. Line-intercept transect (LIT) and Quadrat method was used for our seagrass surveys. Each transect was of 100 meters in length, intercepted at intervals of 0, 25, 50 and 75 metres, by a 0.5 x 0.5 m quadrat. We laid 87 transects perpendicular to the land and recorded algal cover, seagrass cover and seagrass shoot density from 348 quadrats. Cover and shoot density were recorded specifically for seven commonly occurring species, namely, *Cymodocea serrulata*, *Cymodocea rotundata*, *Halophila ovalis*, *Halodule uninervis*, *Syringodium isoetifolium*, *Enhalus accoroides* and *Thalassia hemprichii*. Palk Bay and Gulf of Mannar coasts were divided into 9 segments for ease of sampling; Palk Bay into 4 and the Gulf into 5:

- **A:** Eripurakkarai to Vadakku Ammapattinam
- **B:** Ammapattinam to Narendal
- **C:** PV Pattinam to Devipattinam
- **D:** Chittarkottai to Mandapam
- **E:** Mandapam group of islands (Shingle to Poomarichan) and adjoining mainland
- **F:** Mandapam group of islands (Manoliputti to Muyal) and adjoining mainland
- **G:** Kilakarai group of islands (Mulli to Anaipar) and adjoining mainland
- **H:** Vembar group of islands (Nallathanni to Upputhanni) and adjoining mainland
- **I:** Tuticorin group of islands (Vilanguchalli to Vaan) and adjoining Mainland



Image 3.1: Seagrass surveys for habitat characterization

However, for analysis, Palk Bay alone was taken into consideration due to the high number of surveys conducted in the region. For ease of analysis and comparison of obtained results, Palk Bay coast was divided into 3 parts: North Palk Bay (from Eripurakkurai to Ammapattinam), Central Palk Bay (from Adhipattinam to Morepannai) and South Palk Bay (from Tiruppalaikkudi to Mandapam).

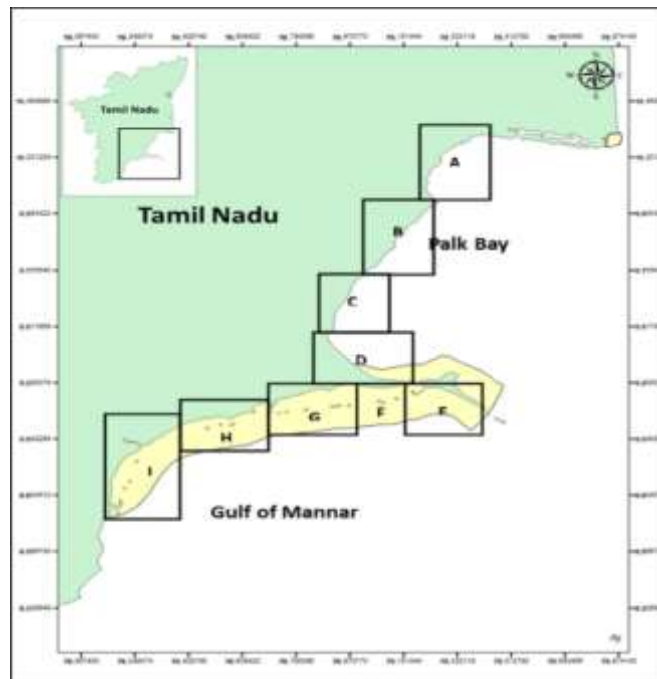


Image 3.2: Palk Bay Division for sampling

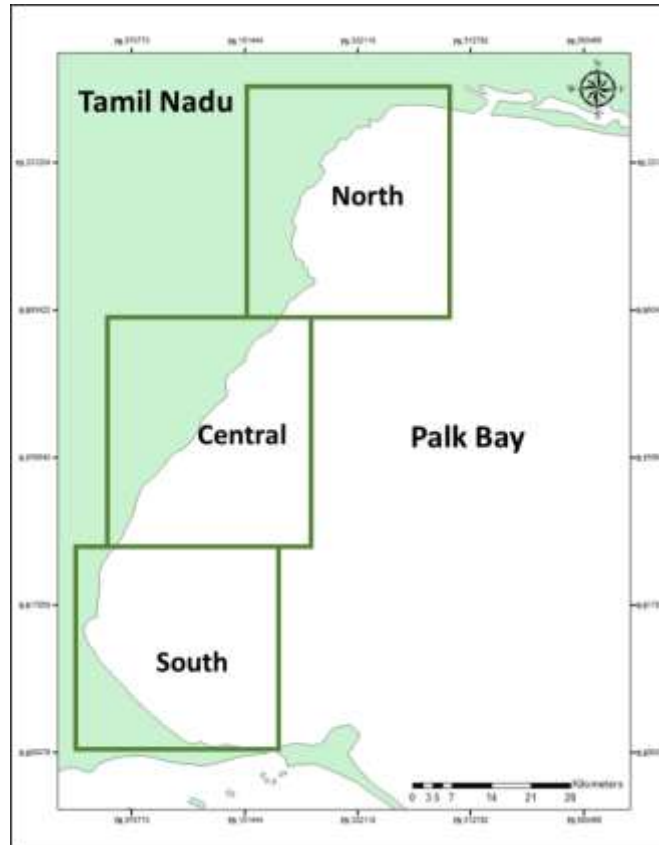


Image 3.3: Palk Bay Division for Analysis

Results from surveys conducted from May, 2018-April, 2019

From the surveys, percentage seagrass cover was found to be highest in North Palk Bay (90.47%), moderate in Central Palk Bay (79.61%) and lowest in South Palk Bay region (44.56%).

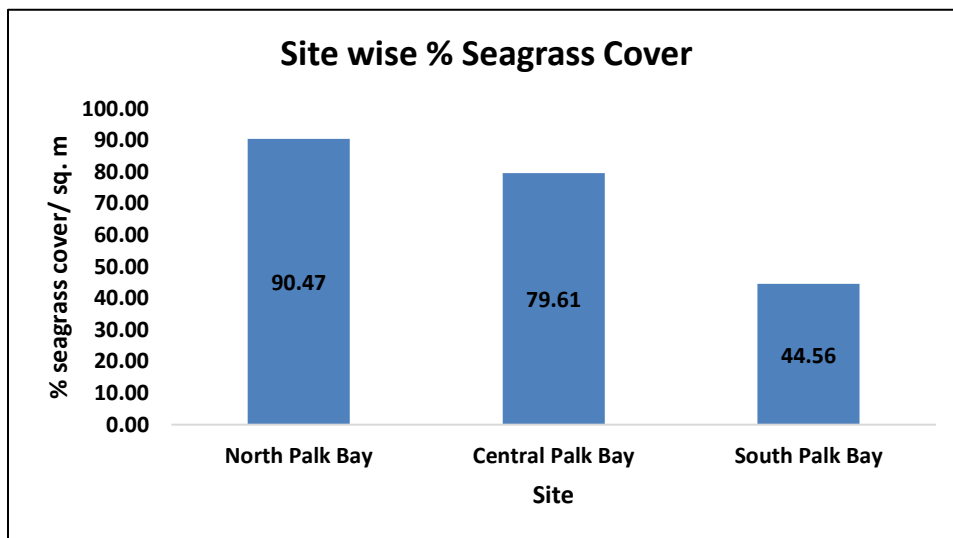


Fig 3.1: Site wise percent seagrass cover in Palk Bay

Cymodocea serrulata was found to be the most abundant seagrass in Palk Bay. The most commonly occurring seagrass in North Palk Bay was *Halophila ovalis* (32.42%), followed by *Cymodocea rotundata* (22.92%) and *Halodule uninervis* (20.85%). In Central Palk Bay, *Syringodium isoetifolium* (29.62%) was found to be the most abundant after *Cymodocea serrulata* (32.39%); and, in South Palk Bay, *Cymodocea serrulata* (30.48%) and *Syringodium isoetifolium* (28.80%) were most abundant, followed by *Halophila ovalis* (18.70%).

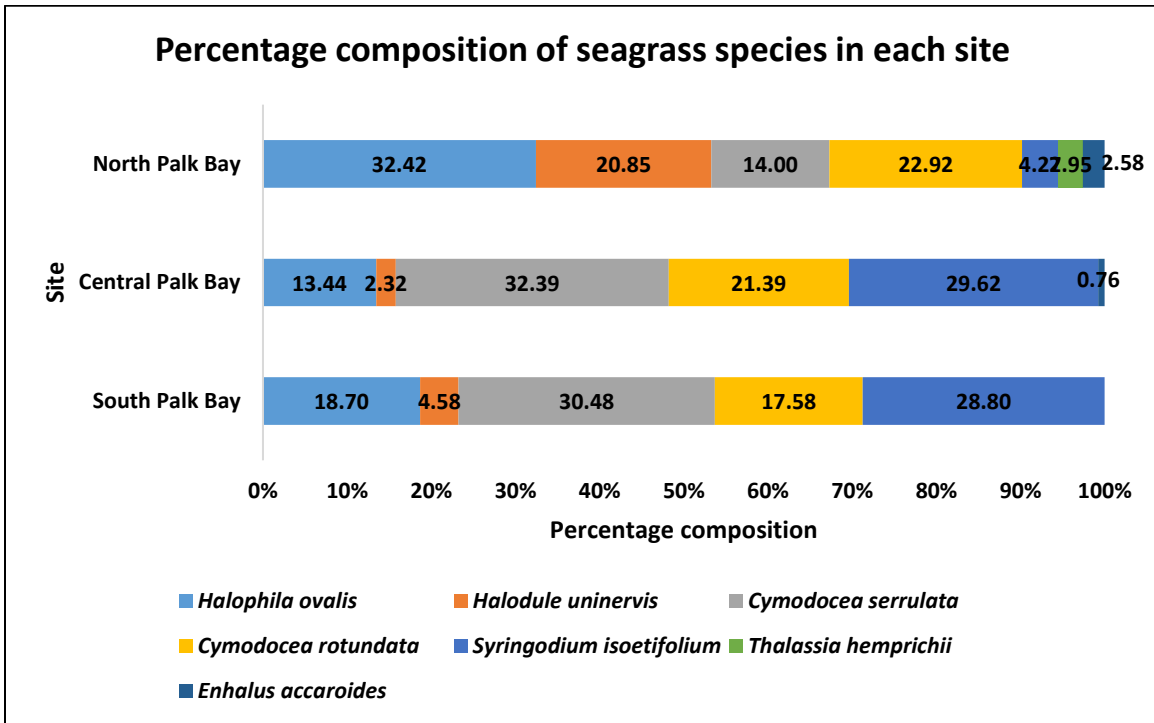


Fig 3.2: Percent composition of seagrass species in Palk bay

Shoot density of *Syringodium isoetifolium* and *Thalassia hemprichii* was found to be the highest and lowest, respectively, among the 7 observed species in all three sites.

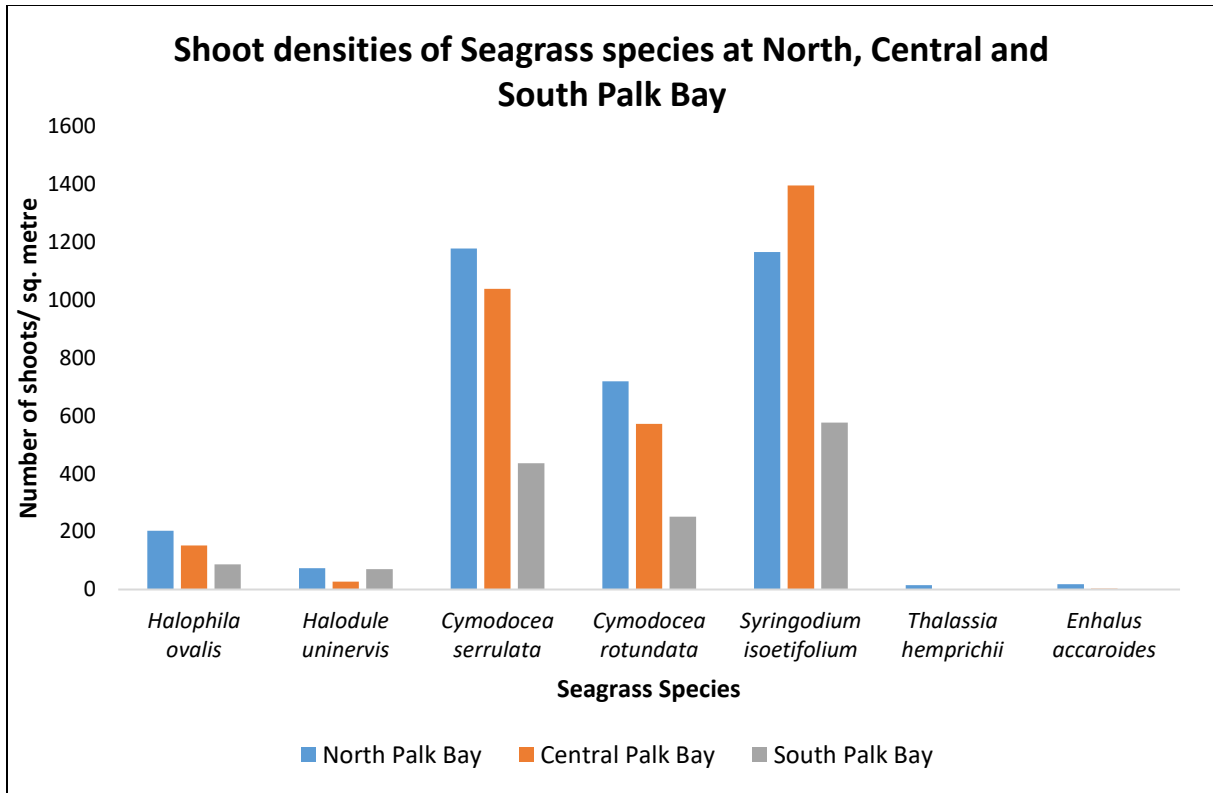


Fig 3.3: Shoot Densities of seagrass species in Palk Bay

Data was collected for the non-epiphytic algal cover in every quadrat that was sampled for seagrass presence and composition. Algal cover was found to be highest in North Palk Bay, where beds of *Caulerpa sp.* was found growing in the midst of seagrass meadows. Least algal cover was at South Palk Bay.

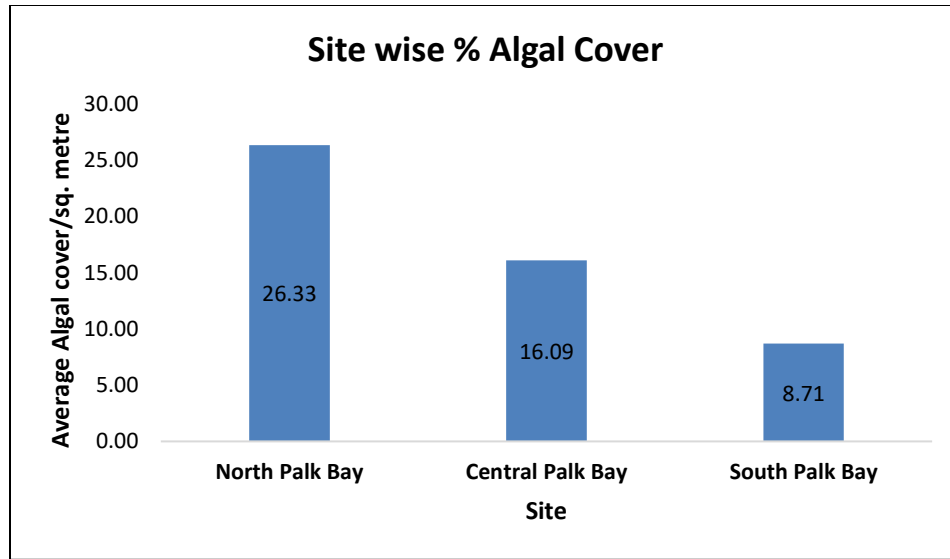


Fig 3.4: Site wise percent algal cover

3.1.2 Boat surveys for Dugongs and other marine mammal sightings

Boat Surveys were carried out in an attempt to sight Dugongs and other marine mammals. A boat consisting of at least 2 observers other than the crew (usually one boat-man and one assistant) covered a pre-defined track to sight marine mammals using binoculars and range-finders to estimate distance. Boats travelled at a speed not exceeding 15 nautical miles/hour, in a direction perpendicular to land. 4 transects of 2 km length with 500 m inter-transect distance were covered by each boat. Floating debris were also recorded along with marine mammals. To ensure community and stake-holder involvement, fishing boats were used and at least one Anti-poaching watcher from the Tamil Nadu Forest Department was on board.

This survey was conducted with either one or more boats simultaneously (mass boat surveys). Three such mass boat surveys were conducted; using 5 boats. Apart from the mass boat surveys, 6 single boat surveys were conducted in 6 sites of Palk Bay.

3.1.2.1 Mass boat surveys for Dugong sightings

5 fishing boats were hired to conduct the first set of mass boat survey in Mandapam area, Palk Bay. Each boat was led by a researcher from our team, a forest guard, a boat man and one or 2 others from the fishing community to help in efficient sighting of marine megafauna and plastic. Sea state was not favourable during this survey. No Marine mammals were sighted during this survey.



Image 3.4: Mass Boat surveys

Another mass boat survey was conducted in Ammapattinam which is an area frequented by Dugongs (information by locals). 5 boats set sail simultaneously, with 1 or 2 researchers and 2 crew members on board. One of the crew members was also trained to sight marine mammals and litter. This also helped strengthen the capacity of the fishing community as well. No Marine mammals were sighted during this survey.



Image 3.5: Boat survey for marine mammal sighting

5 boats were used for a mass boat survey in the north Palk Bay area with at least 2 fishermen and one researcher on board. The sea was calm and interactions with accompanying boat-men assured us of Dugong presence in the area. Though no direct sightings were recorded in this survey.



Image 3.6: Participation of Fisher community in Boat surveys

After the death of the pregnant female and the fortunate rescue of an adult male dugong, an impromptu boat survey was done in the Manamelkudi and Ammapattinam region, Palk Bay to sight dugongs or any other marine mammals along with forest officials and fishermen. No Marine mammals were sighted during this survey.

3.1.3 Drone Testing for Dugongs and other marine mammals sighting

In order to start aerial surveys to sight dugongs and other marine mammals, the Phantom Pro+ drone was tested by Mr. Krishna and Mr. Prathap, under Dr. K. Ramesh's (Scientist E, Wildlife Institute of India, Dehradun) permission and guidance, and under the supervision of Dr. K. Sivakumar. The test allowed us to understand and analyze the constraints and advantages of the drone. It included 25 members of

the fishing community who helped carry out this successfully. The drone was tested from a moving boat, as well as from the beach.



Image 3.7: Drone testing at Palk Bay

3.1.4 Questionnaire Surveys with local fishermen

24 fishing villages in Thanjavur district, 30 in Pudukottai and 11 villages in Ramanathapuram District were surveyed for basic information about each village (names of Village Headman, Fishery Society Head, number of fishermen, number of fishing families, number of traditional, motorized and mechanized boats) and to initiate the creation of a database for all the coastal villages of the Tamil Nadu field site.



Image 3.8: Questionnaire Surveys

3.1.5 Fish Market Surveys

Fish Market surveys were initiated in Thondi, where fish vendors were questioned about the rates of fish (and dry fish), elasmobranchs, cephalopods and crustaceans at the fish market. Further surveys were conducted in Devipattinam fish market. Surveys are yet to be conducted in other parts of Palk Bay and Gulf of Mannar.

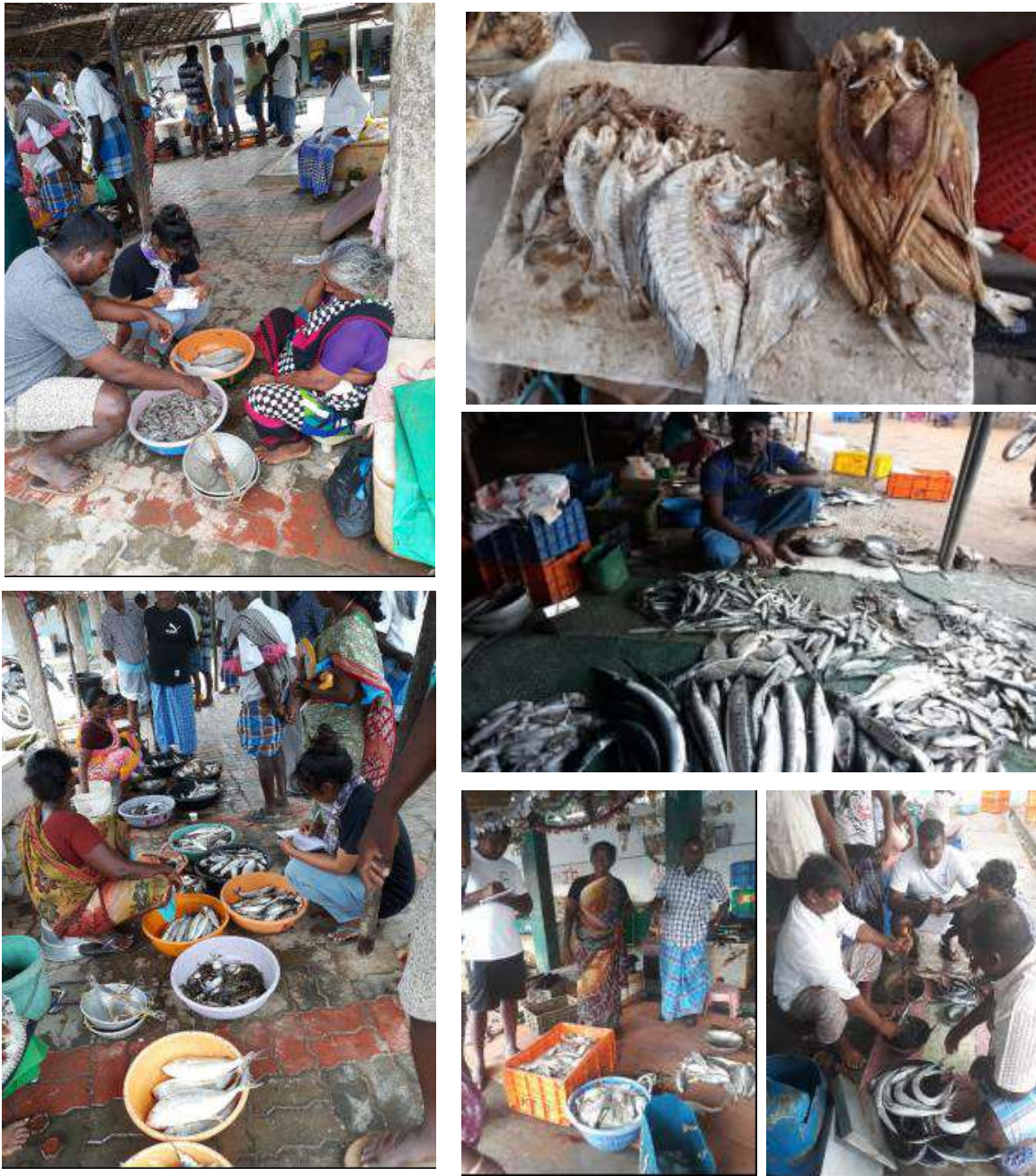


Image 3.9: Fish Market surveys at Thondi

3.1.6 Seagrass Associated Fish Surveys

3.1.6.1 Fish Market survey

Methodology: Fish diversity at the landing center was recorded by recording fish species available at each vendor. Photographs were taken of individual species for identification.

Result

Fish market survey was done at fish landing Centre in Thondi and Sethubavachhatiram in Palk Bay (n=4).

Checklist of fish species observed is as follows:

Table 3.1: Checklist of fish species documented in Fish market surveys

Sr. No.	Scientific Name	Common Name	Family
1	<i>Hemiramphus far</i>	Black barred half-beaked fish	Hemiramphidae
2	<i>Arius Maculatus</i>	Spotted catfish	Ariidae
3	<i>Planiliza macrolepis</i>	Large scaled Mullet	Mugilidae
4	<i>Atule mate</i>	Yellow tailed scad	Carangidae
5	<i>Gerres erythrourus</i>	Deep-bodied mojarra	Gerreidae
6	<i>Cynoglossus arel</i>	Large scaled tongue sole	Cynoglossidae
7	<i>Alectis ciliaris</i>	African pompano	Carangidae
8	<i>Lethrinus ornatus</i>	Pink ear Emperor	Lethrinidae
9	<i>Upeneus tragula</i>	Freckled goatfish	Mullidae
10	<i>Elloche lonvaigiensis</i>	Square tailed mullet	Mugilidae
11	<i>Psammopercawaiigiensis</i>	Sand bass	Latidae
12	<i>Tylosurusacus melanotus</i>	Keel jawed N eedlefish	Belonidae
13	<i>Plotosus canius</i>	Grey eel Catfish	Plotosidae
14	<i>Hemiramphus lutkei</i>	Lutke's half-beaked	Hemiramphidae
15	<i>Chanos chanos</i>	Milkfish	Chanidae
16	<i>Terapon puta</i>	Striped Grunter	Terapontidae
17	<i>Chiloscyllum griseum</i>	Grey bamboo Shark	Hemiscyllidae
18	<i>Scomberoides commersonianus</i>	Talang queenfish	Carangidae
19	<i>Scarus ghobban</i>	Blur-barred Parrotfish	Scaridae
20	<i>Diagramma picta</i>	Silver sweetlips	Haemulidae
21	<i>Carangoides ferdau</i>	Blue trevalley	Carangidae
22	<i>Lutjanus quinquelineatus</i>	Five lined Snapper	Lutjanidae
23	<i>Sphyraena barracuda</i>	Great barracuda	Sphyraenidae
24	<i>Moolgarda seheli</i>	Blue-spotted mullet	Mugilidae

Sr. No.	Scientific Name	Common Name	Family
25	<i>Pampus chinensis</i>	Chinese silver Pomfret	Stromateidae
26	<i>Scatophagus argus</i>	Spotted Scatfish	Scatophagidae
26	<i>Parupenes macronema</i>	Longbarbel goatfish	Mullidae
27	<i>Pellonaditchela</i>	Indian Pellona	Pristigasteridae
28	<i>Sphyraena obtuse</i>	Obtuse Barracuda	Sphyraenidae
29	<i>Trichiurus lepturus</i>	Large scaled Hairtail	Trichiuridae
30	<i>Terapon jarbua</i>	Crescent banded Grunter	Terapontidae
31	<i>Chirocentrus sp.</i>	Wolf herring	Chirocentridae
32	<i>Himantura marginatus</i>	Black edged sting ray	Dasyatidae
33	<i>Stolephorus indicus</i>	Indian Anchovy	Engraulidae
34	<i>Ephippus orbis</i>	Orb fish	Ephippidae
35	<i>Sphyraenjello</i>	Pickhandle Barracuda	Sphyraenidae
36	<i>Platax teira</i>	Longfin Spadefish	Ephippidae
37	<i>Kuhilia mugil</i>	Barred Flagtail	Kuhliidae
38	<i>Lethrinus harak</i>	Thumbprint Emperor	Lethrinidae
39	<i>Platycephalus indicus</i>	Bartail Flathead	Platycephalidae
40	<i>Pseudorhombus malayanus</i>	Malyan Flounder	Paralichthyidae
41	<i>Leiognathus dussumieri</i>	Dussumier'sponyfish	Leiognathidae



Image 3.10: Fish Catch for sell in Thondi market



Image 3.11: *Stolephorus indicus*



Image 3.12: *Platax teira*

3.1.6.2 Point counts for assessing Seagrass associated Fish in Palk Bay

Methodology: To understand diversity and usage seagrass meadows by fish, point counts were conducted in Palk Bay at depth of 1-2 metres by standardized method mentioned above (n=38).

Results:

Checklist of fish species observed (n=18) is as follow

Table 3.2: Checklist of fish species documented in seagrass meadows

Sr. No.	Scientific Name	Common Name	Family
1	<i>Terapon puta</i>	Striped Grunter	Terapontidae
2	<i>Gerres oyena</i>	Blacktip Silverbidy	Gerreidae
3	<i>Gerres oblongus</i>	Oblong silverbidy	Gerreidae
4	<i>Arius maculatus</i>	Spotted catfish	Ariidae
5	<i>Chiloscyllium griseum</i>	Grey bamboo Shark	Hemiscyllidae
6	<i>Pleurosicya mossambica</i>	Common Ghost goby	Gobiidae
7	<i>Gerres erythrourus</i>	Deep-bodied mojarra	Gerreidae
8	<i>Moolgarda seheli</i>	Bluespot mullet	Mugilidae
9	<i>Syngnathoides biaculeatus</i>	Alligator pipefish	Syngnathidae
10	<i>Siganus vermiculatus</i>	Vermiculate rabbitfish	Siganidae
11	<i>Anampsescaeruleo punctatus</i>	Blue spotted wrasse	Labridae
12	<i>Arothron immaculatus</i>	Immaculate Puffer	Tetraodontidae
13	<i>Ostorhincus</i> sp.	Cardinalfish	Apogonidae
14	<i>Amblyeleotris</i> sp.	Gobi	Gobiidae
15	<i>Cryptocentrus</i> sp.	Gobi	Gobiidae
16	<i>Valenciennea</i> sp.	Gobi	Gobiidae
17	<i>Leiognathus daura</i>	Gold stripe ponyfish	Leiognathidae
18	<i>Scatophagus argus</i>	Spotted scatfish	Scatophagidae



Image 3.13: *Terapon puta* in seagrass



Image 3.14: *Amblyeleotris* sp in seagrass



Image3.15: *Syngnathoides biaculeatus*



Image 3.16: Point count

Average densities of fish family Terapontidae and Gerreidae were found to be the highest in all the points.

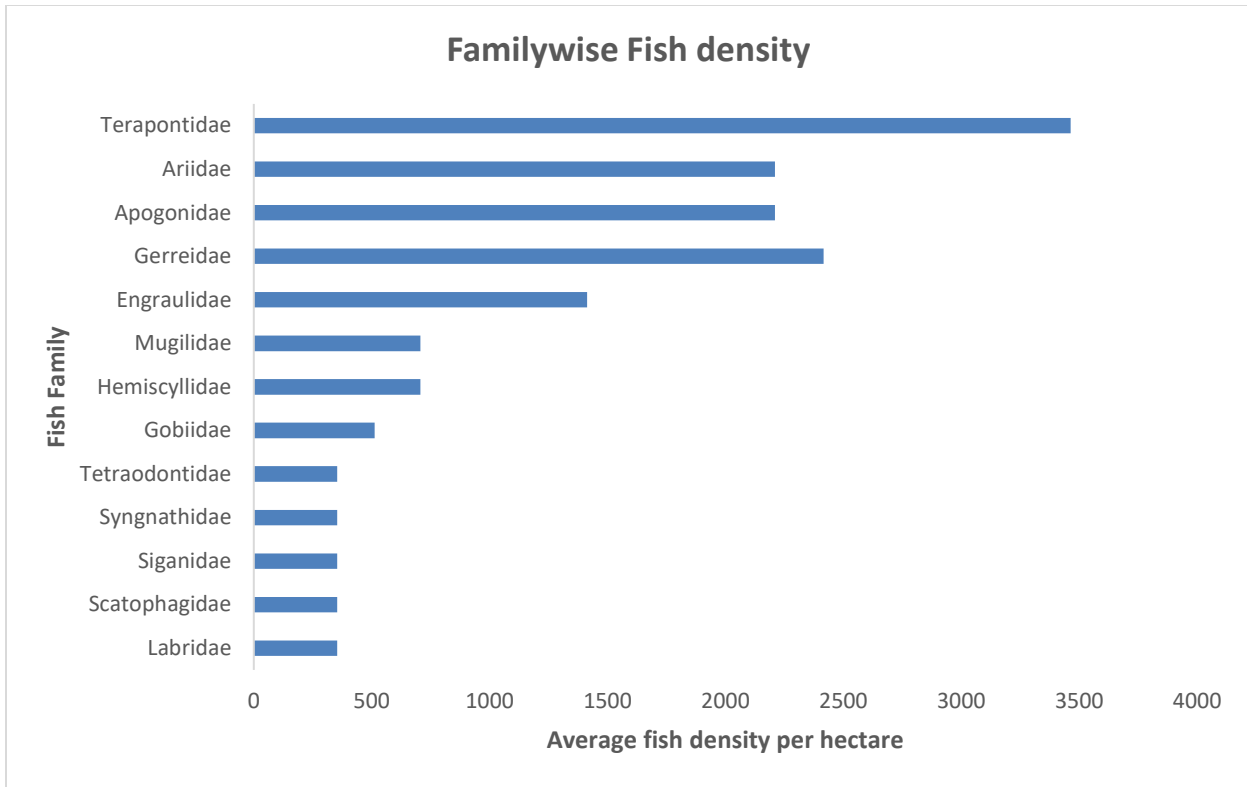


Fig. 3.5: Family wise fish densities in observed in seagrass meadows in Palk Bay

3.1.7 Dugong stranding reports (June 2018- April 2019)

A young dugong of length 1.55m was washed ashore in P. M. Valasai (Erwadi), Gulf of Mannar. Post mortem was conducted by the TNFD. Samples of tissue, bone and blubber were collected. Cause of death was unknown. Fisherman network was created in the village.



Image 3.17: Dugong calf stranded at P.M. Valasai, Gulf of Mannar

A fully grown adult male dugong (300kg, 2.99m long) was captured by 3 fishermen using gill nets. The marine police, who were the first to spot this illegal activity, informed the forest department. We were informed by both, the fishermen and the forest department. Post mortem was carried out by us under the guidance of a Government veterinarian. Worms were found in the dugong's stomach. Samples were collected to be sent for genetic analysis.



Image 3.18: Dugong poached at Thondi

The dugong that had stranded at Vembar was possibly poached as the injury on the animal was unnatural and not accidental. Post mortem was carried out and samples were collected.



Image 3.19: Dugong stranding at Vembar

Samples of tissue, bone and blubber were collected from a dugong that had stranded 3 days earlier on Thiruchendur beach. The Thiruchendur range forest department was present along with a veterinarian to collect samples and morphometrics of the stranded dugong.



Image 3.20: Dugong Stranding at Tirchendur, Gulf of Mannar

Samples were collected from a dead dugong that had washed ashore at Manamelkudi, Palk Bay. The carcass was cut in two and it was a suspected case of poaching for reasons unknown.



Image 3.21: Dugong stranding at Manamelkudi, Palk Bay

Three kilograms of dugong meat was seized by the Tamil Nadu Coastal Security Group in Manthiripattinam and the accused were caught.



Image 3.22: Dugong meat seized by Tamil Nadu Coastal Security Group

A female dugong was stranded off Mimisal coast, Palk Bay. Samples were collected and morphometric measurements were recorded



Image 3.22: Dugong Stranding at Mimisal, Palk Bay

Dugong skin and a dead dolphin were washed ashore on Ammapattinam coast, Palk Bay. Samples were collected.



Image 3.23: Dugong Skin, Ammapattinam, Palk Bay

Another dugong suspected to have been killed as a result of poaching had washed ashore at Periyapattinam (near Uchipuli). A case was filed by the Forest Department.



Image 3.24: Dugong Stranding at Periyapattinam, Palk Bay

2 adult dugongs (one male and one pregnant female) were entangled in a fishing net. The male dugong was successfully rescued; however, the female could not be rescued. Unfortunately, as it was not known that the female was pregnant, she was chosen to be rescued second. The fishermen, marine police, forest department, OMCAR team and the WII team were involved in the rescue. Samples of the unborn calf and the female were collected and morphometric measurements were recorded.



Image 3.25: Pregnant Female Dugong stranding, Palk Bay

A washed ashore dugong was suspected to have been killed by poachers in Mandapam. Another case was filed by the Forest Department.



Image 3.26: Dugong Stranding, Mandapam, Palk Bay

A dead adult female dugong that was most likely to have been killed by a propeller hit had washed up ashore on Ammapattinam beach. The forest department (Mr.,Rajashekar, RFO, Pudukottai and an Anti-Poaching Watcher) and Marine Police (Mr. Rajkumar, SI, Manamelkudi) was also present. After approval from the Forest Veterinarian, morphometrics were recorded and samples were collected by the WII team.



Image 3.27: Dugong stranding, Ammapattinam, Palk Bay

3.1.8 Other Marine Megafauna Strandings

Marine megafauna stranded: Dolphin

Date: 13/08/2018

Venue: Kodimunai, Palk Bay

Samples were collected from a dolphin that was stranded off at Kodimunai coast.



Image 3.28: Dolphin stranding, Kodimunai, Palk Bay



Image 3.29: Dolphin stranding, Manalmelkudi, Palk bay

Marine megafauna stranded: Dolphin

Date: 23/02/2019

Venue: Palakkudi, Palk Bay

Dolphin stranded at Palakudi, Palk Bay. Samples collected.



Image 3.30: Dolphin Stranding, Palakudi, Palk Bay

Marine megafauna stranded: Dolphin

Date: 03/03/2019

Venue: Mimisal, Palk Bay

A dolphin was stranded off Mimisal coast. Samples were collected.



Image: 3.31: Dolphin Stranding, Mimisal, Palk Bay

Marine megafauna stranded: Dolphin

Date: 09/03/2019

Venue: Karangkadu, Palk Bay

A dolphin was stranded off Karangkadu coast, Palk Bay. Samples were collected.



Image 3.32: Dolphin Stranding, Karangkadu, Palk Bay

Marine megafauna stranded: Green Turtle

Date: 12/04/2019

Venue: Thondi, Palk Bay

A green turtle was stranded at Thondi, Palk Bay. As the carcass was found at night, and the place of stranding was inaccessible, samples could not be collected. The carcass was buried the following day by the TNFD.



Image 3.33: Green Turtle Stranding, Thondi, Palk Bay

Marine megafauna stranded: Green Turtle

Date: 14/04/2019

Venue: Ammapattinam, Palk Bay

A green turtle was stranded at Ammapattinam, Palk Bay. The team was present, but samples could not be collected as there was delay in arrival of forest officials.



Image 3.34: Green Turtle Stranding, Ammapattinam, Palk Bay

3.1.9 Coral Bleaching Event

During an exploratory survey at Mandapam, Palk Bay, the WII team observed bleached corals in the region. This was reported to the Forest Department as a possible bleaching event. This was confirmed by Suganthi Devadasan Marine Research Institute (a Tuticorin-based NGO) during their surveys. This was also reported in a local newspaper as a bleaching event from April 15-24th, 2019. In 'The Hindu', the event was reported to have occurred on 21st April, 2019.

Link to the article in 'The Hindu': <http://www.thehindu.com/news/cities/Madurai/corals-in-gulf-of-mannar-feel-the-heat/article26904665.ece>



Image 3.35: Coral bleaching, Mandapam, Palk Bay

3.2 Outreach and Awareness

3.2.1 Dugong Scholarship Program

Date: 22/11/2018

The team visited coastal 31 government high schools and higher secondary schools selected to participate in the Dugong Scholarship Examination, 2018. These schools were to be newly included this year.



Image 3.36: Government High School visit

Date: 19-20/11/2018 and 26-28/11/2018

Application forms were distributed to 52 schools for the students to participate in the Scholarship Examination. Only 9th and 11th Standard students whose parents/guardian possessed a 'fisherman identity card' were eligible to appear for the examination. We also visited the District Educational Officer and District Forest Officer (WLW), Ramanathapuram, Pudukottai and Thanjavur Districts, to request for permission and support to conduct the examination.

Date: 06-19/12/2018

Application forms were collected from all schools and verified to make sure only eligible students were issued admit cards.

Date: 22/12/2018

A 20 page study material (in Tamil) was provided to each student who had applied for the Dugong scholarship Examination, from the 50 schools across 3 districts. The material was distributed on the same day to all schools.

Date: 01/02/2019

Forenoon: 140 (out of 144 students who applied) students from five govt. schools on the coast of Thanjavur district (from Adiramapattinam to Sethubhavasathiram) appeared for the exam at Mallipattinam govt school, Mallipattinam. The programme began with an inaugural function. Mr. Guruswamy, DFO, Thanjavur District, Mr.Mohan, RFO, Pattukottai, Mrs. Gangeshwari, Inspector of Fisheries, Fisheries Department, Mrs. Subha, Marine Police Head and SI, Thanjavur District, Dr.Balaji, OMCAR Director, and the Fishing Community head, Mallipattinam, Thanjavur District accepted our invitation to the programme and addressed the school children who had assembled at the school before commencement of the examination. A sapling was also planted by the officials before the exam began, and every participating school was presented with 2 saplings each. 5 teachers and other school staff helped in carrying out the event smoothly.



Image 3.37: Dugong Scholarship exam at Thanjavur District



Image 3.38: Dugong Scholarship exam at Thanjavur District

Afternoon: 121 (out of 132 students who applied) students from seven govt. schools from coastal part of Pudukottai District (from Kattumavadi to Mimisal) appeared for the exam at Manamelkudi Govt. Boys Hr. Sec. School, Manamelkudi. The inaugural function was graced by Marine Police Inspector, Mr. Jawahar and Mr. Selvendran from the Fisheries Dept., Pudukottai, who shared their thoughts with the students before they wrote the exam. A sapling was also planted by the officials before the exam began, and every participating school was presented with 2 saplings each. 7 teachers and other school staff were involved in the programme.



Image 3.39: Dugong Scholarship Exam, Pudukottai district

Date: 07/02/2019

Forenoon: 125 (out of 136 students who applied) students from 6 schools from S. P. Pattinam to Karangadu appeared for the exam at S. M. Boys Hr. Sec. School, Thondi, Ramnad District. Mr. Balamurugan, Magistrate of Thiruvadanai, Mr. Abdul Kadhar, Assistant director of Fisheries, Dr. Stella, Head of the Department of Marine Studies, Alagappa University, Mr. Sudhakar, Forester, Thondi, the Marine police sub inspector, and Fishing community head, Thondi were present at the inaugural function. A sapling was also planted by the officials before the exam began, and every participating school was presented with 2 saplings each. 6 teachers and other school staff extended their help.



Image 3.40: Dugong Scholarship Exam, Ramand district

Afternoon: The exam was conducted separately in 4 schools of Ramnad District. 64 (out of 67 applied) students appeared for the examination at Govt. High School, Uppur, 42 (out of 46) students at Govt. Hr. Sec. Thiruppalaikudi, and all 6 and 15 students who had applied from Govt. High School, Sambai and Govt. Hr. Sec. School, Devipattinam, respectively, appeared for the examination at their schools. Every participating school was presented with 2 saplings each. 4 teachers helped to conduct the exams.



Image 3.41: Dugong Scholarship Exam, Ramand district

Date: 08/02/2019

The exam was conducted separately in 5 schools of Ramnad District. 22 (out of 22 applied) students appeared for the examination at Mohamedia Hr. Sec. School, ChittarKottai, 16 (out of 18) students at Govt. High School, Palanivalasai, 20 (out of 21) from Girls. Hr. Sec School, Panaikulam, 12 (out of 17) students from Bahruddin Boys' Hr. Sec. School, Panaikulam and all 30 students who had applied from Govt. Hr. Sec. School, Azhagankulam appeared for the examination at their schools. Every participating school was presented with 2 saplings each.

Date: 22/02/2019

135 (out of 147 students who had applied) students from 6 schools from Tirupullani, Kilakarai (4 schools) and Ervadi appeared for the exam conducted at Hameediah Boys' Hr. Sec. School, Kilakarai, Ramnad District. Mr. Sikkandar Batcha, RFO, Kilakarai, Mr. Felix Suresh Peter, Marine Police Inspector, Prof. Dr.Rajabudeen, Principal, Syed Hameedia Arts and Science College, Kilakarai, Mr. Jaysudas from Fisheries department and Mr. Syed Karunai, Fisheries Society Head graced the inaugural function. A sapling was also planted by the officials before the exam began, and every participating school was presented with 2 saplings each. One teacher and other volunteers helped us conduct the exam.



Image 3.42: Dugong Scholarship Exam, Ramand district

Date: 25/02/2019

The exam was conducted separately in 4 schools of Ramnad District. 32 (out of 34 applied) students appeared for the examination at Govt. Hr. Sec. School, Uchipuli, 25 (out of 27) students at Govt. Hr. Sec. School, Irumeni, 70 (out of 78) students who had applied from Govt. Hr. Sec. School, Vedalai, and 47 (out of 52) from Girls. Hr. Sec School, Mandapam. Every participating school was presented with 2 saplings each. 4 teachers and school staff were involved in the event.

Date: 26/02/2019

Forenoon: 188 (out of 251 students who applied) students from 5 schools from Pamban to Karaiyur appeared for the exam at Govt. Hr. Sec. School, Thangachimadam, Ramnad District. Mr. Satish, RFO, Mandapam, Mr. Felix Suresh Peter, Marine Police Inspector, Mr. Ishwaran, Sub-inspector of Fisheries and Mr. Dhanraj, Fisheries Society Head graced the inaugural function. A sapling was also planted by the officials before the exam began, and every participating school was presented with 2 saplings each. 5 teachers and other staff from the schools helped in conducting the exam



Image 3.43: Dugong Scholarship Exam, Ramand district

Afternoon: 15 out of 20 students who had applied for the exam appeared for the exam conducted at Govt. Hr. Sec. School, Mandapam Camp, Ramnad District. 2 saplings were presented to their school. A school teacher and other school staff helped.

Date: 27/02/2019

The exam was conducted separately in 6 schools of Ramnad District. 9 students (out of 9 applied) from Govt. Girls' Hr. Sec. School, Pudumadam, 14 (out of 25) from Govt. Hr. Sec. School, Pudumadam, 5 (out of 5) from Govt. High School, Thamaraiikulam, 21 (out of 21) from Govt. Hr. Sec. School, Periyapattinam,

and 14 (out of 14) from Govt. High School, Kalimankundu appeared for the examination at their schools. Every participating school was presented with 2 saplings each. 6 teachers and other school staff and volunteers were involved in conducting the exam



Image 3.44: Dugong Scholarship Exam, Ramand district

Date: 28/02/2019

All 5 students who had applied from Govt. High School, Puduvalasai appeared for the exam conducted at their school. 2 saplings were given to the school. A teacher and school staff helped conduct the exam smoothly.

Date: 11/04/2019

After correction of answer sheets by the faculty of Mohammed Sathak Dastagir Teacher Training Institute, Ramanathapuram, the Principal of the institute declared the list of the top 100 candidates who were to be awarded the scholarship for the academic years 2018-20.

MARA-Sekolah-Tinggi-CAMPAK-Batang-Beserah
Dugong Scholarship Examination Final Mark List
2018-2019

No.	Nama	Tempat	Markah	Kategori	Status
1	S. Yusoff	1	100.00		Prestasi
2	S. Yusoff	2	100.00		
3	S. Yusoff	3	100.00		
4	S. Yusoff	4	100.00		
5	S. Yusoff	5	100.00		
6	S. Yusoff	6	100.00		
7	S. Yusoff	7	100.00		
8	S. Yusoff	8	100.00		
9	S. Yusoff	9	100.00		
10	S. Yusoff	10	100.00		
11	S. Yusoff	11	100.00		Abiturien
12	S. Yusoff	12	100.00		
13	S. Yusoff	13	100.00		
14	S. Yusoff	14	100.00		
15	S. Yusoff	15	100.00		
16	S. Yusoff	16	100.00		
17	S. Yusoff	17	100.00		
18	S. Yusoff	18	100.00		
19	S. Yusoff	19	100.00		
20	S. Yusoff	20	100.00		
21	S. Yusoff	21	100.00		Mentorship
22	S. Yusoff	22	100.00		
23	S. Yusoff	23	100.00		
24	S. Yusoff	24	100.00		
25	S. Yusoff	25	100.00		
26	S. Yusoff	26	100.00		
27	S. Yusoff	27	100.00		
28	S. Yusoff	28	100.00		
29	S. Yusoff	29	100.00		
30	S. Yusoff	30	100.00		

31	S. Yusoff	31	100.00	
32	S. Yusoff	32	100.00	
33	S. Yusoff	33	100.00	
34	S. Yusoff	34	100.00	
35	S. Yusoff	35	100.00	
36	S. Yusoff	36	100.00	
37	S. Yusoff	37	100.00	
38	S. Yusoff	38	100.00	
39	S. Yusoff	39	100.00	
40	S. Yusoff	40	100.00	
41	S. Yusoff	41	100.00	
42	S. Yusoff	42	100.00	
43	S. Yusoff	43	100.00	
44	S. Yusoff	44	100.00	
45	S. Yusoff	45	100.00	
46	S. Yusoff	46	100.00	
47	S. Yusoff	47	100.00	
48	S. Yusoff	48	100.00	
49	S. Yusoff	49	100.00	
50	S. Yusoff	50	100.00	

51	S. Yusoff	51	100.00	
52	S. Yusoff	52	100.00	
53	S. Yusoff	53	100.00	
54	S. Yusoff	54	100.00	
55	S. Yusoff	55	100.00	
56	S. Yusoff	56	100.00	
57	S. Yusoff	57	100.00	
58	S. Yusoff	58	100.00	
59	S. Yusoff	59	100.00	
60	S. Yusoff	60	100.00	
61	S. Yusoff	61	100.00	
62	S. Yusoff	62	100.00	
63	S. Yusoff	63	100.00	
64	S. Yusoff	64	100.00	
65	S. Yusoff	65	100.00	
66	S. Yusoff	66	100.00	
67	S. Yusoff	67	100.00	
68	S. Yusoff	68	100.00	
69	S. Yusoff	69	100.00	
70	S. Yusoff	70	100.00	

Image 3.45: Candidate list of Dugong Scholarship awardees

3.2.2 World Biodiversity Day celebrations

Date: 22/05/2018

Venue: Ariyaman Beach, Palk Bay

29 dugong ambassadors participated in the World Biodiversity Day celebrations at Ariyaman Beach. The day began with Rangoli competitions for women from EDC, followed by an awareness rally by the dugong ambassadors, an introduction to Turtle Exclusion Device for fishermen and participants by the Range Forest Officer, Mandapam Range and a beach clean-up programme by our dugong ambassadors, EDC members and other volunteers present at the venue.



Image 3. 46: World Biodiversity Day celebrations, Ariyaman beach

3.2.3 World Ocean Day celebrations

Date: 05/06/2018

Venue: Devipattinam, Palk Bay

We were part of the World Ocean Day celebrations organized by the Tamil Nadu Fisheries Dept. Forest dept. officials, people from CMFRI, the Coast Guard and Marine police also addressed the gathering. Men and women of the fishing community attended the meeting. We interacted with the fishermen and emphasised the need to conserve dugongs and other endangered marine organisms.



Image 3.47: World Ocean Day celebrations, Devipattinam, Palk Bay

3.2.4 Meeting with Mr. Dhritiman Mukherjee

Date: 28/05-01/06/2018

We got an opportunity to spend time with India's only full-time still-photographer- Mr. Dhritiman Mukherjee, who visited Tamil Nadu from 28th May to 1st June, 2018. We introduced him to the unique biodiversity of the seagrass and coral ecosystems in different spots at both, Gulf of Mannar and Palk Bay. He explored the biodiversity here and has shared some of his shots of seagrass associated fauna with the team.



Image 3.48: Meeting with Mr. Dhritiman

3.2.5 Community Meetings in collaboration with Tamil Nadu Fisheries Department

Date: 26-29/06/2018

Venue: Soliyakkudi, Pasipattinam, Thondi, Devipattinam and Tirupalaikudi, Palk Bay

Our team from Thondi was invited to talk about dugongs at the community meetings conducted by the Tamil Nadu Fisheries Department at Soliyakkudi, Pasipattinam, Thondi, Devipattinam and Thirupalaikudi for 5 consecutive days. We got an opportunity to meet with village heads and fishermen in order to strengthen our network



Image 3.49: Fisher Community Meeting, Palk Bay

3.2.6 Fishermen Incentive Felicitation Programme

Date: 08/08/2018

Venue: OMCAR, Velivayal, Palk Bay



Image 3.50: Fishermen Incentive Felicitation Programme, OMCAR Foundation, Palk Bay

3.2.7 Awareness Programme

Date: 19/09/2018

Venue: SP Pattinam, Thondi, Palk Bay

The WII TN Dugong Volunteers participated in an awareness programme conducted by the TNFD, regardless of the fact that the team was absent. They contributed to creating awareness about dugong protection and the role of WII for the same. There were about 75 attendees.



Image 3.51: Awareness Programme, SP Pattinam, Palk Bay

Date: 20/09/2018

Venue: Karangkadu, Palk Bay

WII TN Dugong Volunteers participated in an awareness programme conducted by the TNFD at Karangkadu, where the Wildlife Warden, Mr. Ashok Kumar IFS also addressed the fishing community to create awareness about the pros and cons of illegal fishing, poaching and hunting of protected marine species. About 50 attendees were present.



Image 3.52: Awareness Programme, Karangkadu, Palk Bay

3.2.8 Stall at Marine Exhibition

Date: 05/10/2018

Venue: Ramanathapuram

We put up a self-explanatory stall at Mohammed Sathak Dastagir Teacher Training Institute, Ramanathapuram Marine Exhibition conducted by the TNFD. In spite of the absence of the team, our Dugong Volunteers and the Forest department explained our work and created awareness about seagrass and Dugong research and conservation. More than 1000 people comprising of school and college students, diploma trainees, teachers, general public attended the exhibition.



Image 3.53: Marine Exhibition, Ramanathapuram

Date: 02/12/2018

Venue: Pudupattinam and Mullimunai, Palk Bay

A one-day awareness programme in Mullimunai and Pudupattinam was conducted jointly by the TN Forest Department and Karunya trust (an organization that uses folk dances and entertainment programmes to create awareness about legal and illegal hunting and fishing practices, and importance of marine species such as dugongs, turtles, etc.), for which the WII team was invited to be a part. The WII team was present and explained the importance of Dugong presence in Palk Bay waters and made the community take an oath for long-term conservation of Dugongs in Palk Bay. About 70 people from the fisherfolk attended the programme.

3.2.9 Stakeholders Awareness Meet

Date: 12/01/2019

Venue: Ramanathapuram, Palk Bay

Mr. Satish, RFO, Mandapam, conducted a meeting and discussion session for Foresters, Forest guards and Anti-poaching watchers with the Mr. P. Balamurugan, District Munsif cum Judicial Magistrate, Thiruvadanai Court, and the WII Team. This provided a platform to discuss wildlife related issues with different levels of the forest department and legal issues related to filing cases and protection measures. 40-50 members of the Tamil Nadu Forest Department were present at the event



Image 3.54: Awareness meets with Forest Department, Ramanathapuram

3.2.10 Meeting with MoEFCC official, Dr. Tashi Wangdi

Date: 21/01/2019

Venue: Krusadai and Shingle Island, Gulf of Mannar

The TN WII team was invited by the RFO, Mandapam to meet with Dr. Tashi Wangdi, Director and Member Secretary, Indian National MAB Committee, Govt. of India, MoEFCC, who was on a visit to the Marine National Park to monitor, inspect and interact with officials/stakeholders of Gulf of Mannar Biosphere Reserve Trust. We discussed the problems faced by people in and out of the Marine National Park, activities conducted by us and the role of us and the forest department in making the reserve a better place for the biodiversity and the communities living in it. There was a field visit to shingle island with and Kurusadai Island, where salt marshes, coral and seagrass ecosystems were shown to him.



Image 3.55: Meeting with Dr.Tashi Wangdi, Gulf of Mannar

3.2.11. Stall at Marine Exhibition

Date: 12-14/02/2019

Venue: Tuticorin

The team was involved in setting up an exhibit at Kamaraj College, Tuticorin, at the Marine Exhibition conducted by the Forest Department, to showcase marine biodiversity, with importance to dugongs and seagrasses, and demonstrate the techniques used for biodiversity monitoring with importance to snorkelling and SCUBA diving. The crowd of more than a 1000 people was diverse with forest officials, school students, college students, teachers and others.



Image 3.56: Marine Exhibition, Tuticorin

Date: 15/02/2019

Venue: Muthupet, Palk Bay

Our team was invited by the Thiruvarur Forest Department to for an awareness programme conducted by them to create awareness about the importance of marine biodiversity and its protection. We got a platform to explain the same with special focus on dugongs and seagrasses to the fishermen and other stakeholders at Thiruvarur. About 50 people attended the programme from the fishing community.



Image 3.57: Awareness Programme, Muthupet, Palk Bay

3.2.12 National Awareness Conference on the Values of Biodiversity and its Conservation

Date: 08/03/2019

Venue: Dr. Ambedkar Government Arts College, Chennai

Mr. Madhu Magesh presented our work as an oral as well as a poster presentation, and won the Best Poster Award at the conference, where more than 250 people had attended.



Image 3.58: Oral Presentation at National Awareness Conference on the Values of Biodiversity and its Conservation, Chennai

3.2.13 Fishery Department Community Meeting

Date: 23/03/2019

Venue: Kattumavadi, Palk Bay

The WII team created awareness among about 60 members of the fishery community at Kattumavadi, Palk Bay regarding Dugongs and seagrass conservation in the form of a discussion and oral presentation.



Image 3.59: Fisher Community Meeting, Kattumavadi, Palk Bay

3.2.14 Awareness Programme among students

Date: 25/03/2019

Venue: Ramanathapuram District

The WII team along with OMCAR foundation were invited by the TNFD to create awareness about conservation of biodiversity, with emphasis on dugongs and seagrasses at 8 schools in Ramnad District. The reach was overwhelming with school students making up majority of the audience. About 800 students attended the meeting.



Image 3.60: Student Awareness Programme, Ramanathapuram

3.2.15 Community Meeting and Awareness Program

Date: 28/03/2019

Venue: Manamelkudi, Palk Bay

As part of the Awareness programme conducted by the Pudukottai Forest Department, the WII team participated and created awareness about dugongs, seagrasses and their conservation to 60 members of the fishing community in the area.



Image 3.61: Fisher Community Meeting, Manamelkudi, Palk Bay

3.2.16 World Earth Day Celebrations: Underwater Beach Clean-up with Stakeholders

Date: 24/04/2019

Venue: Mandapam, Palk Bay

1 Range officer, 2 Foresters from Ramanathapuram range, 3 Anti-poaching Watchers from Ramanathapuram range, 2 volunteers from Temple Adventures, Pondicherry: Aravind and Deebika, and Madhu Magesh, Rukmini Shekar from WII were involved in an underwater clean-up program as part of World Earth Day Celebrations.



Image 3.62: Underwater Clean-up Program Mandapam

3.2.17 Boat survey involving fisher community

Every boat survey was considered as an outreach event, because the community and their boats assist us in carrying out the surveys. There was a very good interaction with several fishermen who accompanied us. We have got several more members added to our network and they have already reported marine mammal (even dugong) sightings in their area. They now have the 'Save Dugong' mobile application installed on their smart phones and have agreed to take dugong conservation to the community level in a more effective and systematic manner. T-shirts were distributed to all.



Image 3.63: Boat Surveys involving Fisher Community, Palk Bay

3.3 Capacity Building

3.3.1 2nd Special Training Course on Hands-on Training towards Underwater Marine Biodiversity Monitoring with SCUBA Diving

Date: 13-18/08/2018

Venue: Ramanathapuram

5 Foresters were provided Open Water Diver certification by PADI, Australia and were prepared to monitor the coastal biodiversity. Mr. Aravind, Temple Adventures, Pondicherry, was their instructor. The event attracted the attention of Forest Staff from all ranks- District Forest Officers, Assistant Conservator of Forest and Range Forest Officers, to dive with the trainees, and it was a great encouragement for the new students.



Image 3.64: 2nd Special training course Training with SCUBA Diving, Ramanathapuram

3.3.2 National Workshop on Rapid Response Plan for Managing Coral Reef Ecosystems of India to mitigate threats of coral bleaching and Disease outbreak

Date: 23-24/08/2018

Venue: Tuticorin

Mr. Prem Jothi attended the workshop, where several aspects of coral reef conservation and the needs for a rapid action plan to save our reefs were discussed.



Image 3.65: National Workshop on Rapid Response Plan for Managing Coral Reef Ecosystems of India, Tuticorin

3.3.3 Field Trip for M.Sc. Students, WII

Date: 22-24/11/2018

Venue: Ramanathapuram, Islands of Gulf of Mannar Marine National Park

Wildlife Institute of India's MSc. Wildlife Science 2017-19 batch visited the Gulf of Mannar as part of their field trip from 22nd-24th November, 2018 along with Dr. J. A. Johnson and Dr. G. V. Gopi and researchers from WII- Mr. Frank and Mr. Paul Peter. On 23rd Nov, Tamil Nadu Dugong team along with the Tamil Nadu Forest Department, accompanied them to Muyal Thivu (Hare Island), the 7th island of the Mandapam Group of Islands. They were introduced to field techniques such as Snorkeling and SCUBA Diving. The students could explore the coral and seagrass ecosystems around the island. The afternoon session included a discussion with the

forest Range Officer, Mandapam, Mr. Satish, where they discussed about the challenges and opportunities in managing the Gulf of Mannar Marine National Park. Their day ended with a visit to Rameshwaram and Dhanushkodi. On the next day, they were taken to Nallathanni Island, the first island of Vembar group of Islands. The students got an opportunity to snorkel in this Island as well.



Image 3.66: Field Trip for MSc Students of WII, Gulf of Mannar Marine National Park

3.3.4 Biodiversity Monitoring Training for SCUBA certified Frontline staff of the Tamil Nadu Forest Dept

Date: 04/01/2019

Venue: Kurusadai Island, Gulf of Mannar

In the sheltered reef and seagrass patches of Kurusadai Island, 15 SCUBA Certified frontline staff and 7 other forest department staff from Palk Bay and Gulf of Mannar region were trained to monitor marine biodiversity in the region using basic monitoring techniques. Dr. Sivakumar conducted the training programme, with the Tamil Nadu team to help and assist. Mr. Krishna and Mr. Prathap also demonstrated the use of drones in aerial monitoring as well. Mr. Rajkumar, ACF, Ramanathapuram, Mr. Satish, RFO, Mandapam and Mr. Guna, Forester, Mandapam also attended the training session.



Image 3.67: Biodiversity Monitoring Training, Krusadai Island, Gulf of Mannar

3.3.5 Biodiversity monitoring training (follow-up)

Date: 20-01-2019

Venue: Mandapam

Forest guards and anti-poaching watchers were given another practical session of biodiversity monitoring along with a demonstration of how to use a compressor.



Image 3.68: Biodiversity monitoring training, Mandapam

3.3.6 Field trip for students from Manonmaniam Sundaranar University, Nagarcovil campus, Tamil Nadu

Date: 15-03-2019

Venue: Mandapam, Palk Bay

WII team conducted a field training program with hands-on training on sea grass and coral habitat monitoring surveys using snorkeling as a tool.



Image 3.69: Field trip for students of Manonmaniam Sundaranar University, Mandapam

3.3.7 3rd Special Training Course on Hands-on Training towards Underwater Marine Biodiversity Monitoring with SCUBA Diving

Date: 25-28-04-2019

Venue: Ramanathapuram, Ariyaman Beach, Mandapam

Day 1 (25.04.2019): The inaugural program for the underwater marine biodiversity monitoring with SCUBA diving April 2019 was conducted at the Forest Department Conference Hall, Ramanathapuram. The occasion was graced by Mr. Vanniya Perumal IPS, Additional Director General of Police, Tamil Nadu, Mr. T. K. Ashok Kumar IFS, Wildlife Warden, Gulf of Mannar Marine Biosphere Reserve, Mr. Raj Kumar, Assistant Conservator of Forest, Ramanathapuram, and Mr. S. B. Aravind (dive instructor for the course) Director, Temple Adventures, Pondicherry. The participants of the course were 12 in number, with 5 from the Tamil Nadu Forest Department (2 foresters from Ramanathapuram, 2 foresters from Trichy and one forest watcher from Pudukottai division), 5 from the Tamil Nadu Coastal Security Group (3 Sub-Inspectors from Pudukottai and 3 Sub-Inspectors Ramanathapuram district) and 2 participants from the fishing community, who are also active Dugong Volunteers. The Welcome address was delivered by Ms. Rukmini Shekar, Project fellow, Dugong Recovery Project, WII. The Chief Guest, Mr. Vanniya Perumal, IPS and the Wildlife Warden Mr. Ashok Kumar IFS were honoured with a memento. The gathering was addressed by the Wildlife Warden Mr Ashok Kumar and the inaugural address was delivered by Mr. Vanniya Perumal. The participants were presented with a stationery kit by Mr. Vanniya Perumal. The dive instructor for this course, Mr. S. B. Aravind also spoke a few words of introduction. The vote of thanks was presented by Mr. Madhu Magesh Project Fellow, Dugong Recovery Project, WII. After a short tea break, the session was handed over to Mr. Aravind, marking the beginning of the theory classes of this course which continued after a short lunch break. The sessions were aided with videos followed by knowledge review tests for each session (chapter).



Image 3.70: 3rd Special training course Training with SCUBA Diving, Ramanathapuram

Day 2 (26.04.2019):



Image 3.71: SCUBA Diving Training, Ramanathapuram

Day 3 (27.04.2019): The third day of the training started with briefing and a demonstration of few techniques, followed by the first open water dive assisted by the Temple Adventures team and a second dive near the coral patches of Mandapam in two batches respectively. After the lunch break, a discussion was conducted at the Forest Outpost, Mandapam.

Day 4 (29.04.2019) : The first batch of the participants (marine police team and one fisherman) were taken for a 20 minute dive, while the second batch (consisting of a fisherman and the forest department team) attended the theory and practical session of biodiversity monitoring conducted by Ms. Rukmini Shekar and Mr. Madhu Magesh from WII, and vice versa. The final examination for the participants was conducted in the afternoon at the Ramanathapuram Forest office. The valedictory event was attended by the Wildlife Warden, Gulf of Mannar Biosphere Reserve, Mr. Ashok Kumar, who presented the participants with the course completion certificate and a memento, and delivered a speech highlighting the importance of the course and the collaborative work. Mr. Aravind gave a small speech encouraging the participants to dive more and to put this skill for a better purpose. He was presented with a memento by the Wildlife Warden, Mr. Ashok Kumar. The participants shared their experience and opinions. A presentation about the project and its aspects was delivered by Mr. Madhu Magesh. The vote of thanks for this occasion was delivered by Ms. Chinmaya Ghanekar, INSPIRE Fellow, Dugong Recovery Project, WII.





Image 3.72: 3rd Special training course Training with SCUBA Diving, Ramanathapuram

3.4 Outputs and Accomplishments

3.4.1 Dugong Rescue

Date: 26/07/2018

Venue: Keezhathottam, Rajamadam, Palk Bay

An entangled Dugong was rescued from by Fishermen, volunteers from the NGO- OMCAR, and the Tamil Nadu Coastal Security Group. The WII team helped in the rescue by ensuring participatory management during the rescue, with the help of the Friends of Dugong Network and related stakeholders. However, the team could not be present during the event, as the Draft Integrated Management Plan for the Gulf of Mannar Marine National Park and Biosphere Reserve (2018-27) had to be submitted at the office of the Principal Chief Conservator of Forests, Chennai, Tamil Nadu, on 27/07/2018.



Image 3.73: Dugong Rescue Rajamadam, Palk Bay

Date: 01/11/2018

Venue: Keezhathottam, Rajamadam, Palk Bay

A dugong that was entangled in fishing net was rescued by the fishermen, the WII team, Tamil Nadu Coastal Security Group, Forest Department and OMCAR foundation overnight at Ammapattinam. The rescue was successful, resulting in the release of an adult dugong.



Image 3.74: Dugong Rescue, Rajamadam, Palk Bay

Date: 14/03/2019

Venue: Ammapattinam, Palk Bay

2 adult dugongs (one male and one pregnant female) were entangled in a fishing net. The male dugong was successfully rescued; however, the female could not be rescued. Unfortunately, as it was not known that the female was pregnant, she was chosen to be rescued second. The fishermen, coastal security group, forest department, OMCAR team and the WII team were involved in the rescue.



Image 3.75: Dugong Rescue, Ammapattinam, Palk Bay

3.4.2 Dugong Sighting Video

Date: 21/11/2018

Venue: Thondi

We conducted a boat survey off Thondi coast on getting information from a Dugong volunteer (fisherman) about a recent dugong sighting. The evidence was in the form of a video and is hence the first video of a dugong in the wild from Tamil Nadu.



Image 3.76: Dugong Sighting, Thondi, Palk Bay

3.4.3 Management plan

Draft Integrated Management Plan for the Gulf of Mannar Marine National Park and Biosphere Reserve (2018-27)

Date: 27/07/2018

Venue: Office of the Tamil Nadu Principal Chief Conservator of Forest, Chennai

The Draft Integrated Management Plan for the Gulf of Mannar Marine National Park and Biosphere Reserve (2018-27) was presented to Mr. Raghunathan IFS, former Principal Chief Conservator of Forests, Tamil Nadu Forest Department (TNFD), Mr. Sanjay Srivastav IFS, Chief Wildlife Warden, TNFD, Mr. Debasis Jana IFS, Additional Chief Conservator of Forests, TNFD and Mr. Ashok Kumar IFS, Wildlife Warden, Ramanathapuram (GoMMNP). The plan was explained with the help of a presentation by Dr. K. Sivakumar, Scientist F and Principal Investigator of the Dugong Recovery Project, Wildlife Institute of India. Changes in the draft plan and suggestions were discussed.



Image 3.77: Meeting for Management Plan for the Gulf of Mannar Marine National Park and Biosphere Reserve, Chennai

3.4.4 Biodiversity monitoring of seagrass and coral restoration efforts

Date: 08/08/2018

Venue: Mandapam and Thondi, Palk Bay

Using SCUBA and Snorkeling techniques, WII team monitored the habitat restoration progress at Mandapam and Thondi, in the presence of TN PCCF and TBGP Director, Mr. Jagdish IFS, WLW, Ramanathapuram, GoMMNP, Mr. Ashok Kumar IFS, and ACF, Ramanathapuram, Mr. C. Rajkumar.



Image 3.78: Biodiversity Monitoring, Mandapam



Sh. Tarun Coomar (PCCF- ANI) Sh. D M Shukla (PCCF- Wildlife)
Sh. K. G. Rassogi (DFO- Mayabunder Wildlife Division)
Sh. Shaji Abraham (DFO- Havelock Division)
Sh. Naveen Kumar (DFO- DCF, Wildlife Division, Haddo)
Sh. A. K. Paul (ACF, Wildlife)
Sh. A. K. Singh (Range officer, Headquarters, Chidiyatapu Biological Park)
Sh. K. P. Abdul Rasheed (Range officer, Kalara Range-Mayabunder Wildlife Division)
Sh. Prasanta Das (Head Forest guard, Mayabunder Wildlife Division)
Sh. G. Charlice Kullu (Forest guard, Mayabunder Wildlife Division)
Sh. A. Gopi (Forest Guard, Mayabunder Wildlife Division)
Sh. Mohammad Hussain (Forester, Wildlife Division, Wandoor)
Sh. C. Rammaya (Forest guard, Wildlife Division, Wandoor)
Sh. Basheer Ahmed (Forest guard, Wildlife Division, Wandoor)
Sh. Pradip Mondal (Forest guard, Wildlife Division, Wandoor)

Sh. Vinay Mistry (Camp Officer Havelock Division)

Sh. M Syed Hussain (Forest guard, Havelock Division)

Sh. K Ravi Kumar (Forester, Havelock Division)

Ms. Krepa Singh (Forester, Havelock Division)

Sh. Jagdeep Lall (Forest guard, Mount Harriet National Park)

Indian Navy

Commander Kishore Birra (Air- INS Utkrosh)

Commander Ramanath (Director, Navy Children School)

Indian Coast Guard

DIG Ashish Mehrotra

Commandant L. Zou (Commander District headquarter No. 9- N&M Andaman)

Assistant Commandant Shubham Sharma (District headquarter No. 9- N&M Andaman)

Sh. Bhrigo Muni Das (Pradhan Navi)

4. ANDAMAN AND NICOBAR ISLANDS

4.1 Research and Monitoring

4.1.1 Seagrass habitat assessment of the Ritchie's archipelago (May 2018 and March 2019)

RJMNP is an archipelago comprised of 13 islands situated on the east coast of the Andaman Islands, and harbor seagrass habitats which support relict population of dugongs in the Islands. We carried out seagrass habitat assessment in the mentioned regions, to study the meadow characteristics like species composition, shoot density, shoot height and biomass. To highlight the habitat importance of seagrass meadows used by dugongs, we also assessed seagrass associated macro-benthic and fish diversity in the study sites (**both the studies being conducted in the islands for the first time**).

Objectives: We conducted seagrass habitat assessment with the following objectives:

- 1) Identify new seagrass habitats across Ritchie's archipelago
- 2) Understanding seagrass meadow characteristics
- 3) Delineating sensitive dugong habitats
- 4) Assessing habitat importance of seagrasses by studying
 - associated macro-benthic invertebrates
 - associated fish fauna

Study site: 5 Islands of this archipelago were surveyed:

3 protected (Henry Lawrence, Hugh Ross, John Lawrence) and

2 unprotected (Shaheed dweep and Swaraj dweep)

Methodology: We used systematic Line Intercept Technique (LIT) to assess seagrass meadow characteristics such as species composition, seagrass cover, shoot density, seagrass shoot height, biomass and algal cover. Three 50 m long LITs were conducted with 50 x 50 cm quadrants after every 5 m interval on each transect. We collected seagrass samples for above and below ground biomass estimation from a 20 X 20 cm quadrat within the larger 50 x 50 cm quadrant. Abiotic parameters like pH, Seawater surface temperature, Salinity, Depth were recorded using suitable data loggers.

Results: 9 seagrass meadows were sampled (26 transects) at non- protected islands of Swaraj dweep and Shaheed dweep and 5 meadows (8 transects) at protected islands of Henry Lawrence, Hugh Ross and John Lawrence were sampled. We recorded 10 species belonging to 6 genera during the survey period, namely *Halophila ovalis*, *Halophila minor*, *Halophila decipiens*, *Halodule pinifolia*, *Halodule uninervis*, *Thalassia hemprichii*, *Cymodocea rotundata*, *Cymodocea serrulata*,

Enhalus acoroides and *Syringodium isoetifolium*. The meadow characters are elaborated as follows:

Meadow characteristics:

Species richness

Highest number of seagrass species was recorded at Swaraj dweep (n=7). Following graph (Figure 4.1) shows species richness across the islands.

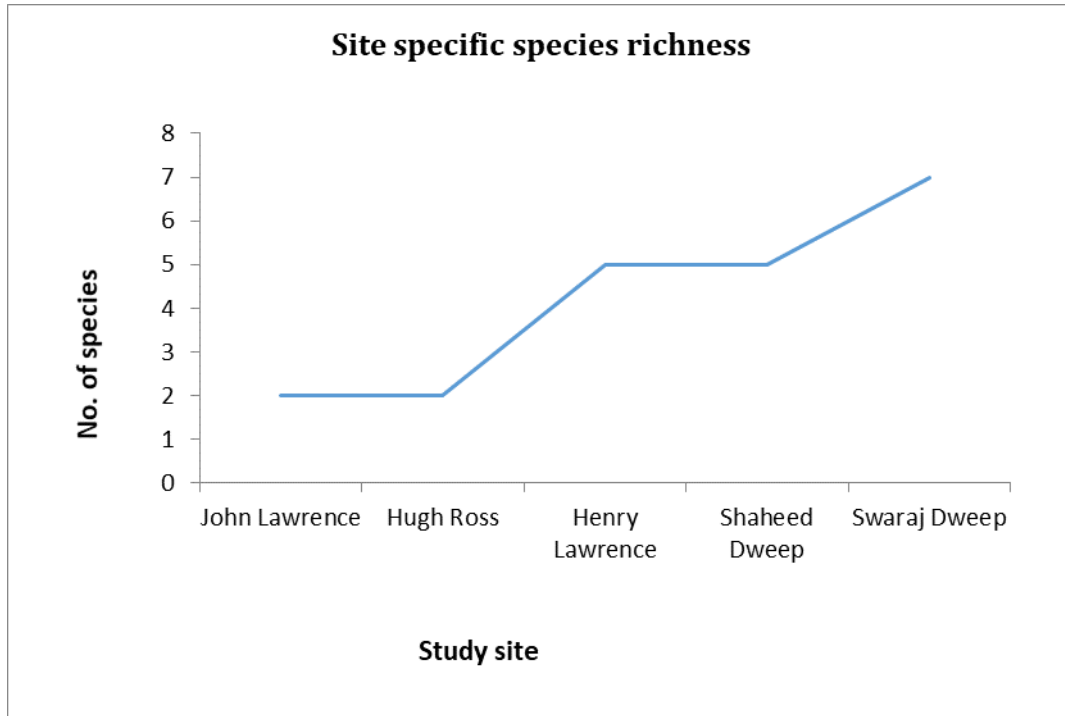


Figure 4.1: Graph showing seagrass species richness across islands of Ritchie’s Archipelago

The sampled meadows were across a depth gradient of 2 to 20m. We found that the species richness was negatively correlated to depth. We found dense multi-specific meadows at depth range of 0- 5m and the meadows became sparse as we sampled upto 20m. The following graph (Figure 4.2) shows distribution of seagrass species across depth- gradient.

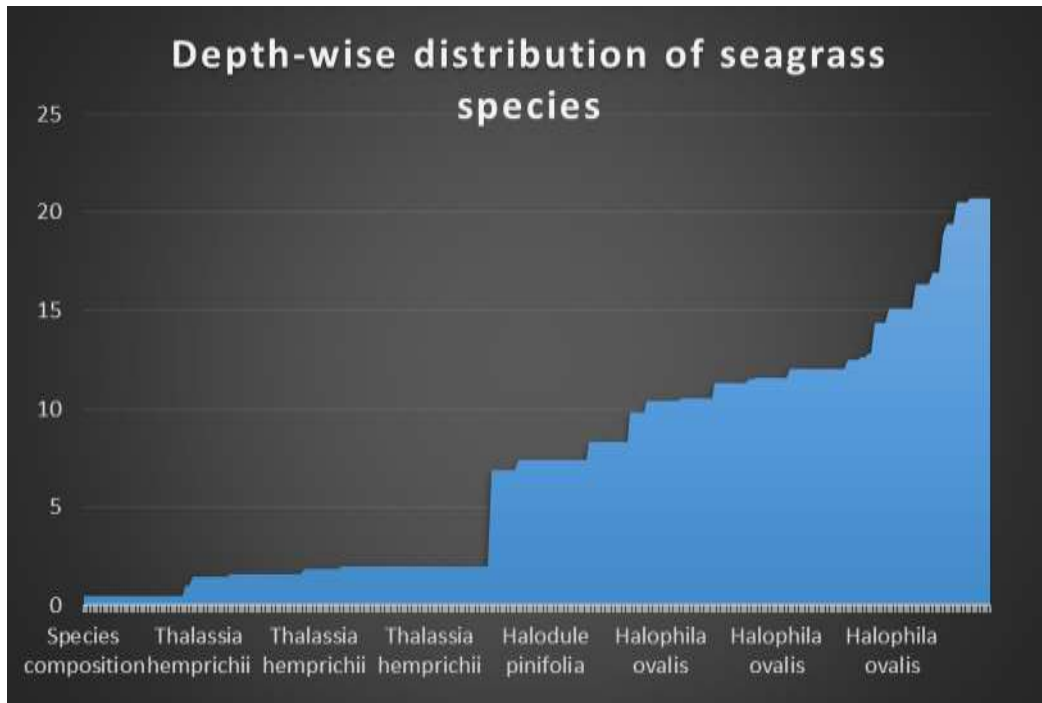


Figure 4.2: Depth wise distribution of seagrass species



Image 4.1: Mixed intertidal seagrass meadow, Swaraj Dweep Island



Image 4.2: Subtidal seagrass meadow of *Thalassia hemprichii*, Henry Lawrence



Image 4.3: Intertidal seagrass habitat assessment



Image 4.4: Subtidal seagrass LIT

4.1.2 Samples collected from stranded dugong for genetic analysis

In August 2018, a sub adult dugong was stranded ashore in Laxmanpur Beach of Shaheed Island. After taking morphometric measurements and conducting necropsy to understand the cause of death, tissue samples were collected by CAMPA-Dugong team in ANI for genetic analysis. This is the first study on dugong genetics from the Islands.

4.1.3 Fish market surveys to understand commercially important fishes associated with seagrasses, Swaraj dweep

It is important to understand fishing pressure at seagrass meadows in the islands. To understand the dependency of fishermen on fishes associated with seagrasses, we conducted fish market surveys in Swaraj dweep from 12th to 14th December 2018. On interaction with the fisher folk; information on type of crafts and gears used, island specific fishing ranges and fishes found in seagrasses and corals was studied.



Image 4.5: Fish market surveys to study commercially important fishes associated with seagrass

4.1.4 Standardizing fish survey methodology to be implemented in Andaman and Nicobar Islands and Tamil Nadu field sites

The team dived at few known seagrass meadows in Swaraj dweep from 18th to 23rd December 2018 and decided upon doing random point counts for assessing diversity and habitat use patterns. In this duration, the team dived at some meadows near Havelock and Henry Lawrence to see how the method needs to be modified in cases of meadows having differing characters.



Image 4.6: Seagrass associated fishes-methodology standardization (Researchers- Ms. Sohini Dudhat and Ms. Chinmaya Ghanekar)

Objective: Determining suitable method for assessing resource use fish fauna in seagrass meadows

Methodology: For selection of optimum method for studying fish fauna in seagrasses, comparison of point count and belt transect methods have been performed at Andaman Islands. 14 belt transects and 48 point counts were used for this comparison with comparative factor of fish densities observed in both methods. Shannon and Simpson diversity indices and evenness index were used to compare for these two methods. T-test was used to compare densities of fish families observed in both methods. Fish species were categorized into guilds based on their habitat- bottom dwelling, Coral/ rock/ anemone associated, seagrass associated and feeding guilds- carnivorous, herbivorous and omnivorous. Fish densities were also compared guild-wise observed in both the methods.

Results and Discussions

Method of point count was standardized for studying fish fauna associated with seagrasses as guild wise densities were higher in point count than belt count. Point count will facilitate observations of seagrass resource use by fish fauna with minimize disturbance which can be created by swimming. Besides this, point count will also be beneficial for cryptic and elusive fish species as observer will be steady throughout observation.

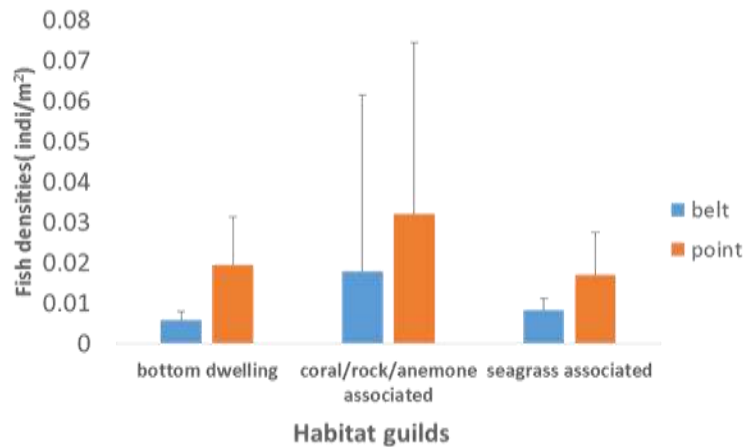


Figure 4.3: Result of comparison of habitat guild-wise average fish densities observed in point count and belt transect

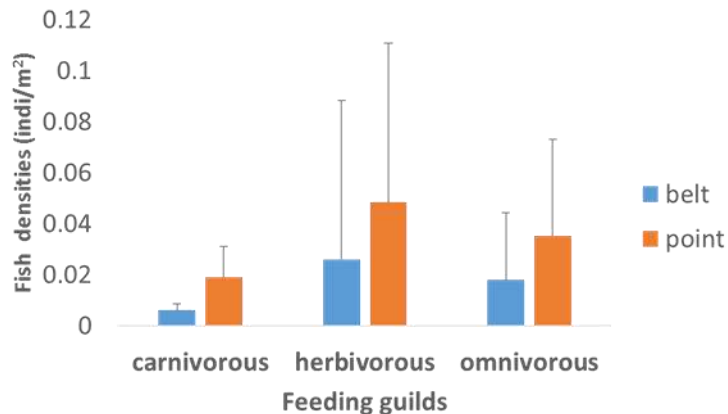


Figure 4.4: Result of comparison of feeding guild-wise average fish densities observed in point count and belt transect

Standardized methodology

Random Point counts by snorkelling or SCUBA diving (whichever appropriate). Variable radius point counts will be conducted by noting down distance of each sighting and then estimating the densities using distance sampling approach. Observer will hover not more than 2m above centre of the point for 10 minutes. The dominant activity within every minute of every fish species

individual or shoal will be noted along with seagrass characteristics. Their numbers will be specified according to size classes with reference to the tape. Position of fish individual/ shoal in seagrass column will also be noted. Selection of next point will be done by swimming in random direction. Distance between two points will be kept minimum 20 m. Number of point counts will be minimum 3 to maximum 5. Equal number of random point counts will also be conducted within 500 m of the meadow, where there is no seagrass.

4.1.5 Threat mapping of critical dugong habitat in Ritchie's Archipelago, South Andaman

Our team carried out systematic grid based boat surveys from 15th to 30th March 2019 at Ritchie's Archipelago (South Andaman) to assess the threats to the relict dugong population in terms of boat traffic and plastic pollution.



Image 4.7: Boat surveys for threat mapping of critical dugong habitats in Ritchie's archipelago

Methods

We used grid based distance sampling approach (2X2 km grids) in which at every point in the selected grid, 360 degree point count method was followed for 15 minutes to document threats in terms of plastic pollution, boat traffic, fishing pressure.

Results

We surveyed 60 grids in Ritchie's Archipelago, and sighted dolphins and sea turtles. Data collected for boat density showed that maximum boats sighted were being used for recreational purpose, and they were present mostly around Swaraj and Shaheed dweep islands. Fishing vessels were also sighted in and around the Rani Jhansi Marine National Park, the vessels

sighted inside the National park boundaries were passing through the protected area to fish in deeper waters.

4.1.6 Social surveys with local fishermen

We carried out questionnaire based surveys with the local fisher communities of Shaheed dweep and Swaraj dweep from 8th march to 25th March 2019 to understand their perception towards dugongs and seagrasses, gain secondary information on their distribution and fisheries aspect of their profession.



Image 4.8: Social surveys with fishermen in Shaheed dweep and Swaraj dweep Island

4.1.7 Threat mapping of critical dugong habitats in Mahatma Gandhi Marine National Park, South Andaman

Objective: We conducted boat surveys in Mahatma Gandhi Marine National Park from 16th to 18th April 2019 to map the threats in terms of boat traffic and plastic pollution as few islands in the region are known to have healthy seagrass meadows forming important habitat for dugongs. The information generated through these surveys will highlight the areas where boat traffic and dugong habitats overlap, giving us an idea of critical areas to be managed.

Methods: We used grid based distance sampling approach (2X2 km grids) in which at every point in the selected grid, 360 degree point count method was followed for 15 minutes to document threats in terms of plastic pollution, boat traffic, fishing pressure.



Image 4.9: Boat surveys for threat mapping critical dugong habitats in Mahatma Gandhi Marine National Park

Results

We samples 25 grids inside the Mahatma Gandhi Marine National Park, out of which 12 were near shore and 13 off shore. Plastic was mostly found in near shore grids, and fishing vessels sighted were passing through the National Park boundaries to fish in the deeper waters beyond the Park boundaries.

Expected outcome

The preliminary data will be used to generate threat maps for MGMNP in terms of fishing pressure, plastic pollution and boat traffic

4.1.8 Seagrass habitat assessment of Mahatma Gandhi Marine National Park

Objectives: We conducted seagrass habitat assessment with the following objectives:

- 1) Identify new seagrass habitats across Ritchie's archipelago
- 2) Understanding seagrass meadow characteristics
- 3) Delineating sensitive dugong habitats
- 4) Assessing habitat importance of seagrasses by studying
 - -associated macro-benthic invertebrates

- -associated fish fauna

Study site: 4 Islands of MGMNP were surveyed namely- Twins, Tarmugli, Boat and Chester

Methodology: We used systematic Line Intercept Technique (LIT) to assess seagrass meadow characteristics such as species composition, seagrass cover, shoot density, shoot height, biomass and algal cover. Three 50 m long LITs were conducted with 50 x 50 cm quadrants after every 5 m interval on each transect. We collected seagrass samples for above and below ground biomass estimation from a 20 X 20 cm quadrat within the larger 50 x 50 cm quadrant. Abiotic parameters like pH, Seawater surface temperature, Salinity, Depth were recorded using suitable data loggers.

Results:

We conducted 7 transects near 4 islands, and recorded presence of 3 seagrass species namely *Halophila ovalis*, *Thalassia hemprichii* and *Halodule uninervis*. Highest number of seagrass species were found at Tarmugli.

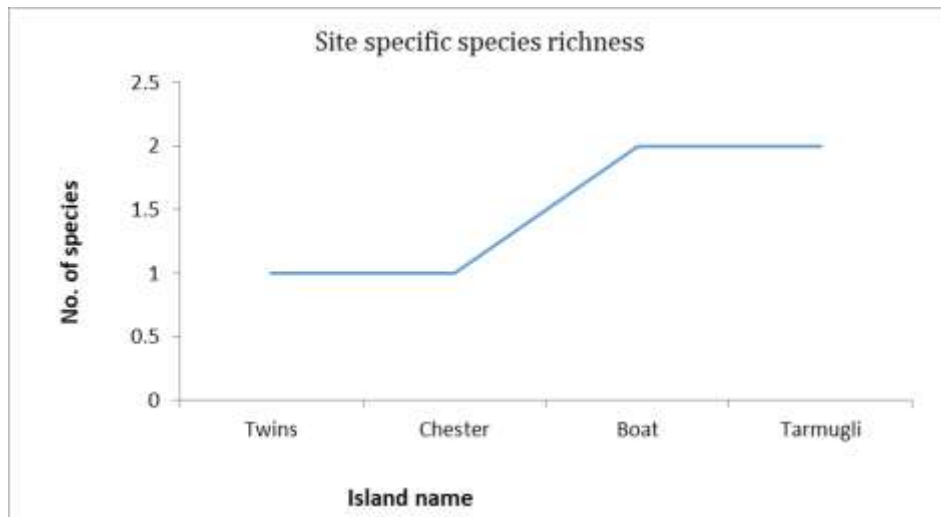


Figure 4.5: Seagrass species richness across islands of Mahatma Gandhi Marine National Park



Image 4.10: Mixed species seagrass meadow (Subtidal), Wandoor



Image 4.11: Seagrass habitat assessment, MGMNP Wandoor

4.1.9 Pilot drone surveys for dugongs in the Islands

Aerial surveys is the most efficient way for estimating population of marine mammals. We conducted pilot drone surveys for understanding distribution of dugongs and seagrasses at two critical dugong habitats viz; Mahatma Gandhi Marine national park and Rani Jhansi marine national park.

4.1.10 Participatory management of dugong habitats

The dugong scholarship program was extended in Government Middle School, Wandoor to upscale the awareness and outreach activities in the region which is also a critical dugong habitat. Total 77 students participated in the awareness program on marine life with emphasis on dugongs and seagrasses followed by a drawing competition with marine life as theme. The school teachers shared their views about marine life with the students, which helped the students to develop a sense of belonging with the oceans. This was followed by a documentary screening and scholarship test for students belonging to fishermen community for which 21 students appeared, out of which 11 students qualified the test and were awarded the Dugong Scholarship.



Image 4.12: Dugong scholarship program with fishermen kids, Wandoor



Image 4.13: Dugong scholarship program with fishermen kids, Guptapara

The CAMPA-Dugong ANI team expanded the dugong scholarship program to Government Middle School, Guptapara where students were sensitized about dugongs and seagrasses through documentary screening on dugongs followed by interactive sessions and quizzes with the students. A total of 25 students belonging to the fishermen community appeared for the scholarship examination out of which 10 students short listed on merit basis have been awarded dugong Scholarship.





Image 4.14: Dugong scholarship program with fishermen kids, Rangachang

On 21st January, 2019, a dugong scholarship program was conducted for 37 fishermen kids, studying in the Government Senior Secondary school, Rangachang. This area and the neighboring regions of Burmanalla, Kodiaghat and Chidiyatapu happen to be a habitat for dugongs, and so creating awareness among students studying there was important. An interactive session with kids on dugongs and seagrasses was followed by a quiz competition and scholarship examination.



Image 4.15 CAMPA_Dugong team (ANI) conducting dugong scholarship program

Dugong scholarship felicitation program

Venue: Government Senior Secondary Schools, Guptapara and Wandoor

After the CAMPA-Dugong team (ANI) conducted dugong awareness programs in the senior secondary schools of Wandoor and Guptapara, scholarship examination was conducted followed by selection of 21 students on merit basis. Felicitation programs were conducted on the 30th and 31st January 2019, to congratulate the selected students who will be participating in awareness programs on dugongs and seagrasses, in future. The program was successfully conducted under the supervision of headmasters Mr. Sushanta Biswas (GMS, Guptapara) and Mr. S. K. Mukherjee (GSS, Wandoor) and school teaching staff. Mrs. S. Simi (Range officer, Wildlife Division, Wandoor) was the chief guest who encouraged the students to participate in dugong awareness activities conducted by WII team, in the Islands.



Image 4.16: Dugong scholarship felicitation program, Guptapara



Image 4.17: Dugong Scholarship felicitation program, Wandoor



Image 4.18: Examination in Government senior secondary school, Bamboo Flat

To expand the Dugong scholarship program further in South Andaman district CAMPA_Dugong team (ANI) conducted the dugong scholarship program with Government senior secondary school (GSS), Bambooflat on 6th February 2019. GSS School, Bamboo Flat is the 7th school of the South Andaman region to participate in this program. The students were briefed about geography of Islands, its biodiversity and endemism as well as dugongs and marine life. Further, a merit based written examination was conducted for the students in which 35 students from class 6th to 12th appeared.



Image 4.19: Dugong Scholarship examination in Government senior secondary school, Bamboo Flat

Dugong Scholarship felicitation program in government schools- Rangachang and Bambooflat

Felicitations programs were conducted on the 27th and 28st February 2019, to congratulate the selected students who will be participating in awareness programs on dugongs and seagrasses, in future. The program was successfully conducted under the supervision of headmaster Mr. Ashok Kumar Tiwari (GSSS, Rangachang) and headmistress Mrs. Shobha Roy (GSSS, Bambooflat) and school teaching staff. Mr. A. K. Singh (Range officer, Headquarters, Chidiyatapu Biological Park) was the chief guest who encouraged the students to participate in dugong awareness activities conducted by WII team, in the Islands. This program is basically targeted to financially aid fishermen kids studying in government schools in the Islands.



Image 4.20: Dugong Scholarship felicitation program in government schools, Rangachang



**Image 4.21: Dugong Scholarship felicitation program in government schools, Bamboofla
Dugong Scholarship examination in Government senior secondary school, Durgapur**

Dugong scholarship program was extended to Durgapur, North Andaman in the month of April. On 24th April 2019, around 60 children belonging to Class 6 to 10 were present during the initial orientation and awareness program. They were briefed about the basic geography and about marine life of the islands. They were briefed about biology of dugongs, its role in ecosystem and threats it is currently facing. These children appeared for the scholarship exam after the program, and 19 of them are selected as dugong ambassadors and will be felicitated and awarded the Dugong Scholarship after the schools reopen.





Image 4.22: Dugong Scholarship program in government schools, Durgapur

4.2 Outreach and awareness activities

4.2.1 Beach Cleanup activity with Dugong Ambassadors, Havelock Island

Duration: 16th December 2018

Location: Havelock Island, South Andaman

Attendees:

- **Forest Department**
- **Government Senior Secondary School Havelock**
- **CAMPA_Dugong (WII Team)**

One of the mandates of the Dugong Scholarship program is to disseminate awareness about dugongs and in general marine life among the students and inculcate importance of conservation in them. With the same approach a beach cleanup activity was conducted on 16 December, 2018 with Dugong ambassadors of Government Senior Secondary School, Havelock Island. One kilometer stretch from beach no. 3 (Forest Department) to Dive India was selected for the activity, a region which is characterized by chain of beach side resorts thus, forming a potential garbage source. The program was supported by the Havelock Forest Division under the supervision of Sh. Shaji P. Abraham (Divisional Forest Officer, Havelock Division). A total of 25 bags of garbage were collected which comprised of plastic bottles, straws, fishing nets, Thermocol buoys, lighters, alcohol and medicine bottles.



Image 4.23: Marine awareness program in Coast Guard Kindergarden School

4.2.2 Interaction with Coastguard Kindergarten School children

Date: 16th January, 2019

Venue: Coastguard kindergarten school, Panipath road, Port Blair

Sensitization of different stakeholders about marine life with special emphasis on dugongs has been one of the objectives of the CAMPA_Dugong recovery program, implemented by the Wildlife Institute of India in the Islands. Taking this program to the Kindergarten level, a 'Dugong Awareness Program' was conducted on the 16th January, 2019 in the Coastguard Kindergarten School, Port Blair. The program organized by the CAMPA_Dugong team (ANI) received an overwhelming participation of 200 kids with 6 school teacher staff led by Mrs. Vidya (Headmistress) and Coastguard administrative officers.

The program commenced with a short interactive session with the kids, on marine animal followed by a coloring competition based on 'Ocean life' as a theme. Students enjoyed coloring various marine creatures like octopus, starfish, turtle, fishes, etc. Lastly a documentary session was conducted on dugongs for 30 students of Upper KG. Few copies of the student friendly story book 'My Friend Dugong' written by Mr. Chanchal Roy (Wipro Earthian National Award winner/School Teacher GSSS Kadamtala) was handed over to the principal and administrative officer for library.



Image 4.24: Colouring competition at Coastguard kindergarten school

4.2.3 Students of Government Senior School, Rangachang visit Chidiyatapu Biological Park

Date: 18th January, 2019

Venue: Chidiyatapu Biological Park

37 children of fishermen folks were sensitized from the Government senior secondary school, Rangachang on 18th January, 2019 as an outdoor session was conducted at Chidiyatapu Biological Park, to brief about the Island biodiversity and ecological importance of the Islands in supporting endemic species. The Nature trail was led by Mr. Saibabu (Forester, Chidiyatapu Biological Park) under the supervision of Mr. A. K. Singh (Range officer, Headquarters, Chidiyatapu Biological Park). During the nature trail students learnt about endemic animals in the park. The outdoor session was followed by a presentation by WII researchers on Dugong and marine biodiversity which covered general biology, importance, threats and need of conservation.



Image 4.25: Visit to Chidiyatapu Biological Park

4.2.4 Marine awareness program in Pranab Kanya Sangha

Date: 19th January, 2019

Venue: Our awareness program on marine life with special emphasis on dugongs, reached a new level when CAMPA_WII team (ANI) conducted a short interactive session on marine life and dugongs with 31 girls from the PranabKanyaSangha, Port Blair. After realizing low level of awareness about islands and marine life, we conveyed the importance of the islands, marine life, dugongs and endemism to the kids. The program was followed by a coloring competition with 'Marine life' as a theme



Image 4.26: Dugong Awareness program at Pranab Kanya Sangha

4.2.5 Dugong awareness program at Pondicherry University

Date: 28th January 2019

Venue: Pondicherry University, marine campus (Brookshabad)

For channelling our sensitization programs to suitable stakeholders, an awareness workshop was conducted for 50 marine biology students from the Pondicherry University, Port Blair. CAMPA_Dugong team (ANI) interacted with the students about their research activities carried out in the Islands and shared their research findings.



Image 4.27: Talk on implementation of dugong recovery program in the islands, Pondicherry University

4.2.6 Dugong awareness program in the Navy Children School

Date: 29th April 2019

Venue: Navy Children School, Minnie Bay

As a part of the awareness and outreach component of CAMPA_Dugong recovery programme, 150 children from class 8th to 11th of the Navy Children School, Minnie Bay-Port Blair were sensitized on 29th April, 2019 where an awareness program on dugongs and seagrasses was conducted by the WII team based in the islands.

The program covered information on marine life in general, followed by the biology of dugongs and seagrasses, threats to the species and habitat and lastly conservation efforts by WII. This awareness program was a great success, given the support of Commdt. Ramanath (Director) and Ms Anita Devi (headmistress). A library copy of the student-friendly book on dugongs called 'My Friend Dugong' authored by Sh. Chanchal Roy (School teacher, GSS Mangloutan) was submitted to the school authorities.



Image 4.28: Dugong awareness program in the Navy Children School

4.2.7 Dugong awareness program in Kendriya Vidyalaya-II, Port Blair

Date: 1st May 2019

Venue: Kendriya Vidyalaya-II,

Minnie Bay A dugong awareness program was conducted in Kendriya Vidyalaya (KV II-Minnie Bay) on 1st May 2019, where researchers of Wildlife Institute of India (WII), visited students of KV-II to sensitize them about their state animal, dugong. An enthusiastic crowd of 60 students of class 8 and 9 attended the dugong awareness program, where they learnt about marine mammals, dugong biology, seagrass habitats, and threats to these animals and habitats. Threats to dugongs like boat traffic, growing tourism followed by developmental activities, net entanglement and hunting were given special emphasis in the program. The program would not have been fruitful without the support of Mr Vijay Kumar (Headmaster) and school teaching staff. The day ended with all the participants learning more about the beautiful marine world in the islands and was in a true sense successful as the kids expressed their wish to take up marine science as a career.



Image 4.29: Dugong awareness program at Kendriya Vidyalay II

4.3 Capacity Building

4.3.1 Important Marine Mammal Area (IMMA) stakeholders meeting

Meeting with the IUCN IMMA Taskforce

Date: 12th November 2018

Venue: Port Blair

Attendees: Dr. TundiAgardy, Mr. Jon Day, Mr. Erich Hoyt and Dr. Giuseppe Notarbartolo di Sciara, Ms. Swapnali Gole (WII), Ms. MahiMankeshwar, Ms. DipaniSutaria.

Experts on the international IMMA Task Force Mr. Erich Hoyt and Dr. Giuseppe Notarbartolo di Sciara along with Dr. TundiAgardy and Mr. Jon Day visited the Islands to conduct a day-long consultation programme, to meet with Administrators and island-based stakeholders. WII team visited the task force to discuss their role in the meeting scheduled on the 16th November 2018.



Image 4.30: Team IMMA (left to right: Dr. TundiAgardy, Mr. Jon Day, Ms. Swapnali Gole, Ms. Mahi Mankeshwar, Ms. Dipani Sutaria, Mr. Erich Hoyt and Dr. Giuseppe Notarbartolo di Sciara

South Andaman IMMA stakeholders meeting

Date: 16th November 2018

Venue: Van Sadan, Haddo, Port Blair

The Southern Andaman Islands has recently been recognized as an Important Marine Mammal Area (IMMA) for dolphins, whales and dugongs. Acknowledging this importance, a meeting of key stakeholders was held in Van Sadan; Port Blair on 16th November 2018 jointly organized by the Wildlife Institute of India (WII) and key local research experts. Attending the meeting were representatives of the Department of Environment and Forests, Indian Navy, Indian Coastguard, Chamber of Commerce, Directorate of Shipping Services, Port Management Board, Directorate of Fisheries, Nature Conservation Foundation, Andaman and Nicobar Environmental Team, Botanical Survey of India, Zoological Survey of India, Dive shops and game fishers. The primary objective of this meeting was to inform stakeholders about the IMMA and discuss the future sustainable use of the area. The meeting strongly acknowledged the importance of marine mammals and the need for effective management to maintain these important values.



Image 4.31: IMMA meeting at Van Sadan with Multi stakeholders

IMMA meeting report writing: 17th to 19th November 2018

After the successful IMMA meeting held on the 16th November, 2018, the IMMA team headed to Neil Island to draft a report on the suggestions/ recommendations given by the stakeholders involved for effective management of Southern Andaman IMMA. The IMMA team collectively discussed to identify the immediate pressures on the marine mammal species, the issues these pressures are causing and the priority of actions and recommendations to respective stakeholders which need to be taken/ given.



Image 4.32: IMMA meeting report writing, Neil Island

4.3.2 Consultation meeting with Mr. Jon Day for revising the management plan for Rani Jhansi Marine National Park

Date: 20th November 2018

Venue: Port Blair, Andaman

International Expert: Mr Jon C. Day (Great Barrier Reef Marine Park Authority)

WII Team: Swapnali Gole, Sohini Dudhat, ChinmayaGhanekar, Prasad Gaidhani

The meeting with international expert Jon C. Day was held principally for 'Rani Jhansi Marine National Park Management Plan Revision' consultation. In this meeting, the existing management plan of Rani Jhansi Marine National Park from the year 2015 to 2021 was discussed in detail and relevant changes were suggested by Mr. Day.



Image 4.33: Meeting with Mr Jon Day

4.3.3 Orientation workshop on marine mammal stranding response- Havelock Division

22nd November to 30th November 2018: SCUBA diving and underwater marine biodiversity monitoring training for frontline forest staff

Duration: 24/11/18 to 29/11/18

Location: Havelock, South Andaman

Attendees:

Forest Department Officials

CAMPA_Dugong WII Team

In the orientation program for the course, the briefing was done on the status of Dugongs and implementation of the Dugong recovery program in the Islands (CAMPA_Dugong project). On the second day (25th November), WII researchers briefed through the field methods while studying marine mammals and seagrass habitats. The participants underwent SCUBA training from open waters to speciality diving by Dive India, Havelock for the next four days. Seven participants were trained for Open Waters, one participant for Advanced Open Water and one for speciality training as an underwater naturalist.



Image 4.34: SCUBA diving and underwater marine biodiversity monitoring training, Orientation workshop



Image 4.35: Participants trained for boat survey methods and handling equipment



Image 4.36: Participants were trained for seagrass mapping by random quadrat method



Image 4.37: Seagrass mapping by random quadrat method



Image 4.38: Fieldwork training for frontline staff

4.3.4 Illegal Trade in Wildlife and Role of Wildlife Forensics in Dealing with Wildlife Crime

Duration: 3rd to 7th December 2018

Location: Port Blair, South Andaman

Attendees: IFS Officers, Dr. Sandeep Gupta (WII), Sh. Vinod (WII), Sh. C.P. Sharma, CAMPA_Dugong Team-WII (Ms. Sohini Dudhat, Ms. ChinmayaGhanekar, Mr. Prasad Gaidhani, Ms. Swapnali Gole)

Poaching and wildlife trade is posing the biggest challenge to managers from Forest department as managing and exposing this well-formed racket needs understanding the nature of this trade. On this aspect, to train the IFS officers on understanding the illegal wildlife trade, a one-week compulsory course on 'Illegal trade in wildlife and role of wildlife forensics in dealing with wildlife crime' was organized by the Wildlife Institute of India in Port Blair, South Andaman. Aspects like how to identify wildlife crime, use of forensics invalidating the crime and field-based practical on the same were demonstrated during the course.





Image 4.39: Talk on Implementation of Dugong recovery Program in the Islands by Ms. Swapnali Gole

4.3.5 One-week refresher training course for Indian Forest Service Officers on “Management of Coastal and Marine Biodiversity in India: Challenges and Prospect”

Date: 4th to 8th February, 2019

Venue: Port Blair

Wildlife Institute of India facilitated another training course for IFS officers who focused on Management of Coastal and Marine Biodiversity. 27 officers participated in this course. The course was directed by Dr. K Sivakumar (Scientist, WII) along with Dr. Alok Saxena WII (Scientist Emeritus) who guided classroom sessions and field visits. The field visits to Wandoor (Grub Island), Havelock and Baratang were accompanied by respective and department of environment and forests, ANI officers Mr. Naveen Kumar (DCF-DFO WL, South Andaman), Mr. Shaji Ibrahim (DFO, Havelock Range) and Ms. Vanjula Vali (DFO, Baratang Range). The CAMPA Dugong team was involved in an arrangement for logistical support.

4.3.6 Stakeholders meeting for Rani Jhansi Marine National Park management plan

Date: 11th February 2019

Venue: VanyaPraniBhawan, Port Blair

A stakeholders' meeting was organized to revise the draft management plan of 'Rani Jhansi Marine National Park' (RJMNP) at VanyaPraniBhawan, Port Blair, Andaman and Nicobar Islands

under the chairmanship of the Chief Wildlife Warden (CWLW). RJMNP situated in the Ritchie's Archipelago, South Andaman, spread over an area of 319.53 sq. km harbors unique terrestrial as well as marine flora and fauna. All concerned stakeholders were invited to this meeting to provide suggestions to revise the draft management plan.



Image 4.40: Stakeholders meeting for Rani Jhansi Marine National Park management plan

4.3.7 Orientation program with the Indian Navy -INS UTKROSH

Date: 12th February, 2019

Venue: INS Utkrosh, Port Blair quarters

We involved Indian Navy in our volunteering network by conducting a short orientation workshop with them, on dugongs and seagrasses. 15 Indian Navy officers from INS- Utkrosh participated in the program where CAMPA_Dugong team (ANI) briefed them about basic data documentation on sighting a dugong and other marine mammals in the logbooks distributed.



Image 4.41: Orientation program with the Indian Navy -INS UTKROSH

4.3.8 Orientation workshop on Dugong monitoring program with the Glass bottom boat operators, Neil

Date: 22nd February 2019

Venue: Panchayat Hall, Neil

Currently, 45 glass bottom boats are been operated in Bharatpur beach in Neil, which forms important dugong feeding ground. In addition to this, 4 jet skis have begun to operate in the same region, which stands out as a potential threat to dugongs, owing to the speed of the boats. With the same rationale, an orientation program was conducted with the glass bottom boat operators, to sensitize them about the importance of this stretch for dugongs in terms of controlled boat speeds when a dugong is spotted. Further, these operators were included as a part of the dugong monitoring network.

4.3.9 Follow up awareness program with Indian Navy- INS Utkrosh

Date: 15th April 2019

Venue: INS Utkrosh Headquarters

Our team conducted a follow-up program with the Navy unit at Port Blair, INS Utkrosh. Around 30 officers attended the program that flies regularly for patrolling in South Andaman region. We briefed them about basic dugong biology, threats and critical areas for dugong distribution. INS-Utkrosh and ships of local Flotilla under the naval component have been involved in our dugong volunteering program.



Image 4. 42: Talk on dugong monitoring program in the Islands



Image 4.43: Officers from INS-Utkrosh in an orientation workshop

4.3.10 Community workshop with fishermen community, Wandoor

Date: 7th February, 2019

Venue: Community Hall, Wandoor

To involve the fishermen communities in Wandoor in the Dugong monitoring program, a community workshop was conducted with the fisher folks to emphasize on the importance of dugongs and current issues in conservation. Fishermen showed their support to inform sightings of Dugong and other marine mammals. Logbooks were distributed to fishermen.



Image 4.44: Workshop with fishermen community, Wandoor

4.4 Outputs and Accomplishments

4.4.1 South Andaman declared as first Important Marine Mammal Area(IMMA) in India

Based on the classification scheme developed to identify Important Marine Mammal Areas (IMMA) in the world, by the IUCN Joint SSC/WCPA Marine Mammal Protected Areas Task Force, an international working group of marine mammal experts, Southern Andamans was proposed as a potential IMMA during the 'North-East Indian Ocean and South-East Asian Seas' IMMA expert workshop held in Kota Kinabalu, Malaysia in March 2018. The work was presented by Dr. K. Sivakumar (Wildlife Institute of India) and Ms. Dipani Sutaria (Marine mammal researcher) to highlight the importance of Southern Andamans as a potential IMMA which forms critical habitats for dugongs and 15 species of cetaceans. The proposal was peer-reviewed and was later approved the status of an IMMA site, making Southern Andaman as the first IMMA in Indian waters.

Later, in November 2018 the IUCN-IMMA taskforce visited the Andaman Islands to engage various stakeholders in discussing conservation tools and management plans within the approved IMMA. The meeting was jointly organized and supported by Dr. K. Sivakumar (WII), Ms. MahiMankeshwar (Marine mammal researcher), Ms. Dipani Sutaria (Marine mammal researcher) and Dr. Elrika D'Souza (Nature Conservation Foundation). After meeting with concerned local stakeholders and analyzing the threats to the Southern Andamans IMMA, the team suggested recommendations and priority actions to be implemented for conservation.

4.4.2 Threat mapping of two critical dugong habitats; Rani Jhansi Marine National Park (RJMNP) and Mahatma Gandhi Marine National Park (MGMNP)

Quantification of threats to dugongs and their habitats is essential to understand the nature and intensity of threats. We successfully completed threat mapping of RJMNP, Ritchie's archipelago and MGMNP, Wandoor which not only form critical dugong habitats but also are growing tourism hotspots in the Islands. Threats in terms of plastic pollution, fishing pressure and boat traffic were documented inside as well as outside the MNP's. The data generated will be used to focus management efforts in areas with a high intensity of threats. **The findings for RJMNP will be included in the management plan of the MNP, which is currently being revised by WII.**



Image 4.45: Boat surveys for threat mapping of critical dugong habitats in Ritchie's archipelago

4.4.3 Seagrass habitat assessment of two critical dugong habitats (RJMNP and MGMNP)

RJMNP and MGMNP harbor seagrass habitats which support the relict population of dugongs in the Islands. We carried out seagrass habitat assessment in the mentioned regions, to study the meadow characteristics like species composition, shoot density, shoot height and biomass. To highlight the habitat importance of seagrass meadows used by dugongs, we also assessed seagrass associated macro-benthic and fish diversity in the study sites(both the studies being conducted in the islands for the first time).

4.4.4 Expanded dugong scholarship program to 5 schools in South and North Andaman

Taking the novel initiative of dugong scholarship program to other critical dugong habitats in the islands, five government schools from South and North Andaman have been included as a part of the program, which supports fishermen children. With the addition of these schools, the total count of dugong ambassadors from the islands is 119.



Image 4.46: Scholarship felicitation program & community workshop with government schools

4.4.5 Indian Navy and Command (ANI) involved in Dugong monitoring program

Success of the dugong recovery programme is in engaging different sea faring stakeholders in the dugong monitoring program and Indian Navy forms one such crucial stakeholder, as their patrolling range is vast and covers most of the critical dugong habitats. Since, Indian Navy along with Indian Coastguard forms our only aerial source for dugong sighting information we conducted an orientation program with INS-Utkrosh, Indian Navy unit in Port Blair and involved them in our monitoring program. Logbooks have been distributed to 35 officers of flying squads and ship patrolling units. We have received dugong sightings from Ritchie's archipelago and Wandoor from Navy officers post orientation workshop.

4.4.6 Expanded dugong monitoring program to fishermen and stakeholders involved in tourism

Dugong monitoring program has been expanded to stakeholders in tourism sector like glass bottom boat operators in Shaheed Dweep Island, where 45 glass bottom boats are being operated currently in an area frequently used by resident dugongs of the island. These high speed boats form a major threat to dugongs there, and boat operators have been briefed about maintaining the speed of vessels in the area. Parallely, fishermen of Bambooflat, Rangachang, Guptapara and Wandoor have been involved in the dugong volunteering network, from where regular sighting information is flowing in.

4.4.7 Training of frontline forest staff in marine mammal stranding response

An orientation workshop was conducted in May 2018 for ten forest personnel (Foresters and Forest Guards) from the Havelock Forest Division in handling marine mammal strandings. Participants were briefed about standard sampling procedures to deal with both lives as dead strandings of dugongs and other marine mammals. **A dugong stranding happened in July 2018 in Shaheed Island (jurisdiction of Havelock Forest division) was successfully handled by our trained forest staff from the division and morphometric measurements and genetic samples were collected using protocols briefed about, in the orientation program.**

4.4.8 SCUBA diving and underwater marine biodiversity monitoring training for frontline forest staff

As a part of the capacity building component of the project, a marine biodiversity training program was conducted in November 2018 for frontline forest staff from Mayabunder Wildlife division, Wildlife division- Port Blair and Havelock Forest division. Seven participants were trained for Open Waters, one participant for Advance Open Water and one for specialty training as an underwater naturalist. The participants were also given hands on training to use field equipment (GPS, depth sounder, compass, multi-parameter tester, range finder) and taught seagrass monitoring methods and distance sampling techniques for marine mammals.



Image 4.47: SCUBA diving training for Forest Department Frontline staff

4.4.9 First genetic study on dugong from the Islands

In August 2018, a sub adult dugong was stranded ashore in Laxmanpur Beach of Shaheed Island. After taking morphometric measurements and conducting necropsy to understand the cause of death, tissue samples were collected by CAMPA_Dugong team in ANI for genetic analysis. This is the first study on dugong genetics from the Islands

4.4.10 Pilot drone surveys for dugongs in the Islands

Aerial surveys are the most efficient way for estimating the population of marine mammals as it has limited constraints as compared to boat surveys. We conducted pilot drone surveys for understanding distribution of dugongs and seagrasses at two critical dugong habitats viz; Mahatma Gandhi Marine national park and Rani Jhansi marine national park.



Image 4.48: Pilot drone surveys at Rani Jhansi Marine national Park and Mahatma Gandhi Marine National Park

4.5 Media Coverage

ANDAMAN Chronicle
The Daily Diary of the Islands

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Jarawa Facts

In 1999 and 2006 the Jarawa suffered outbreaks of measles – a disease that has wiped out many tribes worldwide following contact with outsiders.

Your Nature Guide

Life in the ocean: From the shores or from a boat, the sea looks like a huge mass of uniform, inky blue water. It is not so actually. Life in the sea is amazingly different at different depths. From the surface to a few feet below, the ocean is a sunlit world, that changes from day to night. Below this, the ocean becomes cold, dim, and unchanging. And thousands of meters below the surface, the ocean is a region of near-freezing temperatures, crushing pressure, and complete darkness. Most marine plants and animals are adapted to living in one of three regions- the sunlight,

Southern Andaman Declared as the First Important Marine Mammal Area of India

Port Blair, Dec 3: The Southern Andaman Islands has recently been recognized as an Important Marine Mammal Area (IMMA) for dolphins, whales and dugongs. Acknowledging this importance, a meeting of key stakeholders was held in Port Blair on 16th November 2018 jointly organized by the Wildlife Institute of India (WII) and key local research experts.

Attending the meeting were representatives of the Department of Environment and Forests, Indian Navy, Indian Coastguard, Chamber of Commerce, Directorate of Shipping services, Port Management Board, Directorate of Fisheries, Nature Conservation Foundation, Andaman and Nicobar Environmental Team, Botanical Survey of India, and



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Indian Coastguard Involved in Dugong Monitoring Program

Diglipur, June 16: Dugong monitoring program of the CAMPA_Dugong recovery project, implemented by the Wildlife Institute of India (WII) in the Islands, is a multi-stakeholder approach which involves all the key stakeholders crucial for the success of the program. The objective of this program is to increase dugong sighting probability by involving more stakeholders in and identify areas frequented by dugongs in the islands thus, primarily targeting stakeholders which are regular sea-farers and form a valuable repository for information on marine life and dugongs.

This program which is been supported by fishermen, tour operators and sailors was taken ahead, recently to Indian Coastguard (ICG) where around 50 personnel from ICG's Diglipur



Headquarters and Mayabunder station were sensitized on 29th May and 3rd June 2019, about dugongs and their habitats, and involved in dugong monitoring. The orientation program was well received by the enthusiastic crowd and was supported by DIG Ashish Mehrotra,

Commandant L. Zou (Commander District headquarter No. 9- N&M Andaman) and Assistant Commandant Shubham Sharma (District headquarter No. 9- N&M Andaman).

Andaman ke hie kuch
Regular Camp jaisa Offer
diya jaye ...???

- A Citizen



They are not for security
but to guard the MLA from
escaping to rival camp!

Dugong Awareness Program Conducted for Coast Guard Kids

Port Blair, Jan 28:
Sensitization of different
stakeholders about marine
life with special emphasis on
dugongs has been one of the
objectives of the
CAMPA_Dugong recovery
program, implemented by
the Wildlife Institute of India
in the Islands. Taking this
program to the Kindergarten
level, a 'Dugong Awareness
Program' was conducted on
the 16th January 2019 in the
Coastguard Kindergarten School,
Port Blair. The program organized



by the CAMPA_Dugong team (ANI)
received an overwhelming

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Jarawa Facts

The 300 odd - strong Jarawa, along with the other Andaman tribes the Sentinelese, the Onge and the Great Andamanese, were the sole inhabitants of the Andaman Islands until the British and then the Indians arrived. Their ancestors are thought to have been part of the first successful migrations out of Africa.

Your Nature Guide

Plankton: this is a term used to describe the smellers, free floating plants and animals, which just drift along with the winds and currents. Some plankton have a limited swimming ability and can migrate daily in a vertical direction. Plankton are an

Dugong Ambassadors' Number Soars to 103!

Port Blair, March 4: The Dugong Scholarship Program implemented by the Wildlife Institute of India (WII), Dehradun in the Islands, as a part of CAMPA - Dugong recovery program, has expanded its reach by selecting two new government schools from Rangachang and Bambooflat, which support large number of fisherman kids. These awareness programs aim to sensitize students about their state animal dugong and its importance in the Islands.

72 fisherman kids from Government Senior Schools (Rangachang and Bambooflat) appeared in the dugong scholarship



Continued on P5



No time to fix EVM glitches... we are very busy serving notices and clean chits!

Wildlife Institute of India Expands Dugong Scholarship Program to North Andaman

Diglipur, May 3: Dugong scholarship program run by the Wildlife Institute of India (WII), Dehradun has expanded its reach to North Andaman by conducting scholarship program in Durgapur region of Diglipur. A WII-CAMPA initiative, the scholarship program aims to financially aid fishermen kids studying in government schools in the islands.

On 24th April, 2019 a dugong awareness program was conducted in the Government Senior School, Durgapur which got an

Continued on P5



time to start work in these areas, although you can also go in at high tide later on, just to compare the two. The Navy or the Harbour Office will also tell you about tide timings or where to get the tide table.

Treasured Islands - By Sunita Rao. Courtesy: Kalpavriksh, ANET (M CBT)

People's Voice

Ye Reliance Gio apna Cable kyon wapas nikaal raha hai itni mehnat ke baad... Kya Under Sea Cable sahi mein aayega Andaman mein...?

- A Citizen



Our new slogan!

When Dugong Meets the Kids!

Port Blair, Feb 3: With latest addition of 21 fishermen kids as dugong ambassadors, the total number of students receiving the dugong scholarship has reached 71 in the South Andaman region, a part of the CAMPA_Dugong recovery program, implemented by the Wildlife Institute of India (WII).



Dehradun in the Islands. This program is basically targeted to financially aid fishermen kids studying in government schools in the Islands.

With an aim to expand the dugong scholarship program from the Ritchie's archipelago to other regions supporting dugong population, two schools from Guptapara and Wandoor namely: Government Middle and Senior Schools, were selected respectively. After the CAMPA-Dugong team (ANI) conducted dugong awareness programs in these schools, scholarship examination was conducted followed by selection of 21 students on merit basis.

Felicitation programs were conducted on the 30th and 31st January

2019, to congratulate the selected students who will be participating in awareness programs on dugongs and seagrasses, in future. The program was successfully conducted under the supervision of headmasters Mr. Sushanta Biswas (GMS, Guptapara) and Mr. S. K. Mukherjee (GSS, Wandoor) and school teaching staff.

Mrs. S. Simi (Range officer, Wildlife Division, Wandoor) was the chief guest who encouraged the students to participate in dugong awareness activities conducted by WII team, in the Islands. The surprise element of the program was a dugong mascot meeting the kids, which was received cheerfully by everyone as the program concluded with kids running around the dugong.

Dugong Awareness Program Organised For Navy Children School

Port Blair, May 5: Targeting children of different schools in the Islands, to sensitize them about their state animal; dugong has been the primary mandate of the awareness and outreach component of Wildlife Institute of India's (WII) CAMPA Dugong



recovery programme. With the same approach, 150 children from class 8th to 11th of the Navy Children School, Minnie Bay-Port Blair were sensitized on 29th April, 2019 where an awareness program on dugongs and seagrasses was conducted by the WII team based in the islands.

The program started with presentation on marine life in general, followed by biology of dugongs and seagrasses, threats to the species and habitat and lastly conservation efforts by WII. Effects of recent developmental activities happening in the islands, on seagrass habitats and in

turn dugongs was also highlighted. During the discussion students were actively sharing their experiences regarding marine life and the program concluded with series of questions raised by the enthusiastic crowd. This awareness program was a great success, given the support of Commdt. Ramanath (Director) and Ms. Anita Devi (headmistress). A library copy of student friendly book on dugongs called 'My Friend Dugong' authored by Sh. Chanchal Roy (School teacher, GSS Mangloutan) was submitted to the school authorities.

CAMPA Spreads Awareness about Marine Conservation Among Fishermen Children at Rangachang

Port Blair, Jan 29: Fishermen form one of the crucial stakeholders in marine conservation programs owing to the depth of

knowledge they have about the ocean and their dependency on its resources. This knowledge is then passed on, by these fisher folks to



their children who also contribute to be an important stakeholder. Engaging these children in environmental friendly activities by

Continued on P4

5 Nutrients in the sediments and seagrasses of Andaman and Nicobar Islands, Gujarat and Tamil Nadu

Introduction

In India, fifteen species of seagrass are reported. These species cover nearly 500 sq km area at several locations along the coast, lagoons, backwaters and estuaries. The primary seagrass areas are Gulf of Mannar, Palk Bay, Andaman and Nicobar, Lakshadweep islands and Gulf of Kutch. These areas are characterized by exclusive ecological diversity (Thangaradjou et al., 2018). Sea grasses are submerged marine angiosperms and produce flowers, fruits and seeds. They also have roots, leaves and underground stems (rhizomes), which enable them to create an ambient network under water (K et al., 2018).

Seagrasses holds importance to invertebrates, fish and many birds because they form dense and highly productive beds which provide protection against coastal erosion. Seagrasses are also an indicator of the status of the coastal zone which can be used in coastal management strategies targeting at sustaining the environmental quality of the coastal zone.

Dugongs primarily feed on near-shore seagrasses (Lipkin 1975, Johnstone & Hudson 1981, Marsh et al. 1982). Nutritionally, many herbivores are constrained by the limited abundance of dietary nitrogen (Sinclair 1977, Mattson 1980, White 1993), and seagrasses have low levels of nitrogen compared with terrestrial grasses (Birch 1975, Duarte 1990, Lanyon 1991).

Seagrasses are capable to grow in low nutrient environments, requiring only a chunk of the levels of nitrogen and phosphorus required by other aquatic primary producers such as macroalgae (Duarte 1995). A healthy condition of seagrasses meadows is detected through the nutritional value. In addition it is necessary to understand the chemical composition of principal seagrass species due to their direct or indirect roles in coastal marine food chains (K et al., 2018).

The present investigation is an attempt to understand the nutritional status of seagrass beds and seagrasses in the Andaman & Nicobar Islands, Gujarat and Tamil Nadu region of India.

Material and Methods

1. Sediment

The collected sediment samples were air-dried and then sieved and stored in air-tight bags for further analysis. Organic carbon in the sediment samples was determined using Walkley and Black's (1934) rapid titration method. Nitrogen was determined using Micro-Kjeldahl method (Miller and Houghton, 1945). Sodium and Potassium was determined using Flame Photometer method (Barnes et al., 1980). Phosphorus was determined using colorimetric method (Syers et al., 1968).

2. Seagrass

The collected samples were washed carefully to remove all the foreign materials such as small pebbles and sediments from the leaves. The samples were then air-dried and crushed in a Pestle and Mortar. The crushed samples were then stored in an air-tight container for further analysis. Total organic carbon in the seagrass samples was determined by dry combustion technique (Bojko and Kabala, 2014). The method for determination of N, P, K and Na was same as that of sediment samples.

Results

1. Sediment

A total of 53 sediment samples from Gujarat and 92 from Andaman & Nicobar Islands were analysed for the nutrient content. The results show that the sediment samples of Gujarat were rich in nutrients as compared to Andaman (Table 5.1.1). The factors governing the release of nutrients from the sediments are yet to be understood among all the selected sites.

Table 5.1.1 Nutrients in the sediment sample of study sites

Site	N%	P%	K%	Na%	OC%	OM%
Gujarat (53)	0.056±0.02	0.397±0.2	0.264±0.08	0.272±0.16	0.976±0.94	1.683±1.62
Andaman Islands (92)	0.023±0.006	0.268±0.1	0.099±0.70	0.058±0.02	0.139±0.12	0.269±0.22
Tamil Nadu (27)	0.032±0.003	0.521±0.058	0.086±0.005	0.289±0.025	0.442±0.041	0.760±0.071

(±SD, Value in parenthesis shows the sample size)

Abbreviations: N-Nitrogen, P-Phosphorus, K-Potassium, Na-Sodium, OC-Organic Carbon, OM-Organic Matter

2. Seagrass

A total of 15 seagrass samples from Gujarat, 14 from Andaman and 135 samples from Tamil Nadu were analysed. The dominant seagrass species in Gujarat were *Halodule uninervis*, *Halophila beccarii* and *Halophila ovalis*. In Andaman *Syringodium isoetifolium*, *Halophila ovalis*, *Cymodacea serrulata*, *Enhalus acoroides*, *Thalassia hemprichii*, *Halodule uninervis* and in Tamil Nadu *Cymodacea rotundata*, *Cymodacea serrulata*, *Enhalus aceroides*, *Halophila ovalis*, *Halodule uninervis* and *Syringodium isoetifolium* (Table 5.1.2).

Table 5.1.2. Nutrients in the seagrass sample of study sites (\pm SD, Value in parenthesis shows the sample size)

Site/S pecies	N %			P %			K %			Na %			As h%			TO C%			TO M%		
	AN	Gj	TN	A N	Gj	TN	A N	Gj	TN	A N	Gj	TN	A N	Gj	TN	A N	Gj	TN	A N	Gj	TN
<i>Cymod acea serrula ta</i>	0.1 4, (1)		1.0 0 \pm 0. 27, (33)	8.8 9		1.7 9 \pm 0. 79	0.7 8		0.5 8 \pm 0. 23	2.4 5		0.5 3 \pm 0. 10	55. 8		66. 5 \pm 1 3.7	25. 6		19. 4 \pm 7. 9	44. 1		33. 40 \pm 1 3.7
<i>Cymod acea rotund ata</i>			1.0 9 \pm 0. 12, (30)			2.8 9 \pm 0. 59			0.6 0 \pm 0. 13			0.5 2 \pm 0. 14			67. 1 \pm 1 2.6			19. 08 \pm 7. 3			32. 8 \pm 1 2.6
<i>Enhalu s acoroid es</i>	0.0 9, (1)		1.3 3	1.7 8		3.3 4 \pm 0. 28	0.4 7		0.6 4 \pm 0. 09	4.1 2		0.5 3 \pm 0. 19	54. 3		79. 7 \pm 4. 7	26. 5		11. 7 \pm 2. 7	45. 65		20. 2 \pm 4. 7

Site/Species	N %			P %			K %			Na %			Ash%			TO C%			TO M%		
	AN	Gj	TN	AN	Gj	TN	AN	Gj	TN	AN	Gj	TN	AN	Gj	TN	AN	Gj	TN	AN	Gj	TN
			±0.10, (4)																		
<i>Halodule uninervis</i>	0.36, (1)	1.36	0.69	3.74	4.28	3.81	0.68	0.41	0.19	1.77	2.19	0.28	39.1	85.66	38.1	35.3	8.33	35.9	60.86	14.3	61.8
		±0.36, (6)	±0.11, (13)		±0.99	±5.04		±0.09	±0.06		±0.80	±0.04		±5.17	±6.8		±3.0	±4.0		±5.1	±6.8
<i>Halophila beccarii</i>		1.41			4.56			0.39			3.22			76.9			13.4			23.06	
		±0.08, (2)			±0.62			±0.05			±0.02			±6.6			±3.8			±6.6	
<i>Halophila minor</i>	0.06, (1)			7.57			1.00			2.55			57.9			24.4			42.01		

Site/S pecies	N %			P %			K %			Na %			As h%			TO C%			TO M%		
	AN	Gj	TN	A N	Gj	TN	A N	Gj	TN	A N	Gj	TN	A N	Gj	TN	A N	Gj	TN	A N	Gj	TN
<i>Haloph ila ovalis</i>	0.1 3 ±0. 11, (6)	1.2 3 ±0. 18, (7)	0.6 2 ±0. 11, (27)	4.0 8 ±1. 5	4.4 5 ±0. 26	2.3 9 ±0. 71	0.4 9 ±0. 14	0.4 0 ±0. 03	0.1 4 ±0. 07	3.9 4 ±0. 94	2.3 2 ±1. 02	0.2 8 ±0. 06	51. 9 ±1 4.2	83. 3 ±4. 7	31. 6 ±1 1.1	27. 9 ±8. 2	9.6 7 ±2. 7	39. 7 ±6. 4	48. 08 ±1 4.2	16. 6 ±4. 7	68. 3 ±1 1.1
<i>Syring odium isoetifo lium</i>	0.0 3, (1)		1.1 3 ±0. 78, (28)	5.0 5		2.6 5 ±0. 87	0.9 5		0.6 0 ±0. 29	4.4 3		0.7 5 ±0. 24	76. 85		59. 3 ±1 6.6	13. 4		23. 6 ±9. 6	23. 4		40. 6 ±1 6.6
<i>Thalas sia hempri chii</i>	0.1 8 ±0. 11, (3)			5.1 8 ±1. 13			0.5 9 ±0. 10			2.9 3 ±0. 49			58. 3 ±3. 9			24. 2 ±2. 29			41. 67 ±3. 9		

Abbreviations: AN-Andaman and Nicobar, Gj-Gujarat, TN-Tamil Nadu, N-Nitrogen, P-Phosphorus, K-Potassium, Na-Sodium, Ash-Ash Content, TOC-Total Organic Carbon, TOM-Total Organic Matter

The results show that Nitrogen content was higher in the leaves of the species *Halophila beccarii* (1.4%) followed by *Halodule uninervis* (1.3%) and *Halophila ovalis* (1.2%) in the site Gujarat (Fig. 5.1.1)

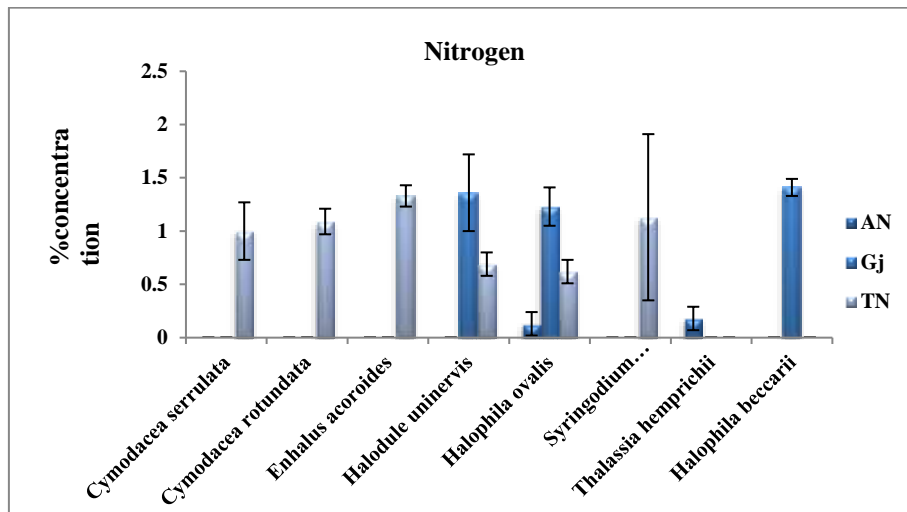


Fig. 5.1.1 Nitrogen Content in the seagrass samples among study sites

Phosphorus content was observed to be more in the leaves of species *Thalassia hemprichii* (5.1%) from Andaman followed by *Halophila beccarii* (4.5%), *Halodule uninervis* (4.2%) and *Halophila ovalis* (4.4%) from the site Gujarat (Fig. 5.1.2).

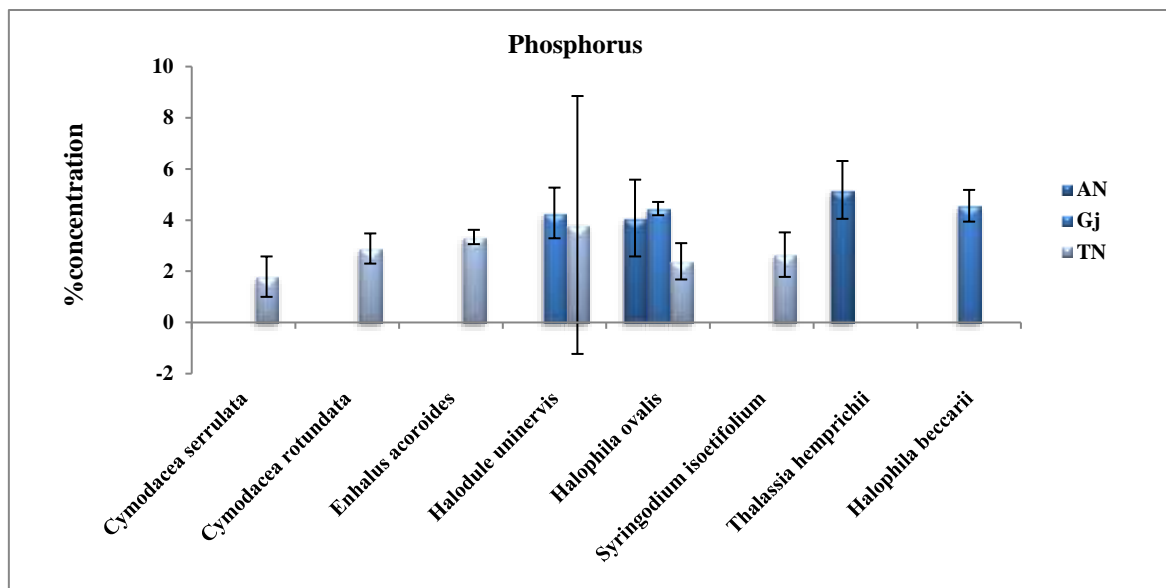


Fig. 5.1.2 Phosphorus Content in the seagrass samples among study sites

The potassium content was observed to be highest in the species *Enhalus acoroides* (0.64%) followed by *Cynodaceae rotunda* (0.60), *Cynodaceae serrulata* (0.58%) and *Syringodium isoetifolium* (0.60) from the site Tamil Nadu (Fig. 5.1.3)

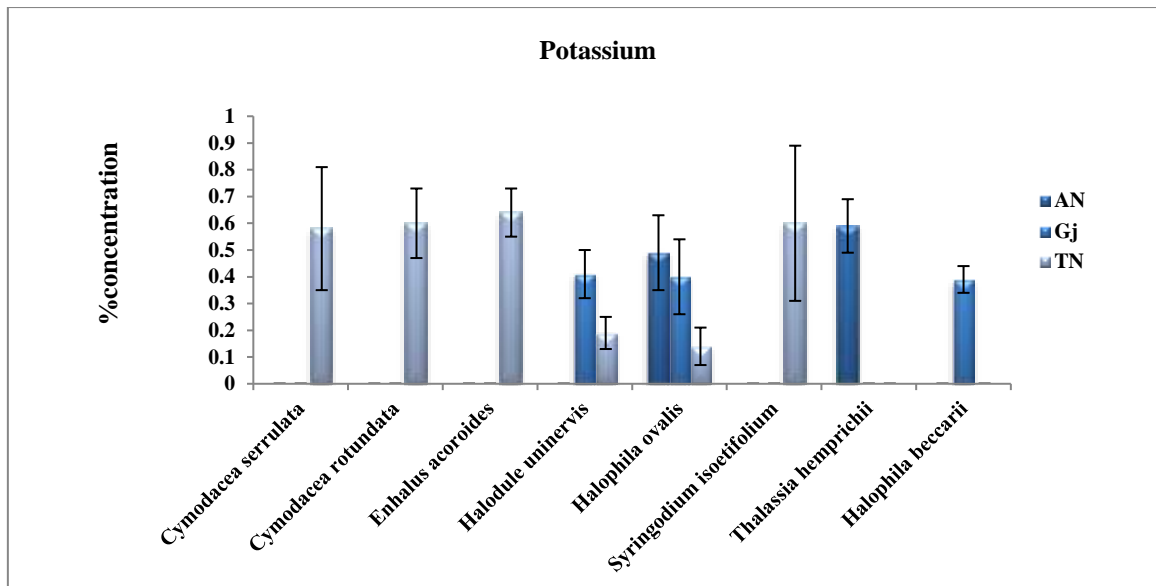


Fig. 5.1.3 Potassium Content in the seagrass samples among study sites

The sodium content in the leaves of seagrass was observed to be highest in the species *Halophila ovalis* (3.94%) followed by *Thalassia hemprichii* (2.93%) in the site Andaman. The concentration of sodium was also observed to be higher in the species *Halophila beccarii* (3.22%) in Gujarat (Fig. 5.1.4)

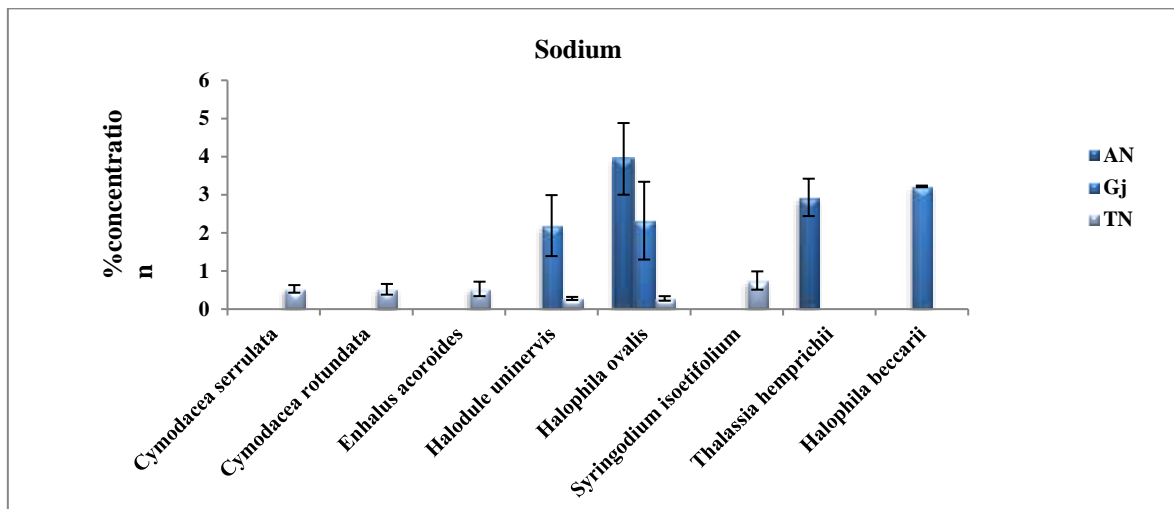


Fig. 5.1.4 Sodium Content in the seagrass samples among study sites

The ash content was higher in the leaves of the species *Halophila beccarii* (6.9%) followed by *Halodule uninervis* (85.6%) and *Halophila ovalis* (83.3%) in the site Gujarat (Fig.5.1.5).

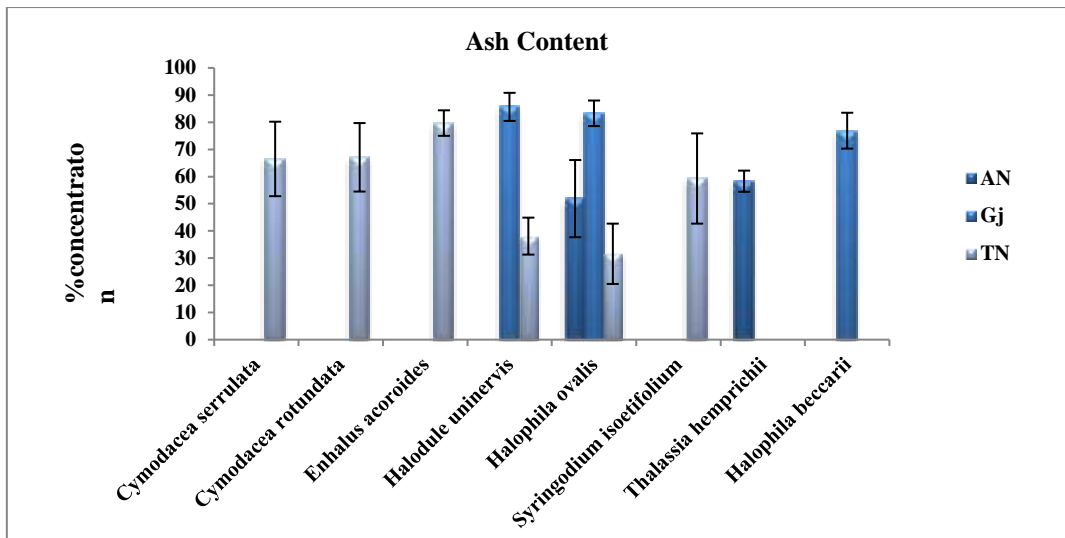


Fig. 5.1.5 Ash Content in the seagrass samples among study sites

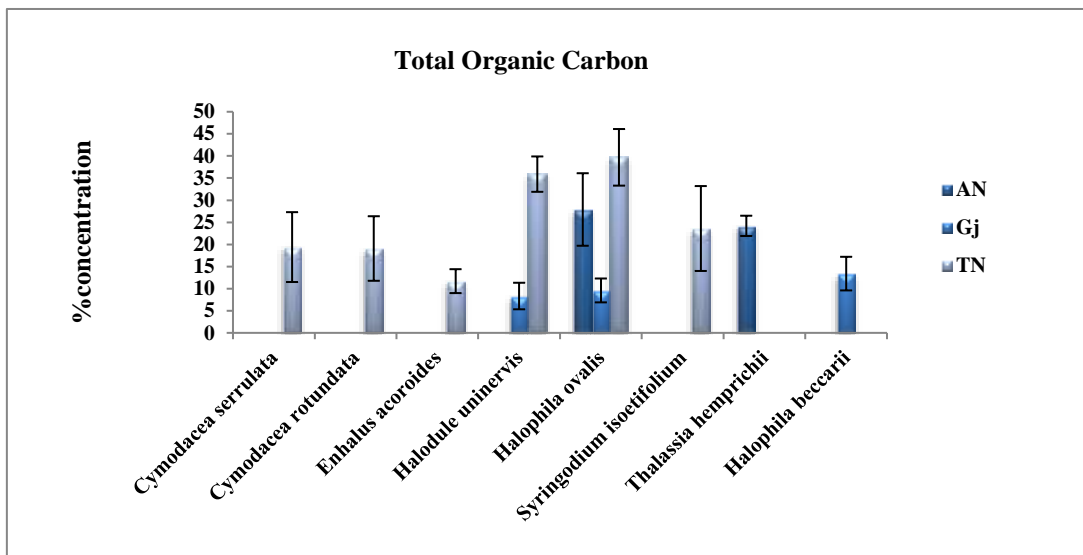


Fig. 5.1.6 Total Organic Carbon in the seagrass samples among study sites

The Total Organic Carbon was higher in the leaves of the species *Halophila Ovalis* (39.7%) followed by *Halodule uninervis* (35.9%) and *Syringodium isoetifolium* (23.6%) in the site Tamilnadu (Fig. 5.1.6). Similar observations were observed for total organic matter content in the leaves of seagrass samples (Fig 5.1.7).

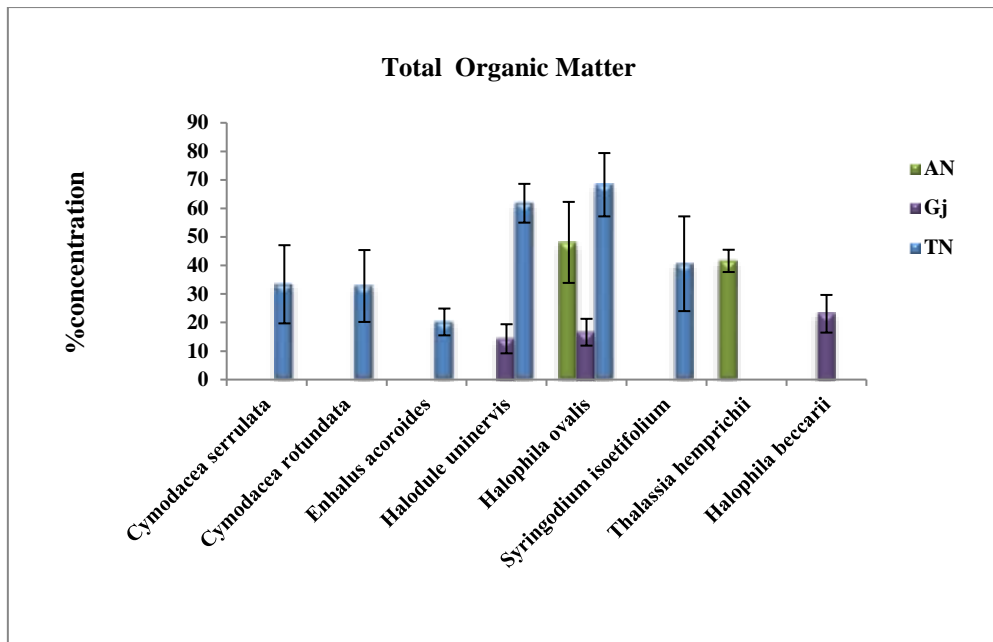


Fig. 5.1.7 Total Organic Matter in the seagrass samples among study sites

The factors influencing the variation in the nutrient status of seagrass leaves among sites are yet to be understood.

5.2 Stomach content analysis of stranded dugongs of Tamil Nadu and Gulf of Kutch, Gujarat

The dugongs are the large primary consumer of seagrasses. Seagrasses are undoubtedly their main food component (Marsh et al., 2011; Pandey et al., 2010; Lipkin, 1975; Adulyanukosol et al., 2010), they prefer various species of seagrasses (Erftemeijer, 1993; Heinsohn, 1972). Adulyanukosol, 2010 quantitatively examined the 6 stomachs of Dugongs from Thailand and found nine species of seagrass in all the 6 dugong stomachs which feed dominantly on 4 seagrass species (*H. Ovalis*, *E. Acoroides*, *C. Serrulata* and *H. Pinfolia*) which were abundant in that area. Marsh et al, 1982 quantitatively analysed 95 stomachs of dugongs from Queensland which shows they prefer all genera of seagrasses in which *Halodule*, *Halophila* (89%), *Cymodocea* (61%), and *Thalassia* (39%) found in the stomach contents.

The aim of the study is to qualitatively analyse the stomach content of five dugong samples received from Tamil Nadu (n=3) and Gulf of Kutch (n=2). This study will help in understanding the diet of Dugongs and their preferred species in these areas.

Material and methods

Seven species of Seagrass, from Tamil Nadu (n=3), Gulf of Kutch (n=2) and Andaman and Nicobar Islands (n=2) were collected. The morphology of leaf and epidermal cell structured were studied and photographed using stereo-microscope (4x) and Inverted-microscope in various magnifications (4x, 10x and 40x) using available field guides and literature. (Channells and Morrissey, 1981; Lanyon 1986; Adulyankosol and Poovachiranon, 2003; Shaffai 2014).

Sample Collection

Samples of digesta were collected from 5 dead Stranded dugong stomach from Tamil Nadu (n=3) and Gulf of Kutch (n=2). A sample of digesta was collected from fore and hindgut region, stored in 70% ethanol at -20°C and transported to the lab for further analysis

Laboratory analysis

Initially, samples were divided into 10 subsamples about 1gm wet weight each was analysed. Samples were identified up to genus/species level under stereo, compound and high-resolution inverted microscope. As the seagrasses in the stomach samples are extensively macerated, so it was necessary to identify the seagrasses on the basis of epidermal cells features, venations and tannin cell patterns and sometime gross morphological features (shape of leaves, size, venation patterns) were observed in case of presence of intact leaves found in the stomach content samples and compared with reference seagrass slides and cited literature.

Results

A total of 5 dugong gut samples were analysed from Gulf of Kutch (n=2) and Tamil Nadu (n=3). Only leaf fragments were selected for identification of seagrass species from stomach content samples. Gut content of dugong in this study consisted almost entirely of seagrasses. In gut samples of Tamil Nadu, we found five genera of

seagrasses *Halophila* spp., *Halodule* spp., *Cymodocea* spp., *Enhalus acoroides*, *Syringodium isoetifolium* and one Algae spp.

Gujarat sample, however, consisted of two genera of seagrasses, *Halophila* spp. And *Halodule* spp. And one Algae spp.

In addition to seagrasses and Algae spp., Non-biological material (plastic fragments) (Image 5.9) was also found in the gut samples of Tamil Nadu and Gujarat. Three types of plastic fragments which include, two fishing net fragments of about 10(Cm) and 4(cm) in length (Image 5.9a & 5.9b), one polythene fragment (5Cm) (Image 5.9b) in length found in the Tamil Nadu gut sample. One red coloured microfilament found in gut samples of Gujarat (Image 5.9c).

A key to identify seagrass genera/ species based on their cell features

1. *Halophila* spp.

The leaf fragments of *Halophila* spp. Are thin, light and transparent. The cells are irregularly arranged with jig-saw like arrangement of cells at (40x) magnification can be seen in the stomach content sample as well as fresh seagrass samples (Image 5.2.1a & 1b).

2. *Halodule* spp.

Differentiation between the *Halodule uninervis* and *Halodule pinifolia* by only their epidermal cell features is very difficult as the cells of the *Halodule* spp. Is elongated, rectangular in shape with arranged in rows like construction bricks only, tannin cells observed (Image 5.2.2)

3. *Cymodocea* spp.

The cell feature of *C. Serrulata* and *C. rotundata* is easy to distinguish as the cell of *C. Serrulata* are square and angular in shape (Image 5.2.3) while *C. rotundata* cells are square with the rounded corner in shape, Tannin cells are also observed.

4. *Enhalus acoroides*

The epidermal cells are generally square with some triangular in appearance in fresh seagrass as well as gut sample. (Image 5.2.4)

5. *Thalassia hemiprichii* and *Cymodocea rotundata*

The features of the epidermal cell are irregularly arranged with a round in shape. (Image 5.2.5) however, the identification and distinction between *Thalassia hemiprichii* and *Cymodocea rotundata* presented a problem because epidermal cells of these two species are fairly same at the same magnification (Channells and Morrissey 1981; Adulyanukosol & Poovachiranon 2003) and Cells of *T. Hemiprichii* are rounded in shape while *C. rotundata* are square with the rounded corner in shape.

6. *Syringodium isoetifolium*

It is easy to identify the epidermal cells of *S. isoetifolium* by the presence of Hexagonal shaped cells and the absence of leaf venation. (Image 5.2.6)

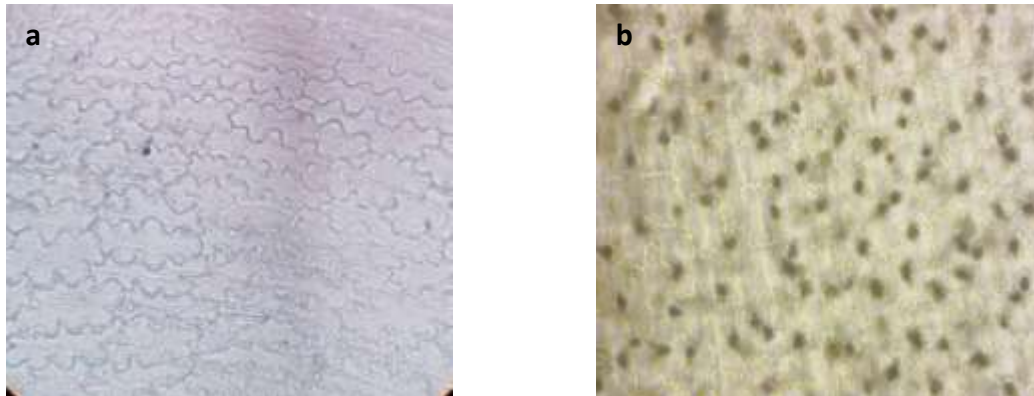


Image 5.2.1:- Epidermal cells of *Halophila ovalis*; a) normal cells (40x) b) stomach content cells (40x)

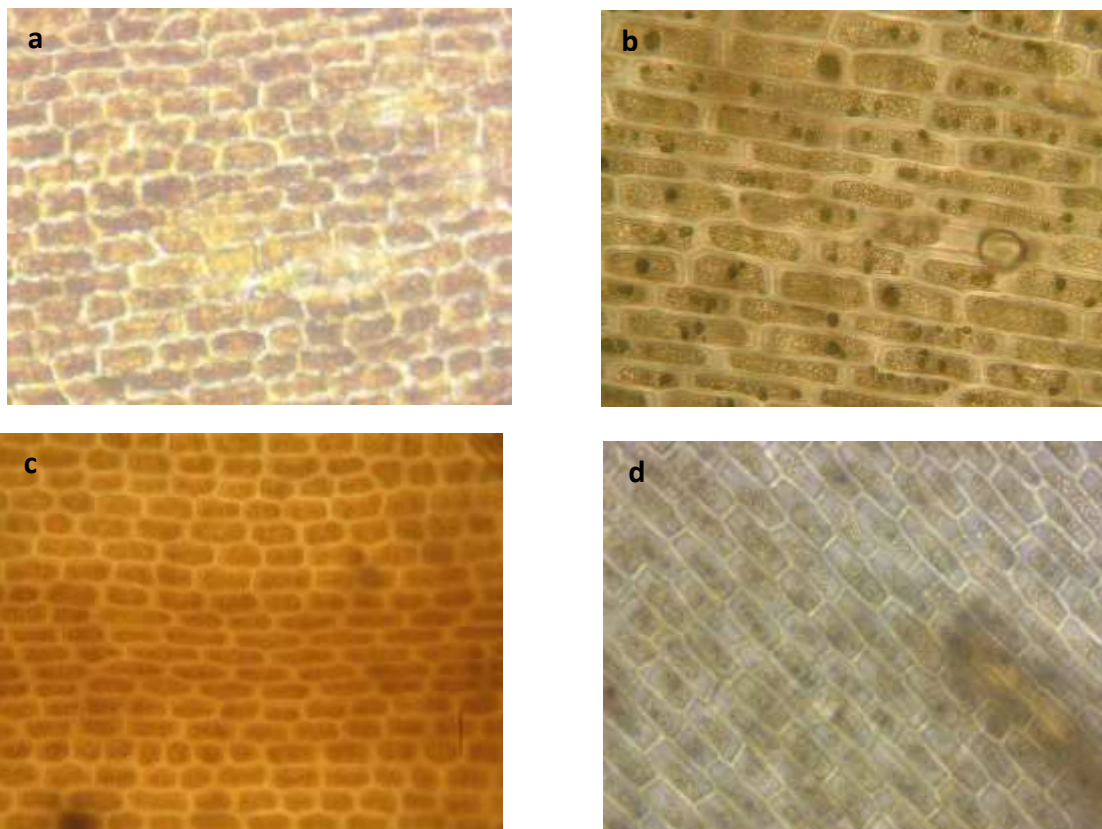


Image 5.2.2:- Epidermal cells of *Halodule* species (40x); a) Normal cells of *Halodule uninervis* b) Stomach content sample of *Halodule* sps. c) Normal cells of *Halodule pinifolia*

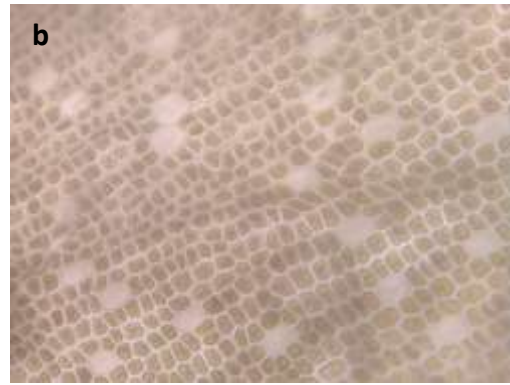


Image 5.2.3:- Epidermal cells of *Cymodocea serrulata* (40x); a) Normal cells of *Cymodocea serrulata* b) stomach content sample of *Cymodocea serrulata*

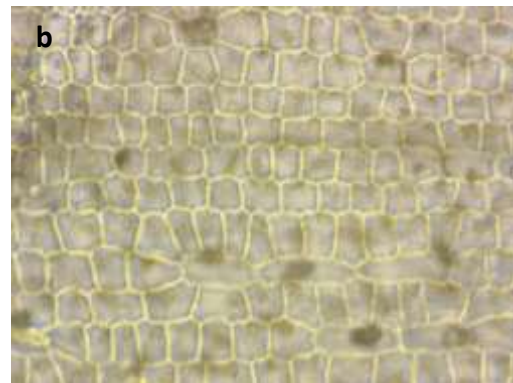
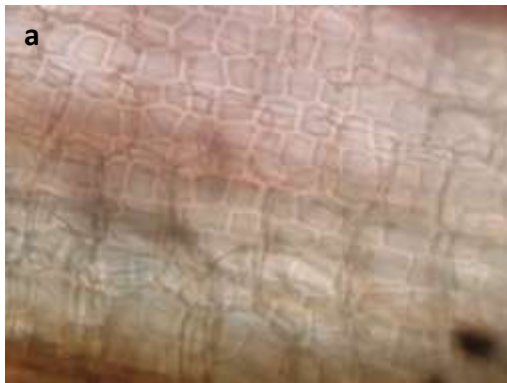


Image 5.2.4:- Epidermal cells of *Enhalus acoroides* (40x); a) Normal cells of *Enhalus acoroides* b) stomach content sample of *Enhalus acoroides*

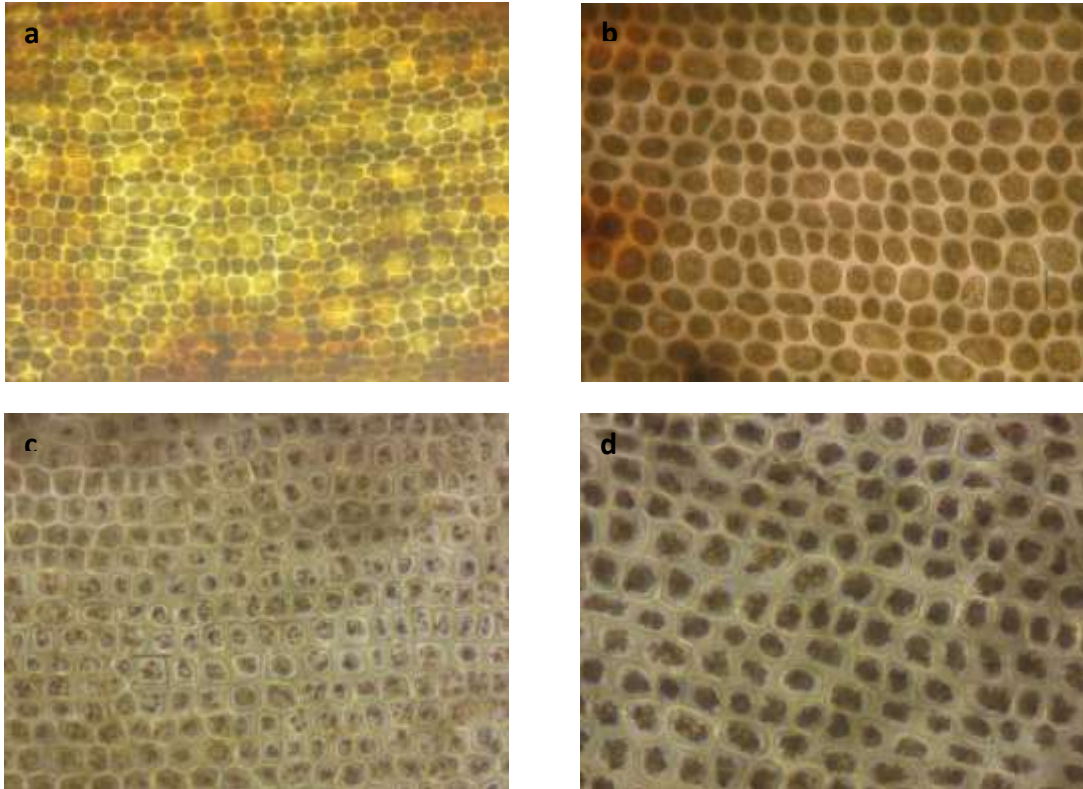


Image 5.2.5:- Epidermal cells of *Thalassia hemiprichi* and *Cymodocea rotundata*; a) Normal cells of *Thalassia hemiprichi* b) Normal cells of *Cymodocea rotundata* c) & d) stomach content sample of *T. hemiprichi* or *C. rotundata*

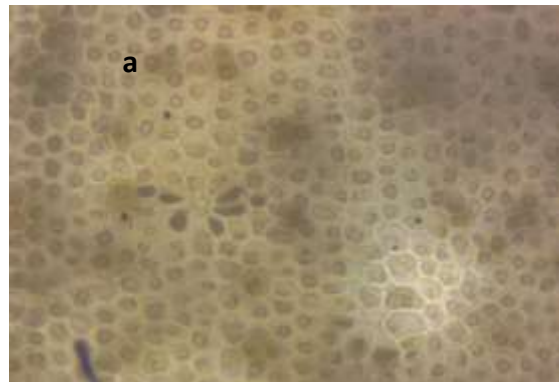


Image 5.2.6:- Epidermal cells of *Syringodium isoetifolium*; a) stomach content sample of *Syringodium isoetifolium*

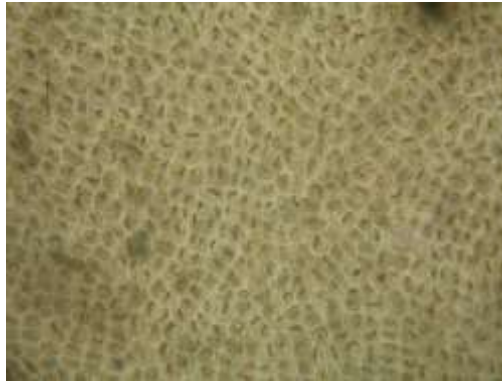


Image 5.2.7:- Epidermal cells of algae species

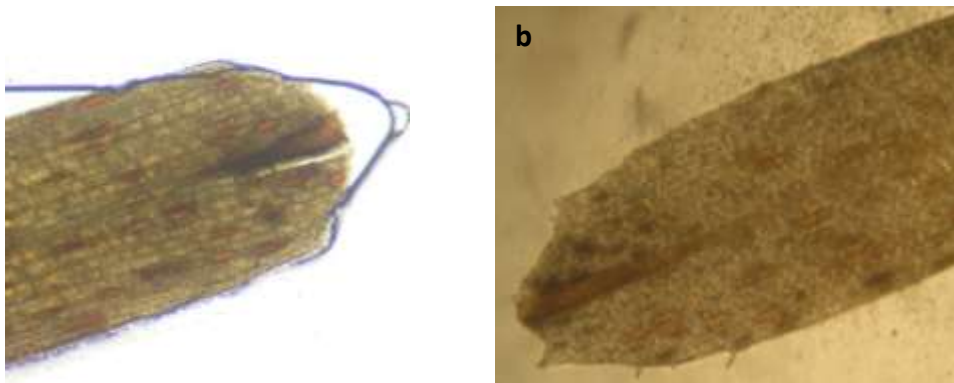


Image 5.2.8:- Leaf tip of *Halodule pinifolia*; a) normal leaf tip of *Halodule pinifolia* (4x) b) leaf fragment of *Halodule pinifolia* from Stomach content sample(4x)

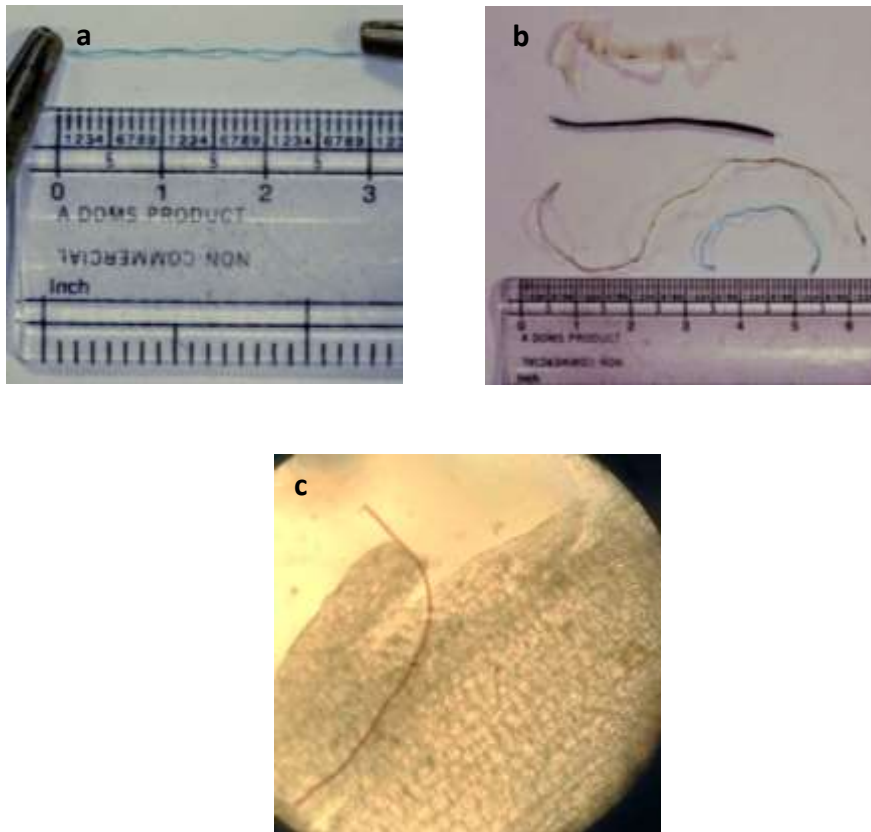


Image 5.2.9:- Non-biological Materials from Stomach content samples; a) Nylon Fibres b) Plastic Fragment c) microfilament (20x)

Discussion

The study provides insights into dugong diets and shows that their main diet is seagrass. This study also provides the identification of seagrasses up to genus or species level on the base of their epidermal cells structures and leaf characters. The samples collected from Tamil Nadu (n=3) and Gulf of Kutch (n=2) shows the differences in their gut content. Five genera of seagrass have been identified from the Tamil Nadu samples, while only two were identified from that of Gujarat (Gulf of Kutch) indicating that the Tamil Nadu coasts are flourished with a wider variety of seagrasses in contrast to that of Gulf of Kutch. Moreover, the low diversity of seagrass from the samples of Gulf of Kutch may result from inaccessibility and patchy distribution of seagrass meadows. Gut content analysis from one of the samples from Tamil Nadu reveals some plastic contents (two nylon threads, one plastic fragment and one unidentified fragment). These finding shows severe plastic pollution in the area and demands immediate action.

5.3 Study of macrobenthic assemblages of seagrass habitats in the Andaman Islands

Introduction

Seagrass beds are an important part in the coastal and estuarine ecosystem which influences a number of ecosystem services (Bos, *et al.*, 2007). Seagrasses are represented by 72 species belonging to 12 genera and 6 families (Short *et al.*, 2011). Seagrass habitat supports greater macrofauna species diversity, abundance and biomass than adjacent unvegetated habitats. Due to their sensitivity to adjust in water and habitat for immoderate biodiversity, they are comprehended as important indicator species that replicate the general health of coastal ecosystems (Thayer *et al.*, 1978). They help in reducing the speed and changing the pattern of currents and sediment transportation, thus playing a vital role of basic land builder and stabilizer, similar to a sand dune and mangrove vegetation (Jagtap and Rodrigues 2004). Macrobenthos, are invertebrates that live on or in sediment or attached to a hard substrate. Annelid worms, bivalves, gastropods, crustaceans, tunicates, and insect' larvae are the most commonly encountered Macrofauna in an estuarine or freshwater environment. Macrofauna can be retained using 500 μm sieve. When macrofauna lives within the substrate it is called infauna and when macrofauna lives on or just above the substrate it is called epifauna. Macrofauna communities are known to play an important role for ecosystem & ecosystem services (including coastal stabilization, nutrient and carbon cycling and storage, trophic transfer). Macrofauna is sedentary and tropically diverse and their communities mix the effects of water and sediment changes over time (Lenihan & Micheli 2001). For dugongs, the seagrass beds are crucial for their sustenance and the seagrass habitat is degrading which has become a great threat for Dugong and also for other marine animals. The study is based on the understanding habitat of the seagrass beds with respect to the Macrofauna in the sediments of the seagrass beds. Understanding may result to conserve and protect the seagrass habitat which will in return play a vital role in conserving Dugongs. According to these factors, the objective of the study has been designed.

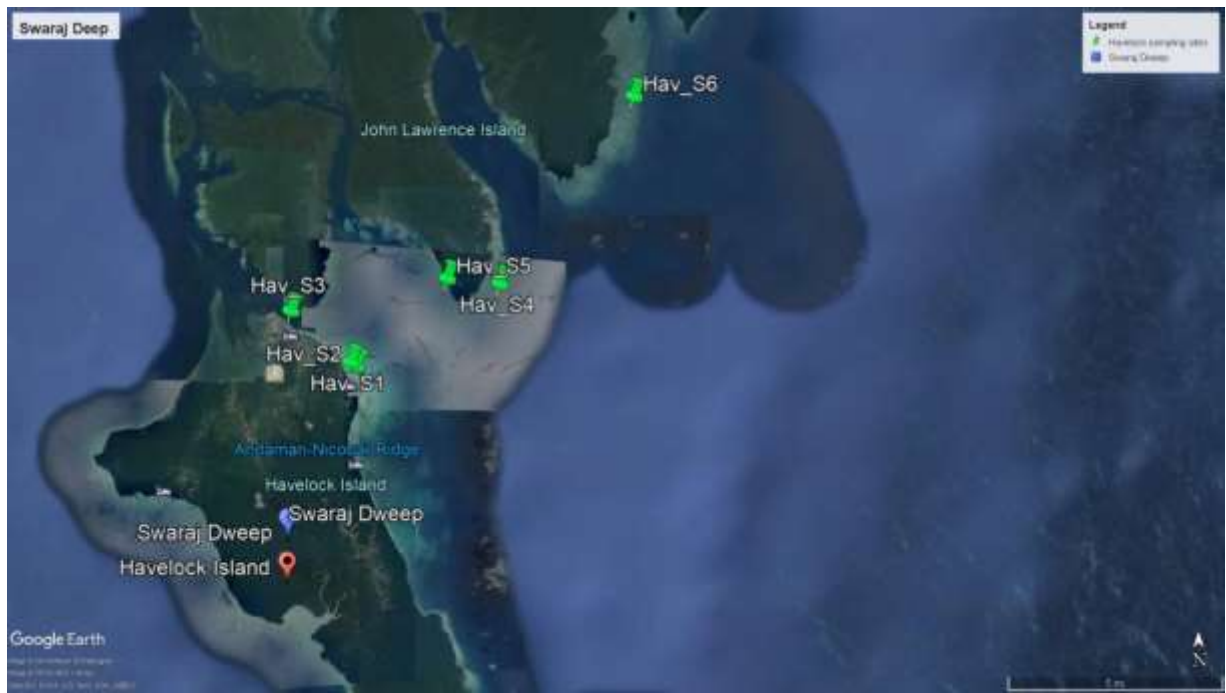
Objective

To understand seagrass associated macrobenthic communities in Ritchie's archipelago, South Andaman

Study site

The present study was carried out across two Islands viz; Shaheeddweep and Swarajdweep Ritchie's archipelago, South Andaman. Total 94 sediment samples were collected from seven sites at Swarajdweep and 18 sites at Shaheeddweep in Ritchie's archipelago from seagrass beds of *Thalassia hemprichii*, *Halophila ovalis*, *Halophila decipiens*, *Halodule pinifolia*, *Halodule uninervis*, and *Cymodocea* sp.

Study area and collected sediment sample locations



Map 5.3.1 Swaraj dweep sediment collected station



Map 5.3.2 Shaheed dweep collected sediment station

The sediments were collected from 7 Station from Swaraj Dweep (Havelock Island) and 18 Stations from Shaheed Dweep (Neil Island). The following table shows the Stations and coordinates.

Table 5.3.1 Stations and coordinates

Tr id	Name of the island	Station name	
NB1.1	Shaheed dweep (Neil)	Neil_S1	
NB 1.6	Shaheed dweep (Neil)		
NB 1.11	Shaheed dweep (Neil)		
NB 2.1	Shaheed dweep (Neil)		
NB 2.6	Shaheed dweep (Neil)	Neil_S2	
NB 2.11	Shaheed dweep (Neil)		
NB 3.1	Shaheed dweep (Neil)		
NB 3.6	Shaheed dweep (Neil)	Neil_S3	
NB 4.1	Shaheed dweep (Neil)		
NB 4.6	Shaheed dweep (Neil)	Neil_S4	
NB 4.11	Shaheed dweep (Neil)		
LX 1.1	Shaheed dweep (Neil)		
LX 1.6	Shaheed dweep (Neil)	Neil_S5	
LX 1.11	Shaheed dweep (Neil)		
LX 2.1	Shaheed dweep (Neil)		
LX 2.6	Shaheed dweep (Neil)	Neil_S6	
LX 2.11	Shaheed dweep (Neil)		
NU1.1	Shaheed dweep (Neil)		
NU1.6	Shaheed dweep (Neil)	Neil_S7	
NU1.11	Shaheed dweep (Neil)		
NU2.1	Shaheed dweep (Neil)		
NU2.6	Shaheed dweep (Neil)	Neil_S8	
NU2.11	Shaheed dweep (Neil)		
NU3.1	Shaheed dweep (Neil)		
NU3.6	Shaheed dweep (Neil)	Neil_S9	
NU3.11	Shaheed dweep (Neil)		
AQ1.1	Shaheed dweep (Neil)		Neil_S10
AQ1.6	Shaheed dweep (Neil)		
AQ1.11	Shaheed dweep (Neil)		
AQ2.1	Shaheed dweep (Neil)		
AQ2.6	Shaheed dweep (Neil)		
AQ3.1	Shaheed dweep (Neil)		
AQ3.6	Shaheed dweep (Neil)		
AQ3.11	Shaheed dweep (Neil)		
MG1.1	Shaheed dweep (Neil)	Neil_S11	
MG1.6	Shaheed dweep (Neil)		
MG1.11	Shaheed dweep (Neil)		
MG2.1	Shaheed dweep (Neil)	Neil_S12	
MG2.6	Shaheed dweep (Neil)		
MG2.11	Shaheed dweep (Neil)		
MG3.1	Shaheed dweep (Neil)	Neil_S13	
MG3.6	Shaheed dweep (Neil)		
MG3.11	Shaheed dweep (Neil)		
BH1.1	Shaheed dweep (Neil)	Neil_S14	
BH1.6	Shaheed dweep (Neil)		
BH1.11	Shaheed dweep (Neil)		
BH2.1	Shaheed dweep (Neil)	Neil_S15	
BH2.6	Shaheed dweep (Neil)		
BH2.11	Shaheed dweep (Neil)		
BH3.1	Shaheed dweep (Neil)	Neil_S16	
BH3.6	Shaheed dweep (Neil)		
BH3.11	Shaheed dweep (Neil)		

BB 1.1	Shaheed dweep (Neil)	Neil_517
BB 1.6	Shaheed dweep (Neil)	
BB 1.11	Shaheed dweep (Neil)	
BB 2.1	Shaheed dweep (Neil)	
BB 2.6	Shaheed dweep (Neil)	
BB 2.11	Shaheed dweep (Neil)	
BB 3.1	Shaheed dweep (Neil)	
BB 3.6	Shaheed dweep (Neil)	
BB 3.11	Shaheed dweep (Neil)	
CH 1.1	Shaheed dweep (Neil)	
CH 1.6	Shaheed dweep (Neil)	
CH 1.11	Shaheed dweep (Neil)	
DL1.1	Swaraj Dweep (Havelock)	Hav_51
DL1.6	Swaraj Dweep (Havelock)	
DL1.11	Swaraj Dweep (Havelock)	
DL2.1	Swaraj Dweep (Havelock)	Hav_52
DL2.6	Swaraj Dweep (Havelock)	
DL2.11	Swaraj Dweep (Havelock)	
NR1.1	Swaraj Dweep (Havelock)	
NR1.6	Swaraj Dweep (Havelock)	
NR1.11	Swaraj Dweep (Havelock)	

NR2.1	Swaraj Dweep (Havelock)	Hav_53	
NR2.6	Swaraj Dweep (Havelock)		
NR2.11	Swaraj Dweep (Havelock)		
NR3.1	Swaraj Dweep (Havelock)		
NR3.6	Swaraj Dweep (Havelock)		
NR3.11	Swaraj Dweep (Havelock)		
JL1.1	Swaraj Dweep (Havelock)		Hav_54
JL1.6	Swaraj Dweep (Havelock)		
JL1.11	Swaraj Dweep (Havelock)		
JL2.1	Swaraj Dweep (Havelock)		Hav_54
JL2.6	Swaraj Dweep (Havelock)		
JL2.11	Swaraj Dweep (Havelock)		
HL1.1	Swaraj Dweep (Havelock)	Hav_55	
HL1.6	Swaraj Dweep (Havelock)		
HL1.11	Swaraj Dweep (Havelock)		
HL2.1	Swaraj Dweep (Havelock)	Hav_56	
HL2.6	Swaraj Dweep (Havelock)		

	(Havelock)		
HL2.11	Swaraj (Havelock)	Dweep	
HL3.1	Swaraj (Havelock)	Dweep	Hav_57
HL3.6	Swaraj (Havelock)	Dweep	
HL3.11	Swaraj (Havelock)	Dweep	

Site name: Transect number: Quadrat number
eg: NR 1.1
NR: Nemo Reef/ 1: 1st transect/ 1: First quadrat

NR- Nemo reef
BH- Bharatpur
CH- Chhotaneil
DL- Dolphin resort
LX- Laxmanpur
AQ- Aquarium
MG- Manchhigadda
HL- Henry Lawre
NB- Natural bridge
JL- Join lawrence
NU- Nursery

Methodology

Sample collection

From the Line Intercept transects (50m) for seagrass habitat assessment, 500gm (approx.) sediment samples were scooped from 20x20cm quadrat, from the top 10cm layer of soil in three replicates. Collected samples were stored in zip lock bags and transported to the laboratory where later preservation was done in 4% Rose Bengal buffered formalin solution.

Sieving and sorting

Each sediment sample was washed using 500µ sieve and sub-sampled (50-100 gm), which was further sorted up to group level for macrobenthic assessment.

Group validation and photo documentation

Out of 94 sorted sediment subsamples, 12 were analysed using Bright field Microscope (Magnum CX46) using 4X lens and DSLR camera using 18-55mm lens.

Result

Total 207 individuals from 12 samples that have been analysed belonging to the following groups viz; gastropods, bivalve and foraminifera were. Collectively Gastropods were the most dominant group (n=78) followed by bivalve (n=67) and Foraminiferans (n=30). Individuals who could not be identified up to group level were categorised as 'unidentified' (n=32).

Table 5.3.2 The number of individual imaged from the 12 sorted sediment sub-sample

Sediment Sample ID	No. of Gastropod specimen	No. of Bivalve specimen	No. of Foraminifera specimen	No. of Polychaetes specimen	No. of Unidentified specimen
LX 2.6	14	3	1	0	6
LX1.11	7	5	2	0	9
LX 2.1	5	4	3	0	0
LX 2.11	5	0	3	0	3
LX 1.1	10	0	1	0	5
LX 1.6	13	1	1	0	1
MG 3.11	8	14	2	0	0
MG 1.1	8	4	2	0	5
NU 2.11	2	12	15	0	3
BB 3.1	2	4	-	-	-
JL 1.6	2	10	-	-	-
NR 3.1	2	10	-	-	-

Images of different species of macrofauna specimen from sorted sub sediment samples

Gastropods



Image 5.3.1:- 01- 15 Gastropods specimens

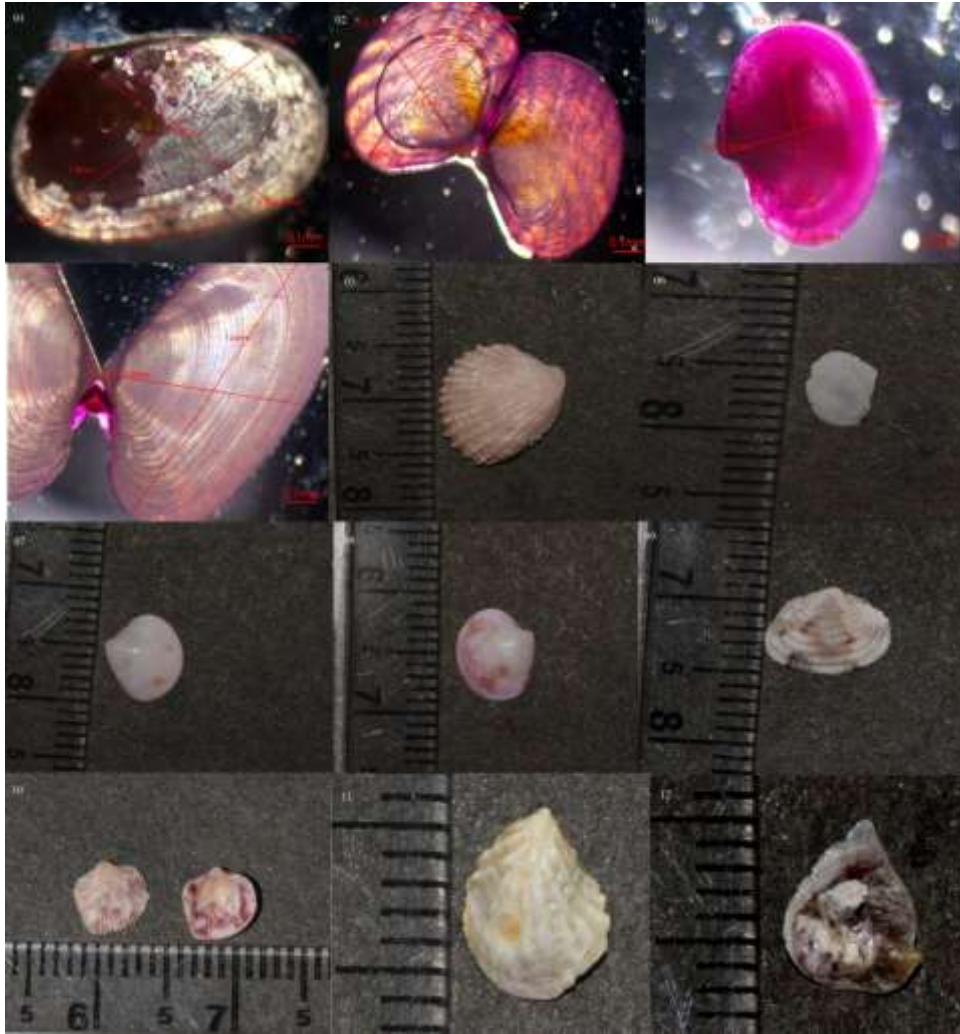


Image 5.3.2: 01-12 Bivalve specimens

Foraminifera



Image 5.3.3 01-03 Foraminifera specimen

Unidentified

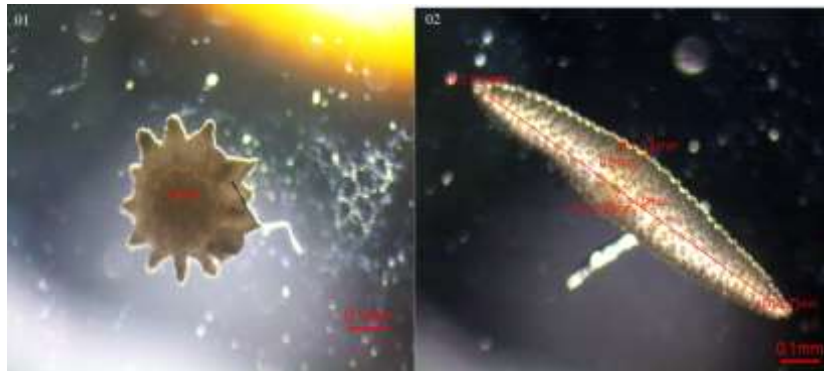


Image 5.3.4: 01-02 Unidentified species

Discussion

Sieving, sorting of all 94 samples have been done and imaging of 207 intact individual organisms from 12 samples that have been analysed has been done. Where there were 78 numbers of Gastropods, 67 Bivalve, 30 foraminifera, 0 polychaetes and 32 unidentified organisms have been recorded. Presence of Foraminifera tests was found high during sorting of the organisms but very few were intact. So, we can assume that some of them may have come to the study area by the water currents. Remaining samples are to be analysed. Based on the data generated the further analysis will be undertaken to get results of our objective mentioned above.

5.4 Budget details for financial year 2018-2019

Receipt and Payment A/c for the year ending 31st March 2019

Particulars	Amount (Rs.) 2018-19	Amount (Rs.) 2017-18
RECEIPTS		
<u>Balances as on 01.04.2018</u>		
UBI Saving A/c No. 518502010055294	2,195,050.00	2,190,245.00
By Grant Received	-	-
By Fixed Deposit	15,000,000.00	12,500,000.00
By Interest Received(including FDR)	3,397,844.00	1,923,226.00
Total (A) in Rs..	20,592,894.00	16,613,471.00
PAYMENTS		
<u>Expenditure from Grant</u>		
<u>Revenue Expenditure</u>		
To Manpower	5,077,496.00	1,976,658.00
To Capacity Building & Awareness	4,795,743.00	5,776,211.00
To Research monitoring species & habitat conservation & management	4,622,055.00	5,595,357.00
To Participatory Management	1,748,374.00	279,435.00
To Marine Mammal Rescue	43,144.00	70,760.00
To Niti Aayog	1,668,512.00	
Advances		
Forest Advance	115,615.00	
Tour Advance	56,709.00	220,000.00
Advance to Dive India	159,300.00	
Advance to Fern Sattva Resort Dwarka	123,035.00	
Advance to M/s TSG Hotel	438,120.00	
Advance to D/WII A/c No.-55701	250,000.00	500,000.00
Total (B) in Rs..	19,098,103.00	14,418,421.00
By Balance (A-B) as on 31st March 2019		
Cash at Bank		
UBI Saving A/c No. 518502010055294(A-B)	1,494,791.00	2,195,050.00

5.5 List of Dugong Ambassadors

Name of Dugong Ambassadors from Tamil Nadu

SN	Name of Dugong Ambassadors
1	M. Thirunavukarasu
2	B. Karan Raj
3	C Mutthupandi
4	P Ashokkumar
5	K Athisaya
6	V. Viswa Praween
7	C. Ragulravi
8	K. Anushiya
9	M. Kaviya
10	R Jeyapugaleshwari
11	M. Sruthika
12	T. Santhiya
13	M Kosalai Raman
14	R Sakthivel
15	M. Nabitha
16	A Jenifer
17	H Muhammed Aslam
18	R Ramadayan
19	P. Sneka
20	K. Yogalakshmi
21	K. Sumathi
22	B Vanniyanathan
23	V. Visitha
24	S Prakash
25	S Ashwathi
26	M Vishva
27	S Praveen
28	J. Ranjith raj
29	H. Bhuvana
30	S. Sabitha
31	K. Abdul Basith Khan
32	N Kalidas
33	M Pandi Piriyan
34	S Sumitha
35	D Durgeswari
36	A. Arthi
37	T. Kuppuselvi
38	K Vimal

SN	Name of Dugong Ambassadors
39	K. Ramana
40	M. Manisiya
41	M Srinivasan
42	S. Durga
43	P. Laksmi priya
44	K Ranjith
45	R. Manikandan
46	M. Palanivel
47	V. Veeravel
48	K. Ajay
49	L. Aljesira
50	P. Pavithra
51	R. Marudhu
52	A. Madhavan
53	M Vijaykumar
54	S. Deebika
55	S. Prathana
56	P. Kamali
57	N. Nageshwari
58	E. Nasrin Banu
59	B. Mohamed Paisul
60	J. Aseera
61	S. Shabhurrusha
62	M. Sarumathi
63	B. Riyana
64	P. Pavithra
65	K. Sundareswari
66	P. Karthika
67	M.Kaviyarasan
68	B. Chitralakshmi
69	M. Aruna Devi
70	C. Suhitha
71	R. Thaslina Banu
72	R. Nanthini
73	M. Murugeswari
74	R. Saminathan
75	U. Pavithra
76	S. Megaran Beevi
77	G. Munishwaran
78	R. Kerishtoper

SN	Name of Dugong Ambassadors
79	M. Malaiyarasi
80	V. Bagampriyal
81	B. Nagasoundarya
82	M. Gayathri
83	K. Kavinesh Kumar
84	S. Santhos
85	S. Sivaranjani
86	T. Vimalthasan
87	M. Achitha
88	S. Dhivya
89	K. Kali Karthika
90	N. Durkka
91	S. Bowmiya Begam
92	S. Logesh Raj
93	S. Karthigadevi
94	N. Jeyapratha
95	K. Savithiri
96	N. Gowtham
97	K. Ritheesh
98	G. Vijaya
99	P. Kaviya
100	B. Vikram
101	K. Viji
102	B. Umeshvithya
103	R. Sheeba
104	M. Jansi
105	V. Santhiya
106	U. Udaya Pruntha
107	M. Harris Jayaraj
108	S. Al Shiba Fathima
109	S. Darshika
110	S. Afritha Banu
111	J. Banu Priya
112	A. Babyrani
113	R. Asmiya
114	A. Farsiya Fathima
115	N. Durga
116	M. Arrahilthifa
117	A. R. Harimathi
118	J. Jerolin Santhiya
119	M. Abirami

SN	Name of Dugong Ambassadors
120	A. Mariya Renipa
121	S. Jemil
122	M. Anthony Benosh
123	L. Zionraj
124	S. Sahaya Sweetlin
125	M. Ageciya Nilodika
126	S. Babu
127	T. Palanimurugan
128	M. Thavamurugan
129	I. M. Ramkumar
130	A. Arul Ebineesh
131	N. John Pethuro
132	P. Rathish Kumar
133	N. Nambu Priyadharshini
134	S. Thurgesh Raja
135	M. Jaheedeen
136	A. Nasrin Begam
137	K. Jeya
138	S. Mohammedu Shihar
139	S. Jaisha
140	M. Saktheeswaran
141	R. Jeya Surya
142	M. Muthu Kumar
143	S. Segu Bakurudeen
144	Y. Anthony Akshab
145	A. Mohana Soundhari
146	K. Kaviya
147	R. Mugesh Kunnan
148	M. Vinitha
149	C. Banu Priya
150	M. Nandini
151	G. Durga Devi
152	N. Thilochana
153	P. Iswarya

Name of Dugong Ambassadors from Andaman Island

SN	Name of Dugong ambassadors
1	Snigdha Sikder
2	Anisha Dhali
3	Seema Chowdhury
4	V. Nirmala
5	G. Shiva
6	Abhijeet Mazumder
7	M. Neha
8	Sujith Mazumder
9	Rahul Sarkar
10	Shashodhar Mondal
11	Bipul Bala
12	Abhay Halder
13	Chanchal Sarkar
14	Rohit Sammaddar
15	Sujeet Halder
16	Ashit Halder
17	Rohit Mondal
18	Ranjeet Mondal
19	Payal Bala
20	Tanushree Mondal
21	Srishti Gharami
22	Nibedita Mondal
23	Sunita Roy
24	Deepthi Mondal
25	Rupsha Biswas
26	Shilpi Bala
27	Priyanka Biswas
28	Smriti Mondal
29	P. Sneha
30	R. Priya
31	Rekha Roy
32	Santhona Das
33	Pinky Podder
34	Sumit Das
35	Rohit Kumar Das
36	Abinash Mondal
37	Vishnu Bairagi
38	Kajal Roy
39	Prasanta Roy
40	Rajesh Shill
41	Samaresh Gain
42	Rimi Shil
43	Sushmita Das
44	Nitish Biswas
45	Pritish Biswas
46	Avay Das
47	Baishaki Das
48	Sadhana Das
49	Dev Kumar Biswas
50	Rajdeep Ghose
51	Sangita Das
52	Tapan Biswas
53	Rani Roy
54	Sudeep Mondal

SN	Name of Dugong ambassadors
55	Nisha Roy
56	Ajay Biswas
57	Pasanjit Mondal
58	Bijoy Sutradhar
59	Sakshi Das
60	Beuty Biswas
61	Tarun Mondal
62	Subankar Sardar
63	Uday Bairagi
64	Mitali Mondal
65	Sania Adhikari
66	Manas Biswas
67	Sumit Mondal
68	Madhari Mondal
69	Aysha Toppo
70	T. Zaira Banu
71	Manju
72	Priyanka Tirkey
73	T. Rukshar Begum
74	M. Jaya Praveen
75	Avishek Minj
76	Amit Minj
77	Sumit Kujur
78	S. Rajkumar
79	Abishek Tirkey
80	J. Omakshi
81	K. Kavita
82	P. Dharma Rao
83	K. Madhav Rao
84	A. Kalpana
85	V. Banuwathi
86	B. Kalavathi
87	L. Kurma Rao
88	J. Swathi
89	M. Shana Bibi
90	Rajani
91	N. Kumari
92	B. Joyothi
93	P. Lachaiya
94	P. Uha
95	J. Kavitha
96	Mahesh Dass

List of Dugong Ambassadors from Gujarat

SN	Name of Dugong ambassadors
1	Subhaniya Rijavan
2	Modi Sahil
3	Nariya Sahid
4	Vadha Latif
5	Jagatiya Mohamad Mohyunudin
6	Subhaniya Mohmad
7	Ruknani Soyab
8	Changada Havaaben
9	Sap Navaz Jumabhai
10	Sodha Moyudin
11	Kureshi Ashiyabanu Sattarbhai
12	Chaki Sahid
13	Chaki Tasneem Mahammad bhai
14	Kapil Sureshbhai Dhayani
15	Koshar Shabir Kureshi
16	Nariya Femida Faridbhai
17	Kasta Mansi Harishbhai
18	Sodha Satar Idrushbhai
19	Mokha Jahidhusain Jafarbhai
20	Rahul Harajibhai Gohel
21	Thaim Ashmabanu Sulemanbhai
22	Manek Bharti Gagabha

5.6 Posters presented in Annual Research Seminar 2019



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

XXXIII ANNUAL RESEARCH SEMINAR

DUGONG CONSERVATION IN INDIA: MAKING PARTNERSHIPS IN ENDANGERED SPECIES CONSERVATION








Prachi Hatkar, Himani Saini and CAMPA Dugong team
Supervisors: Dr. K. Sivakumar and Dr. J.A. Johnson



BACKGROUND

- Dugong Recovery Program was initiated in 2016.
- The Dugong ESRP includes research and management actions imperative to stop the population decline and support the recovery of this highly threatened species. With substantial funding under this program, necessary ground interventions have been initiated to ensure the long-term survival of dugongs in the wild through multi-stakeholder partnerships and support of the local communities.

AIM

- To raise awareness among stakeholders about the importance and ecological roles of the species and its habitat in the marine ecosystem through partnerships

STUDY AREA

- Gulf of Kutch (Gujarat), Gulf of Mannar, Palk Bay (Tamil Nadu) and Andaman Islands.



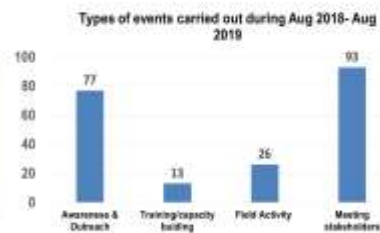
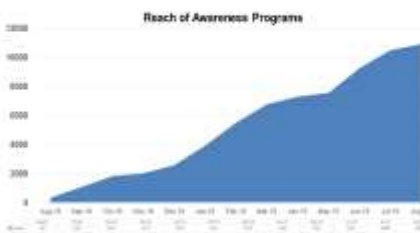
METHODS

KEY STAKEHOLDERS

- Outreach programs consisted of community workshop, presentations, street plays, rallies, beach clean-up activities, exhibitions, TV shows, radio programs etc.
- Targeted school children of fisher community using unique approach of Dugong Scholarship Program.
- Conducted capacity building programs for frontline staff of enforcement agencies, researchers, school teachers and representative of local community.

RESULTS

- 211 outreach programs were conducted in all three sites viz. 116 in Tamil Nadu, 52 in Andaman and 43 in Gujarat, which have reached over 10,000 people.
- 13 stakeholders were targeted from each site including students, Fishermen along with local community, enforcement agencies, NGO's and other organizations.
- Under the phase-II of Dugong Scholarship Program 100 more students from Tamil Nadu and 46 students from Andaman Islands, 22 students from Gujarat have been selected as Dugong Ambassadors in 2019.
- Dugong Volunteer Network has increased the feeling of belongingness towards dugong and sea grass conservation.
- With continuous streaming of information on dugong distribution and stranding has helped the field team and forest department to respond swiftly and initiate necessary action on the ground.
- Improved partnerships have also led to a better understanding of the interests and activities of participants in decision making in the endangered species program.



ACKNOWLEDGEMENTS

- CAMPA Authority, Ministry of Environment, Forest and Climate Change, Government of India.
- Director and Dean Wildlife Institute of India, CAMPA-Dugong Team, National CAMPA Advisory Committee, field assistants, community and regional forest divisions.

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Mapping seagrass meadows of the Gulf of Kachchh: Turbidity's well-kept secret

Diksha Dikshit, Sameeha Pathan, Deven Mehta, Sagar Rajpurkar, Himani Saini, Prachi Hatkar, Shivani Patel, Anant Pande, J.A. Johnson and K. Sivakumar



Seagrass meadows of Gulf of Kachchh

- Highly turbid waters of the gulf obscure **Dugong** habitat and foraging grounds, i.e. seagrass meadows.
- Differences in physical characteristics of seagrasses inspire **selective foraging** behaviour in Dugongs.

Objectives

- To map the distribution and composition of seagrass meadows in the south-western Gulf of Kachchh.
- To identify potential Dugong feeding areas in these meadows.

Methods

- Exploratory surveys involving meadow perimeter walking and visual range estimation were done to map the extent of intertidal seagrass meadows.
- Seagrass associated benthic features like, rocks, mud flats, corals, channels, algae, sand etc. were mapped using GPS waypoints.
- Random quadrats were laid to study physical characteristics of seagrasses.

Results

About **119ha** of seagrass beds found in intertidal zones



First records of **Dugong feeding trails** from Bhaidar island (n=>25), Chuana Island (n=>20) and Noru Island (n=8)



Four seagrass species: *Halodule uninervis*, *Halophila ovalis*, *Halophila beccarii*, and *Halophila decipiens*



Range extension of *Halophila decipiens* to the state of Gujarat

Multiple monospecific meadows of the "vulnerable" *Halophila beccarii* found



Conclusions

- Despite the extremely low water clarity (<1.5m in April-June), the surveyed region supports considerably **diverse seagrass beds**.
- New record** of *Halophila decipiens*, which prefers sub-tidal zones, opens new horizons for intensive exploration in these zones.
- Multiple **monospecific meadows** of *Halophila beccarii*, a Red List Vulnerable species, found in the gulf.
- Presence of immense webs of **dugong feeding trails** at Bhaidar, Chuana and Noru highlights the vitality of intense conservation efforts in these regions of GoK.

Acknowledgements

- State Forest Department, Gujarat.
- Field support and boat crew at Okha.
- CAMPA-Dugong team.



Contact Details

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- Email address: dikshadikshit@wii.gov.in, dikshadiksha@gmail.com



Poster presented for WI APIS 2018-19



Dugongs, Seagrasses and Fisheries: Tales of fisherfolk from the Andaman Islands

Swapnali Gole, Sohini Dudhat, Prasad Gaidhani, Anant Pande, J. A. Johnson, K. Sivakumar



About Dugongs!

- Exclusively marine herbivore mammal which feeds only on seagrasses
- >20 individuals in Andaman and Nicobar with hunting by aboriginals and settlers

Seagrasses

- 60 species globally, 12 species in the Andaman and Nicobar Islands
- Only dugong foraging grounds
- Coastal development, boat anchorage are the major threats

Fisheries

- Fisheries contribute to major threats to dugongs in the Islands, through Gill net entanglement, hunting, boat strike and direct intake.

Methods

Semi structured questionnaire surveys in 25 villages around critical dugong habitats (n=64)



Objectives

Identify current fishing ranges



To understand the types of gears used



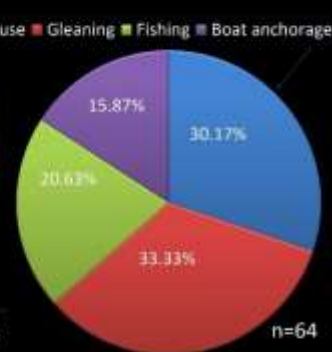
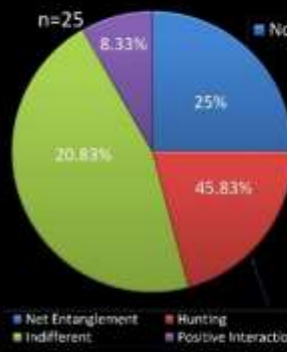
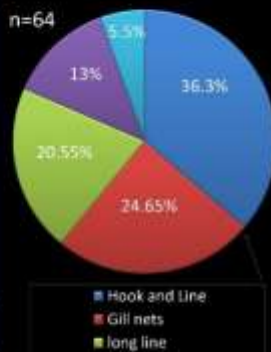
Interaction of fisheries and dugongs



Understand seagrass habitat usage by fisherfolk



Fishing areas overlapping with dugong habitats



Conclusion

- 45.83 % of fishermen (n=25) have hunted dugongs from North and Little Andaman Islands, which demands more attention from state forest department.
- 35.96% of respondents are using seagrass habitats actively for either fishing or gleaning, while 15.87 % are using passively for boat anchorage which is known to affect seagrass habitats.
- Fishing ranges are overlapping with sites frequented by dugongs and 24.65% of gill net use, which is a major mortality reason for dugongs is a matter of concern.
- All these demarcated regions needs major community workshops with fisherfolk, where our outreach activities will be focused in future.

Acknowledgements

- Director, Dean and Research Coordinator, Wildlife Institute of India, Dehradun
- Funding agency: Compensatory Afforestation Fund Management and Planning Authority (CAMPA), Ministry of Environment, Forest and Climate Change, New Delhi, India
- CAMPA_Dugong team
- Andaman and Nicobar Forest department
- Fisherfolk of the Islands

Contact details: swapnali@wii.gov.in



भारतीय वन्यजीव संस्थान
Wildlife Institute of India



Community's Role in Dugong Conservation Insights from Tamil Nadu



Rukmini Shekar, Madhu Magesh, Herlin, Rosmi, Caroline Christina,
Anant Pande, J A Johnson, K Sivakumar



Introduction

- Dugongs are herbivorous marine mammals that are threatened by seagrass habitat fragmentation, deterioration and anthropogenic activities such as fishing.
- Seagrasses experience high fishing pressure owing to their abundance, vastness and high importance to commercial fisheries
- Dugong mortalities are caused by smaller mesh sized nets and collisions mechanized boats



Given the importance of Dugongs and Seagrasses, and the threats faced from the coastal communities, there is a need for the community to involve in conserving Dugongs and their habitats- Seagrasses



Objectives

- To create awareness among the fisherfolk about Dugong conservation and their role in it.
- To strengthen the capacity of local stakeholders to monitor status and face emergency situations under the purview of Dugong conservation.



Study Area



- From Adhirampattinam, Palk Bay to Tuticorin, Gulf of Mannar, Tamil Nadu
- Covers nearly 400km of coastline and covering about 4000km² area.
- Includes a major part of the Gulf of Mannar Marine Biosphere Reserve's Eco-development zone.



Methods

- Community meetings and talks to reach out to the fisher community
- SCUBA training and Biodiversity monitoring assessment training as part of Capacity building for stakeholders
- Rallies and Beach clean-ups to involve the community and trained staff



Dugong Scholarship Examination



Awareness Programme



Capacity Building: Biodiversity Monitoring Training with SCUBA Diving

Results:

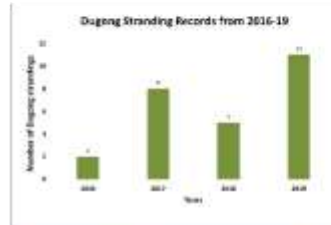
Outreach and Awareness Activities



Community Involvement



'FRIENDS OF DUGONG'



Dugong Stranding



Underwater Clean-up with trained staff



Dugong Ambassadors at work

Dugong Volunteer Network **Till 2018: >1000 members** **Now, >1700 members**

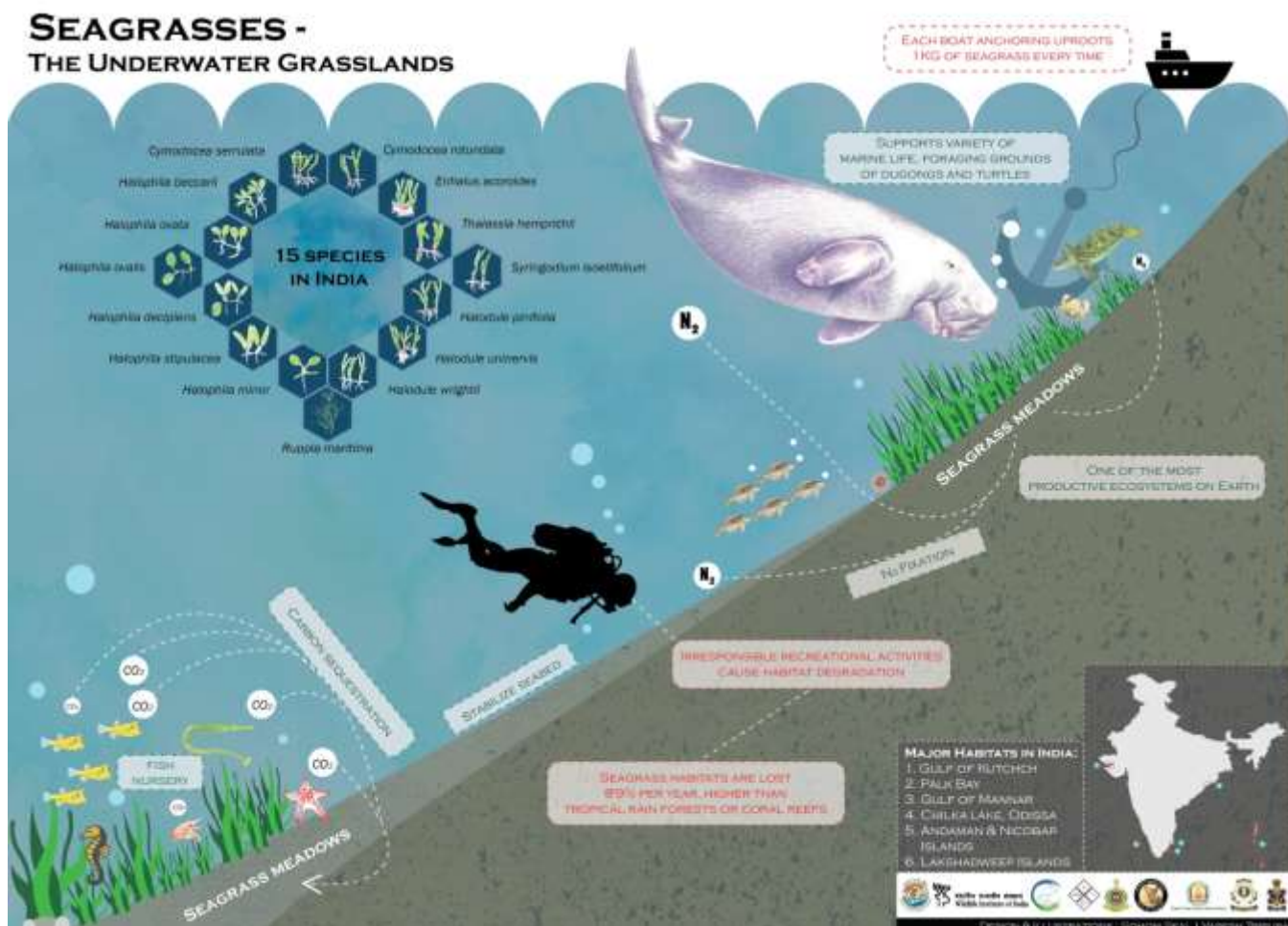
Acknowledgement

We aim to reach many more...

For more information, contact:
Rukmini Shekar, Wildlife Institute of India
Tamil Nadu Forest Department
Tamil Nadu Forest Department
Tamil Nadu Forest Department

- Wildlife Institute of India, India
- Tamil Nadu Forest Department, India
- OMCAR Foundation, India
- Coastal Security Group, India
- Forest Department, India
- Coastal Security Group, India
- Many more...

5.7 Outreach Materials



KNOW YOUR DUGONG!

Who are we?

YOU CAN FIND US HERE!

IN INDIA, YOU CAN FIND US AT

- GULF OF KATCHEH
- GULF OF MANNAR
- PALK BAY
- ANDAMAN AND NICOBAR ISLANDS

WE CAN NOT TOLERATE FRESHWATER.

THIS IS OUR HOME! THE OCEAN!

WE HAVE A MUCH PROMINENT FORKED TAIL

UNLIKE MANATEES WHO HAVE SIMPLE PADDLE LIKE TAIL!

OUR MOUTH IS TURNED DOWN

WE CAN REMAIN UNDER WATER FOR 3 TO 8 MINUTES

OUR AVERAGE WEIGHT RANGES BETWEEN 250 TO 400 KG!

WE CAN EAT UP TO 40 KG OF SEAGRASS IN A DAY!

WE ARE HERBIVOROUS MARINE MAMMALS

WE CAN GROW UP TO 2.5 TO 3.2 METERS IN LENGTH!

WE REACH SEXUAL MATURITY AT 8 TO 10 YEARS OF AGE.

DUGONG CALF STAYS WITH ITS MOTHER FOR 1 TO 2 YEARS.

WE CAN LIVE FOR 70 YEARS, WHICH IS VERY SIMILAR TO HUMANS!

Being Dugong!

Threats

- NET ENTANGLEMENT**
- BOAT STRIKES**
- HUNTING**
- PROPELLER HITS**
- POLLUTION AND MARINE DEBRIS**

Legal Protection: Along with our national animal, Tiger, we dugongs are also categorized as a Schedule I species according to Wildlife (Protection) Act, 1972 and are included in Appendix I of CITES.

ICCN has classified us as a "Vulnerable" species.

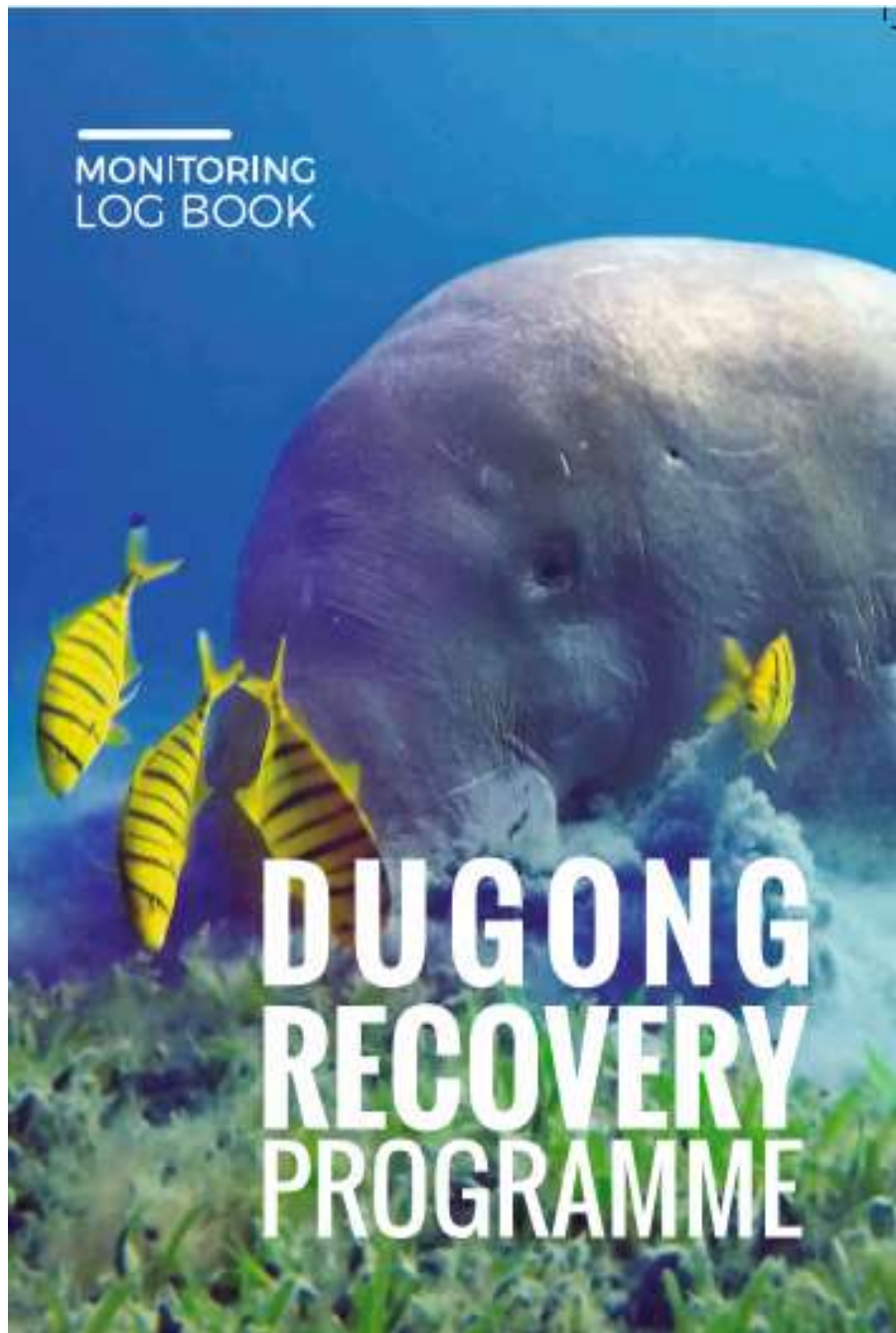
Save the gardeners

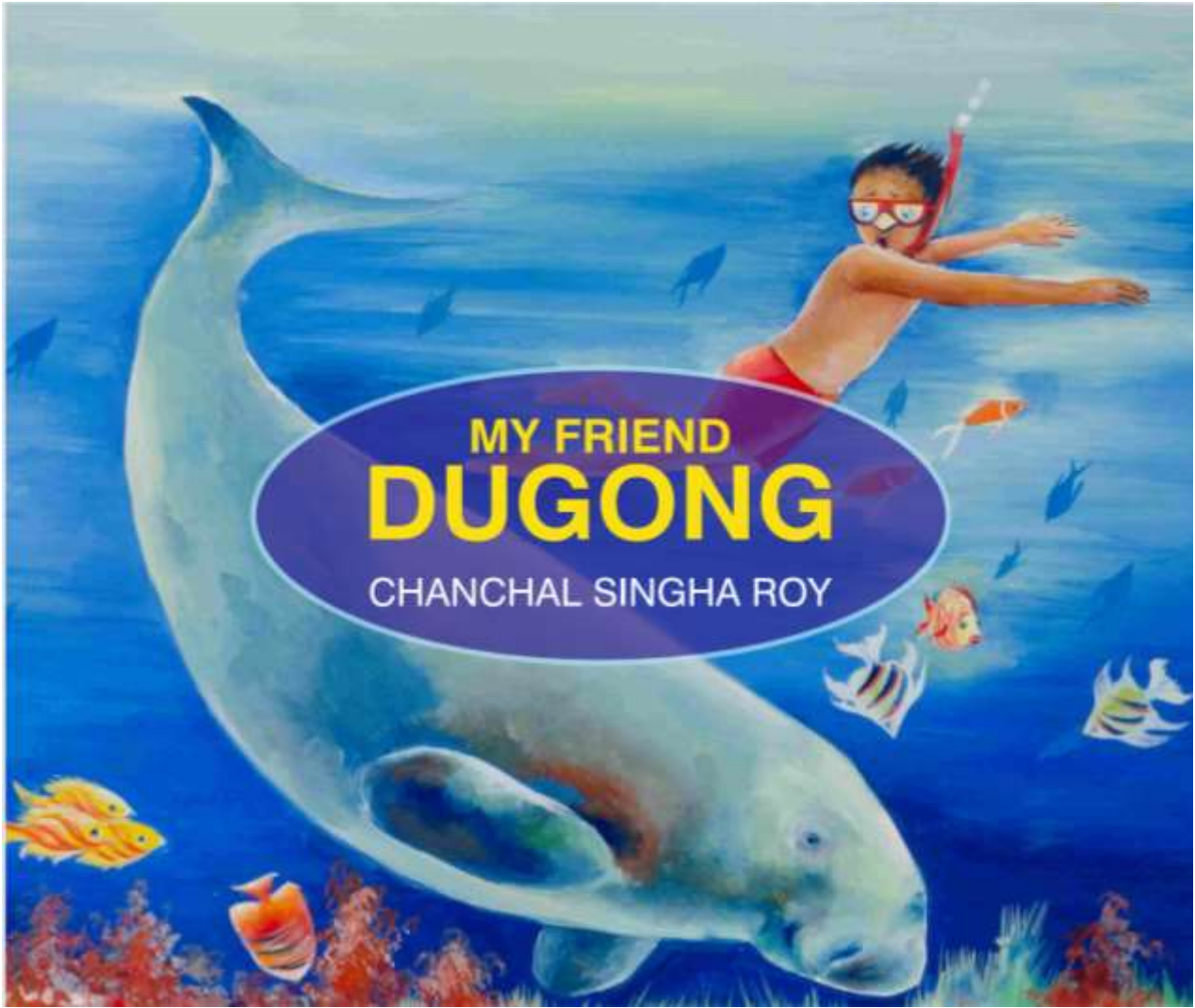
CAMPA Dugong Recovery Programme

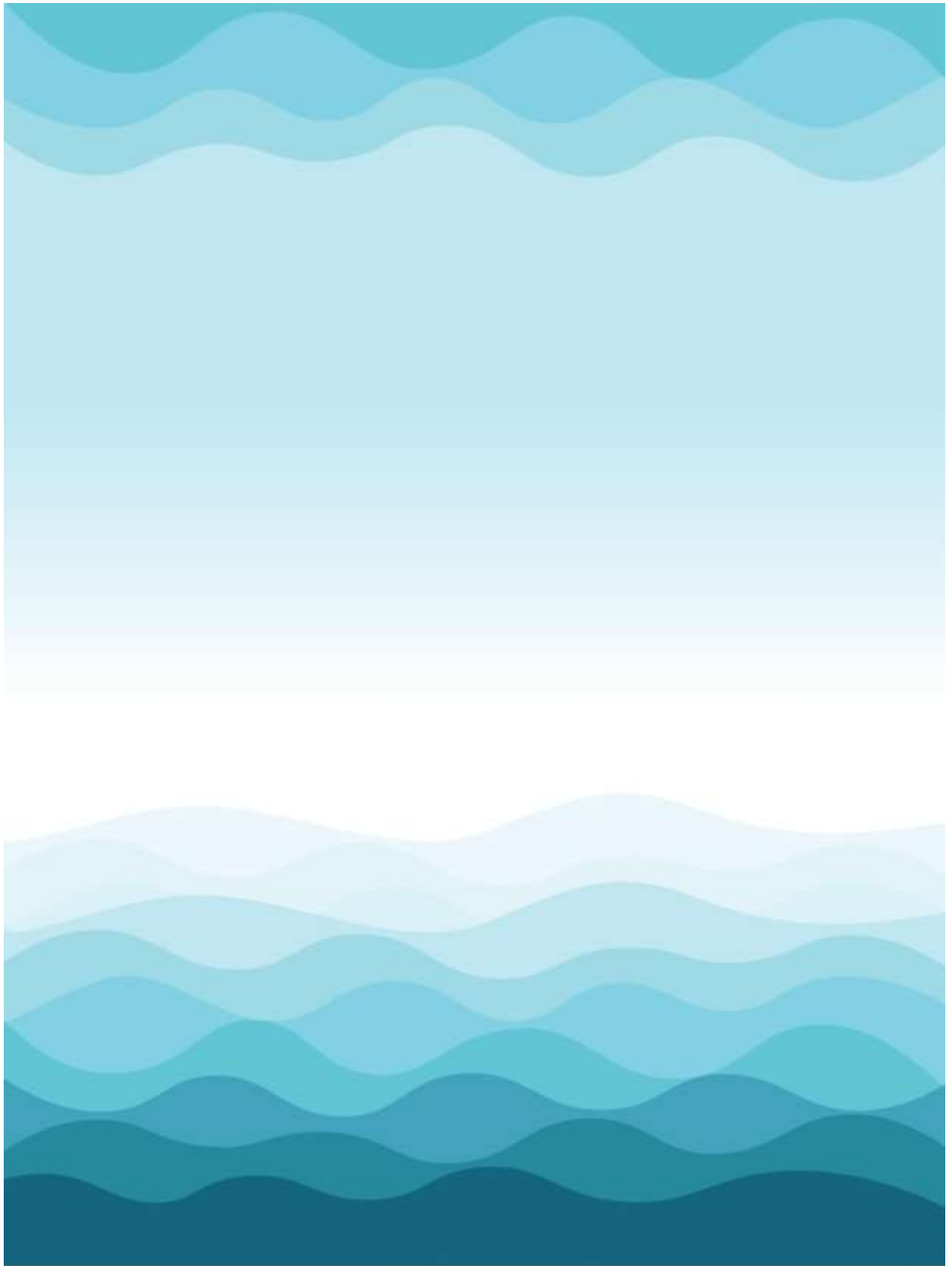




Dugong Monitoring Log Book







Ministry of Environment
Forest & Climate Change



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

