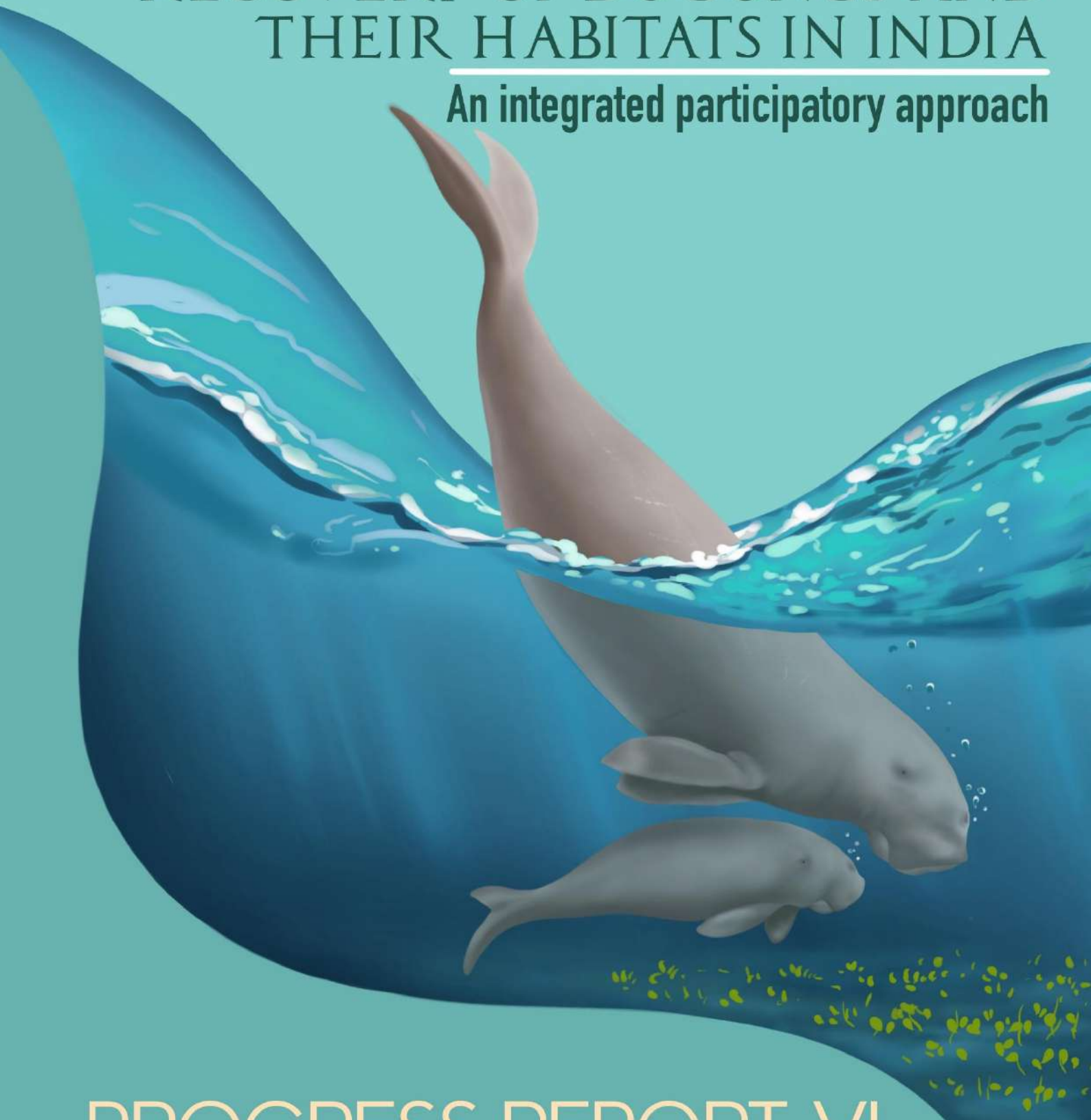
RECOVERY OF DUGONGS AND THEIR HABITATS IN INDIA

An integrated participatory approach



PROGRESS REPORT-VI
2021-23

Recovery of Dugongs and their habitats in India: An integrated participatory approach	
Project Duration:	9 years (2016 – 2025)
Total Budget:	23.58 crore INR
Year 1 release:	5.17 crore INR
Year 2 release:	2.4054 crore INR
Year 3 release:	1.636 crore INR
Year 4 release:	3.88,44 crore INR
Funding agency:	National Compensatory Afforestation Fund Management and Planning Advisory Council, Ministry of Environment, Forest and Climate Change, Government of India
Implementing agencies:	Tamil Nadu Forest Department (TNFD) Department of Environment & Forest, Andaman & Nicobar(ANFD) Gujarat Forest Department (GFD)
National Partners:	Zoological Survey of India (ZSI), National Centre for Sustainable Coastal Management (NCSCM), Central Marine Fisheries Research Institute (CMFRI), Kochi, Bombay Natural History Society, Mumbai University of Petroleum and Energy Studies, Dehradun, Indian Coast Guards (ICGS) Indian Navy
Regional Partners:	State Fisheries Department, Centre for Environment Education (CEE), OMCAR Foundation, Suganthi Devadasan Marine Research Institute (SDMRI), Jehovah Shamma Centre for Marine and Wildlife Research Marine Police (Coastal Security Group) Fisheries

	Department, Andaman Nicobar Environment Team (ANET)
International Partner:	Memorandum of Understanding on the Conservation and Management of Dugongs and their Habitats (Dugong MoU) Signatories

Team:

Dr. J.A. Johnson, Scientist-F (Principal Investigator)
Dr. Nehru Prabakaran, Scientist-C (Co-investigator)
Dr. K. Sivakumar, Prof. Pudducherry University (Co-investigator)
Dr. Oishinee Chakraborty, Project Scientist-I
Ms. Swapnali Gole, Project Fellow
Ms. Sameeha Pathan, Project Fellow
Ms. Chinmaya Ghanekar, DST- Inspire Fellow
Mr. Sohom Seal, UGC Fellow
Ms. Shivani Patel, Project Fellow
Ms. Prachi Hatkar Project Fellow
Mr. Sagar Rajpurkar, Project Fellow
Ms. Sweta Iyer, Project Fellow
Ms. Srabani Bose, Project Associate
Mr. Sumit Prajapati, Project Assistant
Mr. Vabesh Tripura, Project Assistant
Mr. Gem Christian, Project Assistant
Ms. Richa Joshi, Project Assistant
Ms. Garima Dhiman, Project Assistant
Ms. Soni Negi, Project Assistant

Citation: Johnson J.A., Prabakaran N., Sivakumar K., Chakraborty O., Gole S., Pathan S., Ghanekar C., Rajpurkar S., Hatkar P., Seal S., Patel S., Iyer S., Prajapati S., Bose S., Tripura V., Christian, G., Joshi, R., Dhiman G. and Negi, S. (2023). Annual Progress Report VI (2021-23), CAMPA-Recovery of dugongs and their habitats in India: An integrated participatory approach, Wildlife Institute of India, (Ministry of Environment, Forest & Climate Change), Dehradun, pp. 234.

ACKNOWLEDGMENT

National Compensatory Afforestation Fund Management and Planning Advisory Council, Ministry of Environment, Forest and Climate Change, Government of India

Tamil Nadu Forest Department (TNFD); Smt. Supriya Sahu, IAS., Additional Chief Secretary to Government of Tamil Nadu, Thiru. Subrat Mohapatra, I.F.S, Principal Chief Conservator of Forests HoFF, Tamil Nadu Forest Department, Dr. Sudhanshu Gupta, I.F.S., Principal Chief Conservator of Forests, CAMPA, Tamil Nadu Forest Department, Thiru. Srinivas R. Reddy, I.F.S., Principal Chief Conservator of Forests and Chief Wildlife Warden, Tamil Nadu Forest Department), Dr. Shekhar Kumar Niraj, I.F.S., Principal Chief Conservator of Forests Secretary (TNBB), Thiru. Jadgish Bakan, IFS, Wildlife Warden, Gulf of Mannar Marine National Park, Ramanathapuram and all the District Forest Officers as well as Range Forest Officers*.

Department of Environment & Forest, Andaman & Nicobar(ANFD); Sh. T. S. Ashok Kumar, PCCF-ANI, Sh. Kamal Dutta, PCCF, Wildlife Division, Sh. Senthil Kumar, APCCF, Wildlife, Sh. Sanjay Varadkar, CCF, Wildlife, Sh. Kuldeep Sharma, CF, Wildlife, Smt. Deepshikha Sharma, DCF, Wildlife-South Andaman, District Forest Officers, Assistant Conservator of Forest, Deputy Range Officer, Range Forest Officers, Forest Rangers, Foresters and Forest Guards*.

Gujarat Forest Department (GFD); Dr. Sudhirkumar Jagdishnarayan Chaturvedi, IFS; PCCF & Head of Forest Force, Gujarat State, Shri S. K. Chaturvedi, IFS; PCCF & Hoff, Shri R. Senthil Kumaran, IFS; DCF,MNP, Jamnagar, Gujarat Forest Department and all Range Forest Officers*.

Tamil Nadu Administration; Thiru. Johny Varghese, Collector, Ramanthapuram District, Tamil Nadu

Fisheries Department; Thiru. Elamvazhuthy, District Director of Fisheries, Tamil Nadu Fisheries Department, Ramanathapuram District, Smt. Gangeswari, Inspector of Fisheries, Mallipattinam, Thanjavur

*See Annexure I

Indian Coast Guards (ICGS); Commandant Shah Nawaz, Mandapam Station, Indian Coast Guard, Anilkumar Yadav, Executive officer, ICGS, Okha, DHQ-9 Diglipur, DHQ-10, Campbell Bay

Indian Navy; INS Kohassa and INS Kardip

Coastal Security Group, Tamil Nadu; Smt. Muthu Kannu, Inspector of Police, Coastal Security Group, Pattukottai, Thanjavur, Thiru. Rajkumar, Sub-Inspector of Police, Coastal Security Group, Pattukottai, Thanjavur

Andaman and Nicobar Police Department

NGOs and other organizations; Dr. V. Balaji, Director, OMCAR Foundation, Velivayal, Thanjavur District, Dr. C. Stella, Head of the Department, Department of Oceanography and Coastal Area Studies, Alagappa University, Karaikudi, Quest Adventure Sports academy, Pirappanvalasai, Ramanathapuram district, The Ocean Ambassadors Foundation, Pirappanvalasai, Ramanathapuram district, Ashok Kumar, Chief Technical Officer; Indian Institute of Soil and Water Conservation, Dehradun, Ms. Sasmita Swain Ph.D. scholar, CAS in Marine Biology, Annamalai University, Tamil Nadu, Charan Kumar Paidi, Assistant Manager & Project Lead – Whale Shark Conservation Project, Wildlife Trust of India, Dr. Kauresh Vachharajani, Marine Biodiversity and Ecology Lab, Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda, Gujarat, Dr. Vibha Ubhare, Coastal Aquaculture Authority, Chennai

We sincerely thank the fishing community, scuba diver community and life guards from all the respective project sites for their support.

Also, we thank all the Field Assistants and Volunteers* who supported the project.

*See Annexure I

CONTENTS

EXECUTIVE SUMMARY

Dugong (*Dugong dugon*), commonly known as sea cow, is found to occur in three states/Union Territories of India *viz*., Andaman & Nicobar Islands, Tamil Nadu (Gulf of Mannar, Palk Bay), and Gujarat (Gulf of Kutch). Being primarily herbivorous, these marine mammals depend on underwater seagrass habitats for foraging and require large areas to breed along the nearshore waters of these sites. Dugongs are assessed as vulnerable to extinction in the IUCN red list and are 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). Their population along the Indian coast has declined considerably, mostly due to human-mediated threats such as fishnet entanglement, hunting for meat, seagrass habitat loss, and degradation, coastal pollution apart from natural threats such as climate change.

With substantial funding from the National CAMPA Authority under the aegis of Endangered Species Recovery Program, Dugong Recovery Program was initiated with major objectives to a) Assess dugong population status through advanced census techniques and determine its abundance and distribution, identify critical habitats, classify threats and develop a 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. In the last five years of its implementation, an integrated participatory approach was adopted to ensure recovery of dugong populations and conservation of seagrass habitat in India. Some key achievements of this program have been listed below:

1. **Habitat assessment of critical dugong habitats:** The habitat assessment of dugong habitats was carried out at each site, viz., Gujarat, Tamil Nadu and Andaman and Nicobar Islands. The seasonal variations in shoot density of *Halodule uninervis*, *Halophila ovalis* complex and *H. beccarii* to light intensity and temperature were carried out Paga reef, Bhaidar reef and Tam reef, Gujarat. Clear pattern in seagrass abundance variations was observed at all three sites where

Halodule sp. meadows were observed to be seasonally persistent than the *Halophila* sp. meadows. Also, surveys conducted at the South West of Gulf of Kutch charted more than ten reef-top meadows, four vast mid-intertidal meadows and more than five subtidal meadows in the region. Further, seagrass exploratory surveys were extended till the Mithapur reef where new seagrass meadows were discovered. A new regional record of *Halophila decipiens* meadow was also made from Gujarat. To ascertain the seagrass distribution, species composition and percentage cover in the Dugong conservation reserve at Tamil Nadu, surveys were conducted in the region. The seagrass genera recorded from the region were *Halophila*, *Cymodocea*, *Syringodium* and *Halodule*, all of which form a part of the dugong diet. Also, the region has a seagrass cover of >60% in 64 points with seagrass substrate being majorly sand in the offshore areas and mud in the nearshore areas. In Andaman and Nicobar Islands, intensive seagrass exploratory surveys were conducted (intertidal and subtidal) to record the occurrence of seagrasses in the region. Surveys reported the occurrence of 11 species, *viz*., *Enhalus acoroides, Halophila ovalis, Halophila beccarii, Halophila decipiens, Halophila minor, Halodule pinifolia, Halodule uninervis, Syringodium isoetifolium, Cymodocea serrulata, Cymodocea rotundata,* and *Thalassia hemprichii*, from the survey sites. About 70% of the seagrass observed from the intertidal region (0.4 to ~5 m) were mixed species meadows while the remaining were mono-species. The highest seagrass cover percentage was observed at Safed Balu, Trinket (94.5 %), and the least cover was recorded from *Halophila ovalis* and *Halophila decipiens* dominated meadows at Pilpilow, Kamorta (3.6%). Highest shoot densities were recorded from Ship wreck, Little Andaman (4686.7 ± 1290.47 shoots/ m^2) and while highest biomass was contributed by mixed-species meadow at Kardip, Kamorta respectively (3180 gm/ m^2). Of the 26 seagrass meadows investigated, 9 are newly reported from Andaman and Nicobar Islands.

2. **Geospatial analysis of seagrass meadows:** Seagrass mapping surveys were conducted at Gulf of Mannar, Palk Bay and South Andaman. Preliminary analysis of data estimated an expected seagrass cover of 620 km^2 in Tamil Nadu, *i.e*., 310 km^2 in South Palk Bay and 307 km^2 in Gulf of Mannar. Further, it was observed that though Gulf of Mannar has clearer waters, the estimated seagrass cover was lower as compared to Palk Bay. The output maps of seagrass distribution reports South

Andaman and Gulf of Mannar show lesser seagrass cover in comparison to Palk Bay.

2. **Ecological surveys for seagrass-associated benthic macrofauna:** Investigation of seagrass associated benthic faunal assemblages were made at all three sites, *viz.*, Gujarat, Tamil Nadu, and Andaman and Nicobar Islands. A total of 17 groups, *viz.*, Gastropods, Pelecypod, Crustaceans such as Tanaidceans, Cumaceans, Amphipods, Isopods, Polychaetes, Holothuroidea, Ophiuroidea, Scaphopoda, Polyplacophora and Marine insects were recorded form the Paga reef, Taam reef, Chepri reef, Chusna pir Island and Mithapur, Gujarat. In Palk Bay, Tamil Nadu, macrobenthic analysis showed the presence of higher group diversity at seagrass vegetated areas as compared to non-vegetated regions. Furthermore, the group diversity was high in mono specific seagrass beds as compared to mixed species beds. In Andaman and Nicobar Islands, the microbenthic group diversity was recorded to be highest in Little Andaman and the total biomass higher in North and Middle Andaman.
3. **Ecological surveys for seagrass-associated fish species:** Seagrasses act as refuge, foraging areas and nurseries for numerous animals, the most notable amongst these are the fish. The families that preferred the seagrass meadows for Surveys were conducted at Gujarat to assess the fish assemblages of the seagrass meadows. These studies showed the occurrence of 28 species and 7 economically important families, *viz*., Carangidae, Leiognathidae, Lethrinidae, Lutjanidae, Malacanthidae, Nemipteridae, and Serranidae. The surveys at Tamil Nadu for seagrass associated fish in the Dugong Conservation Reserve (DCR) showed the occurrence of 22 species belonging to 18 families, *viz.*, Ariidae, Tetraodontidae, Carangidae, Dasyatidae, Hemiscylliidae, Batrachoididae, Cynoglossidae, Gerreidae, Lethrinidae, Mullidae, Pegasidae, Terapontidae, Leiognathidae, Latidae, Dorosomatidae, Syngnathidae, Triacanthidae and Soleidae.
4. **Threat mapping of seagrass meadows in the Dugong Conservation Reserve:** In the Dugong Conservation Reserve at Tamil Nadu, two types of threats were recorded, *viz.*, fishing activity and floating litter. It was observed that there were greater number of small boats than trawlers operating in the region. Further, an assessment of the various types of litter in the DCR reported the highest percentage contribution by Styrofoam.

5. **Aerial surveys for dugong population monitoring:** Aerial surveys for dugong population estimation were carried out at all three sites; Gujarat, Tamil Nadu and Andaman and Nicobar Islands. These surveys yielded interesting results which includes the first photographic evidence of dugongs from Gujarat. During the aerial surveys in the North West region of Gulf of Kutch, *i.e.*, Chusna Peer, Khara-Mitha Chusna, Chepri and Bhyder Islands, two dugongs were detected. The aerial surveys conducted at Tamil Nadu for understanding the dugong distribution in the Dugong Conservation Reserve (DCR), North Palk Bay yielded the sightings of dugong herd and a mother-calf pair. Thus, emphasising the DCR as a vital breeding habitat for the species. Dugongs were detected at Andaman and Nicobar Islands from North Andaman, South Andaman and in Ritchie's archipelago during the aerial surveys.
6. **Citizen science approach for understanding dugong distribution in Andaman and Nicobar Islands:** A citizen science-based approach was initiated in 2017 targeting the sea-faring community of the Islands called 'Dugong Monitoring Program'. A total of 203 dugong sightings were received from 771 personnel of fishers, defence bodies (Indian Navy and Indian Coast Guard), Forest Department and the Tribal Protection Police.
7. **Nutrients in sediments and seagrasses:** Seagrass meadows have a considerable impact on the chemical, physical and biological environments. Further, these ecosystems are function as nutrient pumps providing essential nutrients in the marine environment. Surveys were conducted to estimate the nutrient content in the seagrass beds at all three sites. In Palk Bay, Tamil Nadu, the higher quantities of organic carbon were found in mono-species specific seagrass meadows but no difference were observed in terms of presence and absence of seagrasses. Also, higher concentration of sodium and potassium was found in unvegetated areas as compared to vegetated regions. In Andaman and Nicobar Islands, sodium, organic carbon and nitrogen content was higher in South Andaman as compared to North and Middle Andaman. Also, the potassium content was higher at North and Middle Andaman in comparison to South Andaman.
8. **Mass boat survey:** Boat surveys were carried out at Gujarat, in collaboration with the Gujarat Forest Department, for Dolphin Census in Gulf of Kutch. The Gujarat team were invited as technical experts for the 3-day survey conduct by the Gujarat Forest Department. A total of 25 Indo-Ocean humpback dolphins and 8-10 Green

Sea turtles were observed foraging near the Bet Dwarka, Paga, Samiyani, Mithapur, and Arambada reefs.

9. **Dugong scholarship program:** The Dugong Scholarship program was initiated to provide financial support to the students from fishing backgrounds. Thereby encouraging the participation of the fishing community towards Dugong conservation. These students are given Rs. 500 per month towards their education and are identified as Dugong Ambassadors. Since the inception of the program, in 2017, 398 students at Gujarat, 447 students at Tamil Nadu and 80 students at Andaman and Nicobar Islands have been awarded this scholarship.
10. **Outreach and awareness programs:** At Gujarat, a total of 23 outreach and awareness events were organised, of which 2 were meetings with the Forest Department. Various stakeholders were targeted to enlighten the people regarding the species, its importance and the major project objectives. School and college students, teachers, forest department, marine police, fishermen and locals were encouraged to partake in different awareness activities. Around 1700 people were sensitised through our outreach activities. At Tamil Nadu, over 5000 people were sensitised through 4 awareness events. The highest percentage of stakeholder targeted were school students (51.7%), followed by locals (28.2 %), fishermen (7.2 %) and college students (5.8%). Other stakeholders during the outreach events were Forest officials, Indian Coast Guard, IFS/IAS officers, veterinarians and the local diving community. At Andaman and Nicobar Islands, 6 outreach and awareness events were organised including stakeholders such as school students, fishermen and local communities.
11. **Capacity building programs:** An integral part of dugong conservation is the need to alter community perspectives regarding the animal to better address the conservation needs. Various approaches, from stakeholder consultations, orientation workshops, oral presentations, community workshops, hands-on training, field visits, etc, were utilized to sensitize and train the stakeholders in dugong conservation and seagrass habitat monitoring. A total of 9 capacity building events were conducted at Tamil Nadu providing training to 250 people in underwater marine biodiversity monitoring, drone operations and trainings on alternate livelihood. In Andaman and Nicobar Islands, 11 capacity building events were conducted targeting stakeholders such as the Indian Coast Guard, Indian Navy, Forest Department, Range Officers, Indian Forest Service Officers, Police

officers and fishermen in marine mammal stranding response, dugong as well as seagrass awareness and monitoring.

12. **Dugong Day celebrations:** Dugong Day celebrations were conducted on 28th May 2022 to spread awareness regarding the importance and the status of the species in the country. A month-long social media campaign was organised to commemorate Dugong Day from 27th April 2022 to 28th May 2022. Various social media platforms were utilised such as the WII website, Facebook, Twitter, and Instagram. Updates and posts were made daily regarding the project, its achievements and infographics on Dugongs. On the occasion of World Dugong Day on 28th May 2022, Wildlife Institute of Indian organized a Dugong and seagrass ecosystem meme contest where 40 people registered. Furthermore, as part of the Dugong Day celebrations, various events were organised at all three sites. In Okha, Gujarat, an awareness rally and sand art competition were conducted. In Thondi, Tamil Nadu, the team organised an awareness campaign in the presence of Mr. Jagdish Sudhakar Bakan, WLW and DFO, Ramanathapuram and Dr. E. Kathavarayan, DD, Fisheries, Ramanathapuram during which the dugong app was released. Further, a village meeting at Somanathanpattinam, Tamil Nadu was arranged was arranged in joint efforts with the Forest Department and OMCAR Foundation. At Andaman and Nicobar Islands, an awareness program was conducted for the fishermen of Great Nicobar Island where they were sensitised to the importance of dugongs and their importance in the maintenance of seagrass meadows.
13. **Rescue and release of dugongs:** The project proposes to incentivise the rescue and release of dugongs thereby promoting the participatory approach for dugong conservation in the local community. In regards to this, in Tamil Nadu, 35 fishermen were felicitated by the Honourable Minister of Forests of Tamil Nadu, OMCAR Foundation and Wildlife Institute of India with Rs. 10,000, a medal, a certificate and dugong rescue kit. Further, the Forest Department of Tamil Nadu provided Rs. 25,000 as compensation for net damages and Rs. 5000 to each fisher. The forest department should adopt incentivization schemes for the fishers to promote the rescue and release of dugongs in the Islands.
14. **Marine mammal stranding response:** In Gujarat, carcasses of one Green Sea turtle, one common dolphin and one dwarf pygmy sperm whale were found during the survey season. To address the issue of marine mammal stranding and review

the subsequent response of stranding records especially for Dugong, a presentation was given in the National Conference on Environment and Biodiversity (NCEB-2022) held on 27th and 28th January 2023 at Chennai. In Tamil Nadu, a total of 26 dugongs, two porpoise, one Kogia and 5 dolphins were recorded from the Ramanathapuram, Pudukkottai, Kanyakumari, Thanjavur and Tuticorin districts. Furthermore, the first "***Marine Mammal Stranding Response Workshop***" was conducted at Tamil Nadu for forest officers and veterinarians which included hands-on training for stranding response for both live and dead marine mammals. The event was organised by the Wildlife Institute of India in collaboration with the Ministry of Environment, Forest and Climate Change, Government of India, Central Zoo Authority, ICAR CMFRI, and the Forest Department Rameswaram, Tamil Nadu, on 17th to 19th October 2022. The workshop was an attempt to help strand networks and the forest department aid in quick response to both alive as well as dead marine mammal strandings, sample collection, and necropsy protocols.

15. **Marine mammal stranding response manual:** A Manual on Marine Mammal Stranding Response has been published detailing the handling protocols for stranded marine mammals.
16. **Management recommendations:** At Gulf of Kutch, seagrass meadows have a high turnover rate, however detrimental activities such as trawling and illegal docking are threats to these meadows. Thus, we recommend increased threat monitoring efforts in the southeastern zone and 'seagrass-priority' areas like North Beyt-Dwarka. Further, we recommend that measure be taken to forestall illegal docking of trawlers that cause sediment resuspension and uprooting of seagrasses. Such docking has also been heavily criticized by the native community which depends on seagrass meadows for small-scale crab fishing. Further, it has been observed that some areas falling under the Marine National Park, *viz.*, Paga reef, and Bhaidar Island, experience infiltrating activities such as illegal poison fishing and beach seining. Though these activities may be minimal in number, they have the potential to leave a long-lasting effect on corals and seagrass meadows. We recommend increased monitoring of these areas. Dugong sightings and monitoring efforts need to be increased in 'Critical Dugong habitats' like Chepri and Taam reefs through drone and boat-based surveys.

Field observations in the Dugong Conservation reserve (DCR) area indicate the existence of threats to dugongs and seagrasses which need to be controlled through continuous patrolling and tighter enforcement of existing rules and regulations. A key factor for conservation management in the DCR is continuous monitoring through approaches such as aerial surveys and seagrass assessment. Since the dugong mortality is prominent in the reserve through human induced threats such as nets, boat traffic and pollution, there needs to be strict regulation of these activities in the region. Further, a rapid response team needs to be set up to handle marine mammal stranding events in DCR as well as adjoining areas. We further recommend that alternative livelihood opportunities for fishermen should be introduced in order to lessen local communities' dependency on the DCR through fishing. The DCR's tourism potential can be translated into a sustainable tourism strategy that involves local people thereby providing them with alternative livelihood options in sectors such as hotels, water sports, transportation, and so forth.

In Andaman and Nicobar Islands, herd and calf sightings indicate that two regions; the south-western coast of South Andaman and Ritchie’s archipelago, are critical for dugong calving mothers. Since these regions could be potentially used for calf protection due to the availability of seagrasses and sheltered provided by the region, it is recommended that enhanced patrolling should be conducted by the patrolling agencies like the forest department, around Shaheed Dweep and Swaraj Dweep in the Ritchie’s archipelago. Further, these regions are tourist hotspots and are exposed to high load of coastal habitat alteration (infrastructure development) and boat traffic (inter-island shipping lanes, high-speed boats, water jet skis). It is recommended to consider these regions as a priority for conservation efforts. A key aspect in Dugong conservation is the engagement of the local community as they are directly engaged in activities that affect the dugong population and habitat. These include accidental net entanglement, direct consumption by locals (illegal), and boat hits. It is recommended that the community is engaged through workshops (especially in areas with high interactions), outreach events and incentivised approaches. The Forest Department should adopt incentivization schemes for the fishers to promote the rescue and release of dugongs in the Islands.

17. **Future plan of action:** Drone surveys will be conducted at all the sites to determine the dugong population at all sites. Further, personnel to be trained in drones to contribute to capacity building at all the three sites. Marine Mammal Rescue and Rehabilitation Facility to be established at Gujarat and Tamil Nadu. After the drone surveys get underway, there are plans for acoustic surveys so that they will be closely monitored. The frontline staff of the Forest Departments need to be trained in conducting seasonal seagrass monitoring surveys and marine mammal monitoring surveys. We plan to organize such training in the upcoming season for state forest department personnel and other key stakeholders. Further, continued expansion of the Dugong Ambassadors network and 'Friends of Dugongs' to be made. This would ensure the continued engagement of sea faring communities such as the fishers, Indian Navy, Indian Coast Guard, Marine Police, Forest Department, locals and the diving community in the efforts towards dugong conservation.

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 the Nicobar Islands for their active support 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. for their constant support to the program.

1. Gulf of Kutch, Gujarat
Annual field report 2021-23

1.1. RESEARCH AND MONITORING

1.1.1. Dugong population estimation

1.1.1.1. Aerial Survey Report of Gulf of Kutch, Gujarat

Unmanned Aerial Vehicles (UAVs) are widely undertaken in the study of marine mammals globally, as they cover larger spatial scales in a shorter duration and significantly reduce the survey effort. They are also known to cause less disturbance to the wildlife and are a cheaper alternative thus they are widely used. UAV surveys serve as an extremely useful tool for marine mammal distribution and population studies, especially for species thriving in shallow coastal waters like dugongs. Dugongs being marine herbivores spend most of the seagrasses in coastal waters and surface every 5-6 minutes, making their detectability using drones much easier, as compared to oceanic marine mammals which dive for longer intervals in deep seas.

Manned aerial surveys using aircrafts have been widely used throughout dugong distribution ranges, to estimate populations (Marsh and Sinclair 1989a, b, Marsh 1995, Miller *et al*. 1998) or understand distribution trends and habitat use patterns (Anderson 1985). Unmanned aerial surveys using drones have been effective like manned aerial surveys and are excellent tools for monitoring rare and elusive marine species. Unmanned Aerial Vehicles have been used to study dugongs (Hodgson *et al*. 2013), manatees (Landeo Yauri *et al*. 2020) and dolphins (Fettermann *et al*. 2019). But a similar approach is lacking in Indian waters, due to cost associated with such surveys and logistics. Further, unlike their Australian counterparts, dugongs in Indian waters exhibit fragmented populations, distributed in pockets, with no detection-based population estimates given till date. In such scenarios, where boat-based detection of dugongs is rare due to low population, drones can prove to be extremely useful in filling major research gaps in dugong research. The surveys were conducted to attempt an assessment of dugong population. The study was carried out in the North West region of Gulf of Kutch, in and around the Marine National Park. The study sites; Chusna Peer, Khara-Mitha Chusna, Chepri and Bhaidar Islands, were surveyed during the study period.

Methodology: Aerial surveys were undertaken using the DJI Mavic 2 Pro UAV manufactured by SZ DJI Technology, which is a micro quadcopter with 4 rotors weighing 907g. The flights were planned systematically, with survey locations chosen

at a distance of about 2 km from each other. From every survey location, 2 flights were undertaken, with a transect length of 3 kms spaced 300 meters apart. The flights were planned using the Litchi Hub application. Fixed width transect sampling was undertaken according to the standard methodology suggested by Raoult *et al*. 2020 for studying sirenians. The altitude of the flight was kept constant at 100 meters with a speed of 35 km/hr. The width of the survey strip was 75 meters. Continuous video was recorded during each flight and the videos were then saved in external hard drives for further analysis.

Findings: In the total 8 transects of 3 km, no dugongs were detected during the systematic sampling efforts. But a pair of dugongs were detected during scan sampling. This was the first photographic record of dugongs from Gulf of Kutch, Gujarat.

Figure 1. First photographic evidence of Dugongs from Gulf of Kutch, Gujarat

1.1.2. Seagrass survey

1.1.2.1. Seagrass phenology studies

We studied seasonal variations in shoot density of seagrass species, *viz.*, *Halodule uninervis*, *Halophila ovalis* complex and *Halophila beccarii*, in response to seasonal variances in local light intensity and temperature at three topographically distinct foraging meadows. The results of this study shall further become indispensable towards predicting the effects of biomass due to climate change; the Arabian sea's

mean sea level and temperature increment, and turbidity events. Moreover, a better understanding of the effects of the seasonality of food source on megaherbivores like the green sea turtles and dugongs in the Gulf of Kutch (GoK) shall be achieved. Field data collection for understanding the effect of light intensity and temperature changes on seagrass meadows of the GoK. The surveys were conducted at Paga reef, Bhaidar reef, and Tam reef.

Methodology: Three meadow types representing topographically unique parts of the reef system were selected for the phenology study. Tam reef meadow; a mid-intertidal, narrow and linear tidal course dissecting a stabilized mud-flat, Bhaidar reef; an intertidal meadow, partly inside a vegetated tidal creek, and Paga reef; a reef-top meadow. The sites were surveyed and sampled every month from October to May, 2020-2021. Ecological responses of seagrasses to seasonal variations in temperatures and light were studied. A HOBO pendant light/temperature logger was mounted at each site to log temperature and light intensity readings every month from October to May, 2021. Loggers were wrapped with a clear tape to prevent the settlement of microalgae and crustose coralline algae. Each month loggers were inspected for probable maintenance and data was off-loaded. To study seasonality in subtidal meadows, sampling points were aligned to the depth contour lines at Bhaidar cove (seasonal study area for subtidal meadow). Sampling was done in November 2021, and in March 2022.

Findings: A clear pattern in seagrass abundance variations was observed at all three sites. *Halodule sp*. meadows were observed to be seasonally persistent than the *Halophila sp.* meadows. Sediment resuspension pre/post monsoon were amongst the main contributors to the light intensity decrements. However, a higher wind velocity and surface currents may also decrease the total photosynthetic light reaching the seagrass beds, resulting in either delay in emergence or pre-pones the senescence. A persistence of low-light conditions causes decrement in abundance of all species present in the Gulf. Temperature played a major role in deciding both flowering and fruiting onset in all *Halophila s*p, along with their peak growth phases. Moreover, Macro-algal species composition responded to increase in turbidity and temperature. *Cladophora herpestica* dominated the mud-flats in late October, whereas, *Sargassum cinereum* dominated the subtidal zones in late April.

Figure 2. Seagrass meadows of Gulf of Kutch

1.1.2.2. Seagrass mapping surveys

Seagrass mapping is crucial for effectively managing and conserving these important ecosystems. Mapping helps identify the location and extent of seagrass beds, their condition, and their health. This information is essential for making informed decisions about the management and conservation of seagrass ecosystems. Mapping can also help to identify areas where seagrass restoration or conservation efforts may be needed. By monitoring changes in seagrass distribution and health over time, managers can better understand the impacts of human activities on these ecosystems and develop strategies to mitigate these impacts. These surveys were carried out to present distributional records of extensive seagrass meadows in the southwest Gulf of Kutch (GoK) that colonizes intertidal and subtidal zones. The objective was to map the extent of seagrass meadows distributed in the south-west GoK. Surveys were conducted at South-West Gulf of Kutch.

Methodology: Relative wave exposure, low-tide exposure, depth, and reef proximity were used as tools to identify and chart patterns in seagrass species presence, abundance, and depth profile.

Findings: Shoot density gradients, extent, and bathymetry maps to understand the colonization depths will be created for each reef and cove mapped. More than 10 reef-top meadows, 4 vast mid-intertidal meadows and >5 subtidal meadows were charted. We report the S-W of the GoK to harbor a vast network of interconnected meadows. As evident from Fig3, meadow occupation and settlement only favored sheltered areas of the reef complexes, radiating from which the abundance thins towards channel disturbances. Similar pattern of colonization is seen seawards part of the meadow too. Barren areas within the sub-tidal meadows near reef crests indicate tidal channel termination. The adjoining flanking meadows are most prone to pulsed turbidity, and high current velocity. Conversely, reef-top meadows (Fig 4) are relatively less dominated by wave/tidal disturbances. A bathymetric prediction of each species will provide a better idea about the relative differences in depth thresholds of colonization of topographical different meadows.

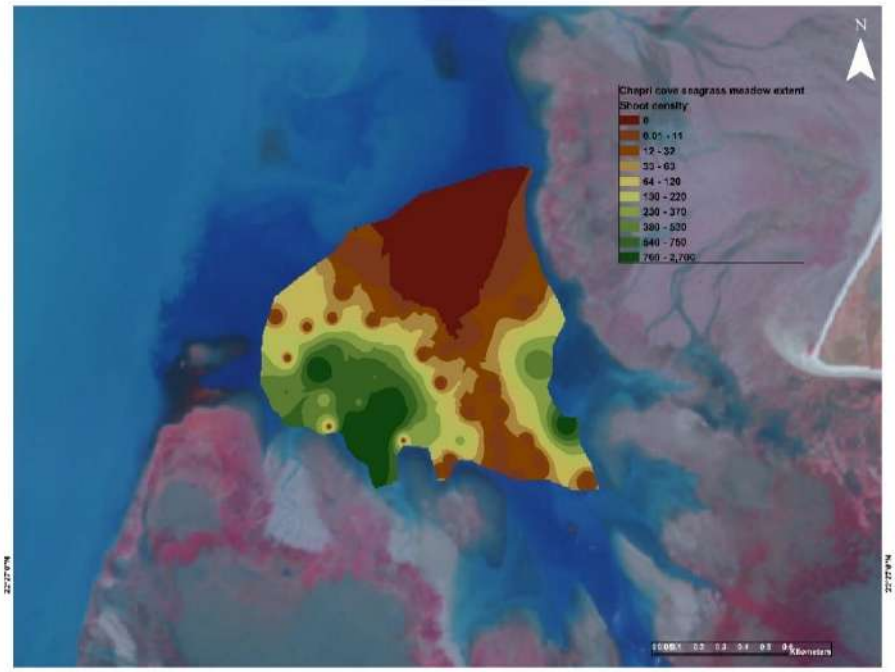


Figure 3. Seagrass meadow distributional map at Bhaidar reef, Gulf of Kutch

Figure 4. Sampling during the seagrass phenology surveys, Bottom right: Foraging trails were found at Nor reef

Figure 5. Data collection during Seagrass mapping surveys: Extreme right: Sargassum bloom in subtidal waters in summer 2022

1.1.3. Seagrass associated faunas

1.1.3.1. Seagrass associated fish assemblages

Since seagrass meadows act as refuges, foraging areas, and nurseries for fish, they are essential habitats for associated faunal groups like fish. Fish assemblages are an essential component of the seagrass ecosystem and are well known for their significant contribution to the community's structure through herbivory (Scott et al., 2018). Studies have also demonstrated that the presence of herbivorous fishes helps control the growth of epiphytic seagrasses, which increases the resilience of seagrass meadows (Campbell, Kartawijaya, and Sabarini 2011). There is a significant research gap in understanding the function of fishes in these meadows because studies on fishes associated with seagrass meadows in Gujarat have not been studied. More

information about the diversity and behaviour of fishes can help us better understand the condition and functionality of seagrass meadows. By highlighting the significance of seagrasses as essential habitats to the associated fauna beyond megaherbivores, we hope to close these research gaps. The objective was to assess the variety and habitat-use behaviour patterns of the fish species found in seagrass meadows. The surveys were conducted at Mithapur (n=30), and Arambada (n=30).

Methodology: Point count transects were chosen as underwater visual census techniques for this purpose. Point intercept transects were made up of 5 points with a fixed radius of 2 m that were adjacent to each other on a 50 m transect while keeping a distance of 3 m between the centers of adjacent circles. For 10 minutes, the observer hovered 2 meters above the center of the point.

The fish species, number of individuals, distance from the observer, and activity in the meadow were all recorded. During the analysis, all of the fish species were divided into guilds based on their feeding habits and preferred habitat/substrate (sand/rock/coral) to better understand the nature of the assemblage and the reasons for their presence in the meadow. Meadows were sampled, which were selected on the basis of their seagrass cover percentage.

At each point, the fish species, number of individuals, distance from the observer, affinities to seagrass/corals or the substrate (sand/rock), and activities were recorded for 10 minutes. Furthermore, because the presence of observers may influence/disturb fish activities, resulting in a bias in the results, video cameras were set up at a distance in the seagrass meadow as a control point to record fish activities in the absence of observers. Each meadow had a continuous 30-minute video recording. A comparison of human observer point counts and video capture will help us understand any differences in fish behaviour in the presence and absence of an observer.

Findings: There is a significant research gap in understanding the function of fishes in seagrass meadows of Gujarat. More information about the diversity and behaviour of fishes can help us better understand the condition and functionality of seagrass meadows. By highlighting the significance of seagrasses as essential habitats to the associated fauna, beyond megaherbivores, we hope to close these research gaps. In order to document the ecosystem services provided by seagrass habitats, fish species associated with seagrass were surveyed at Mithapur (n=30), and Arambada (n=30).

The fish species, number of individuals, distance from the observer, and activity in the meadow were all recorded. During the analysis, all of the fish species were divided into guilds based on their feeding habits and preferred habitat/substrate (sand/rock/coral) to better understand the nature of the assemblage. 28 species of fish were recorded from 7 families: Carangidae, Leiognathidae, Lethrinidae, Lutjanidae, Malacanthidae, Nemipteridae, and Serranidae are economically important species. The density of the fish family in the study area is shown in Figure 9.

Figure 6. Halophila decipiens (left) and Halophila ovalis (right) species

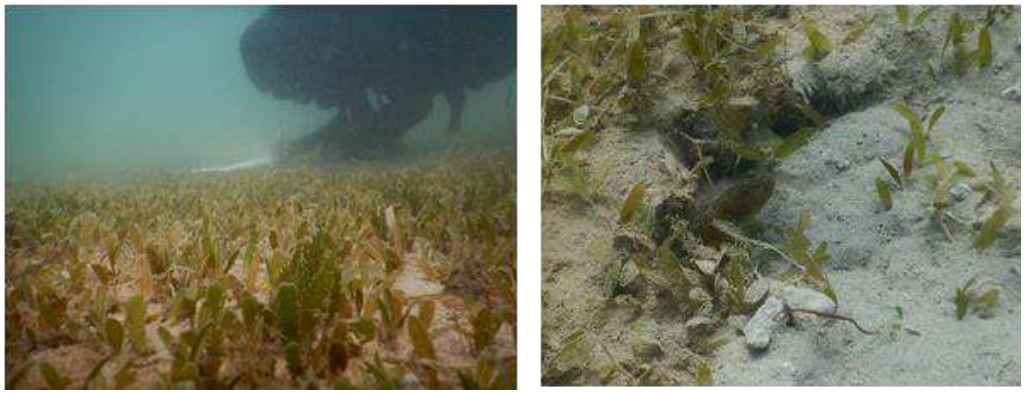


Figure 7. Surveying Seagrass mapping and associated fauna

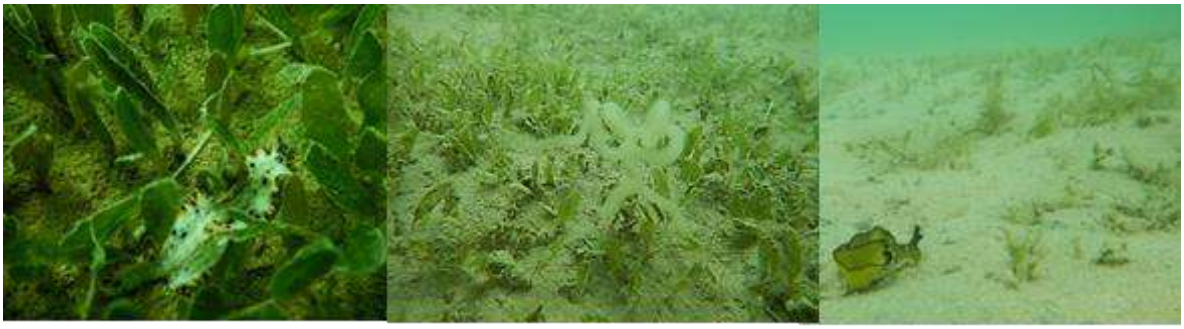


Figure 8. Associated Nudibranchs and its egg case

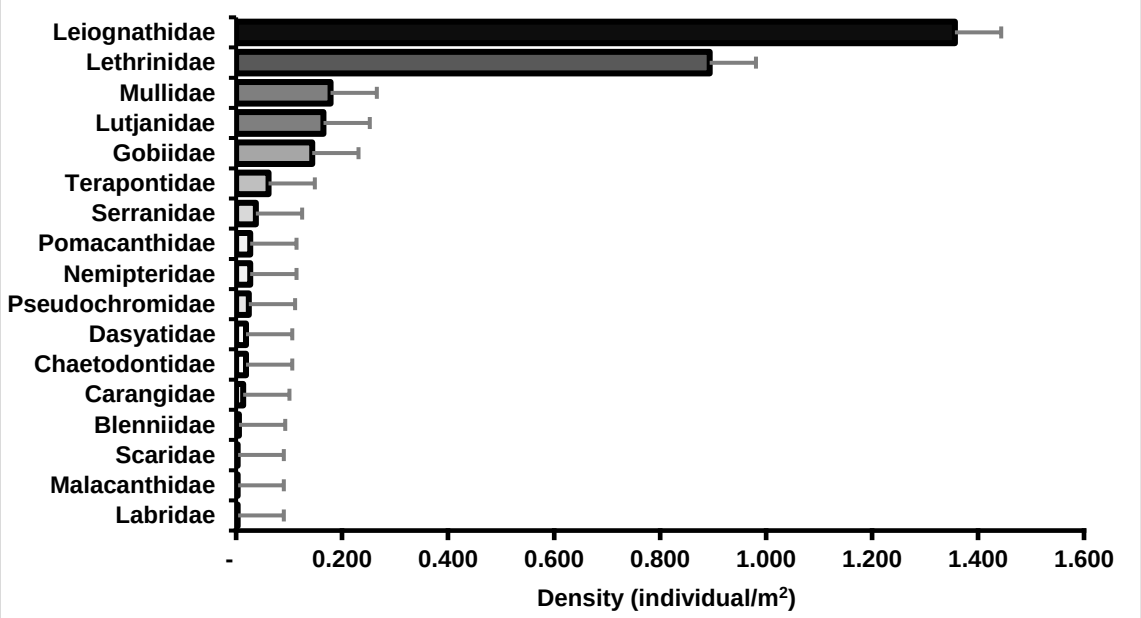


Figure 9. Density of Seagrass-associated fish family in Gujarat

1.1.3.2. Ecological surveys for estimating seagrass-associated benthic fauna

The organisms inhabiting the sediment are referred to as benthos. Depending upon their size, benthic animals are divided into macrofauna, microfauna, and meiofauna macrofauna. Benthic community responses to environmental perturbations are useful in assessing the impact of anthropogenic perturbations on environmental quality. Macrobenthic organisms which are considered for the present study are animals with body sizes larger than 0.5 mm. The presence of benthic species in a given assemblage and population density depends on numerous biotic and abiotic factors. Benthic invertebrates can be differentiated by the position they occupy on or in bottom sediments: infauna – animals that live in sediments; almost all worms and bivalves belong to this category, and epifauna – organisms that live on the surface of bottom sediments; many crabs and gastropods are considered epifauna (Tagliapietra & Sigovini. 2010).

A rich community of infaunal organisms directly or indirectly contributes to the success of seagrasses. Bioturbation by mobile infauna can aid in nutrient cycling and seed burial. Different mixtures of seagrass species alter environmental conditions and food availability within the sediment through a range of processes (ranging from sediment trapping to differences in photosynthate production), affecting differences in nematode community structure directly or through indirect pathways (Somerfield *et al*. 2002). The abundance and biomass patterns of macrofaunal assemblages associated with

seagrass habitat were investigated in the Gulf of Kutch. The objective were; 1) to study species composition of benthic macrofauna associated with seagrass in the Gulf of Kutch, Gujarat, 2) to study the functional composition of the fauna associated with seagrass in the Gulf of Kutch, Gujarat, and, 3) to study the temporal variations in the abundance of benthic macrofauna associated with seagrass meadows in the Gulf of Kutch, Gujarat. The study sites were Paga reef, Taam reef, Chepri reef, Chusna pir Island and Mithapur.

Methodology: Natural Geography inshore areas (NAGISA) sampling protocol for seagrass and macroalgae coastal areas was followed for intertidal macrobenthos collection. GPS Garmin eTrex 30 was used for making waypoints. The intertidal seagrass meadows were exposed during low tide. In intertidal seagrass meadows, quadrats were randomly placed. Macrobenthic samples were collected from quadrates of 25x25 cm in high, mid, and low tide intertidal zones, which were 100 meters spaced apart. Quadrates are the square sampling plots of fixed length and width generally used to study sedentary or slow-moving animals. In total six quadrates were placed. Five replicates were taken from each quadrat, and a depth of 5-10 cm of sediment was collected in seagrass present and absent areas each. Samples were sieved and preserved in 5%, formalin, and stained with Rose-Bengal. The benthos in the sediment sample was recorded after sieving through 500 mesh size sieves on board. The total population was estimated as the number of animals in 1 meter and biomass on a wet weight basis.

Upon receipt in the laboratory, samples were washed and transferred to a preservative. The washed and preserved sediment with benthic invertebrates was poured into a white enamel tray. The organisms were sorted with the help of a stereomicroscope and arranged into different groups in separate vials and preserved in 70% Ethanol. The preserved animals were later identified to their lowest taxonomic group under Leica DM100 stereomicroscope using relevant identification guides and counted. Photographs were taken using Optikam Pro 8 camera at the Wildlife Institute of India, Dehradun.

Van Veen grabs with an area of 0.04m^2 were used to collect subtidal benthic samples. A rope easily operates the Van Veen grab. Once on the boat, the grab was opened above a plastic bucket, and the sample was gently removed. Samples were sieved to

remove fine sediments and any other extraneous material. Depth was measured onboard using the DEPTH TRAX 1H handheld depth finder with the inbuilt temperature sensor. Dissolved oxygen (DO), Salinity, and pH were measured with the help of recalibrated portable Dissolved Oxygen meter, salinity, and pH meter. Seagrass cover could not be estimated due to turbidity. Seagrass biomass composition and shoot density were estimated post-field trips.

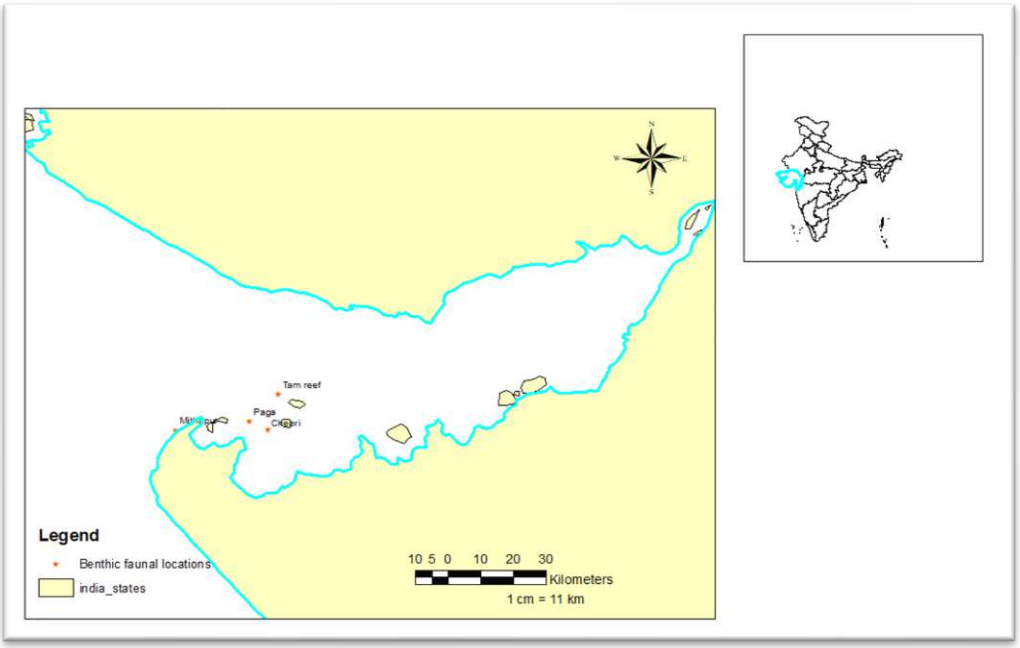


Figure 10. Locations of benthic faunal associated with seagrass in the Gulf of Kutch, Gujarat

The sample was then sieved; water was sprinkled directly onto the sample with a low-pressure nozzle to prevent any damage to animals. The samples were kept in watertight plastic bags. The delicate process of sieving was performed very carefully to avoid any damage to the fragile organisms and to ensure that all animals present in the sample were collected. To separate macrofauna, a sieve of 0.5 mm mesh was used. The samples were preserved in 5% formalin and stained with Rose Bengal. The Rose Bengal dye, at the strength of 0.1% selectivity, coloured all the living organisms in the sample.

Findings: Total 17 groups viz Gastropods, Pelecypod, Crustaceans such as Tanaidceans, Cumaceans, Amphipods, Isopods, Polychaetes, Holothuroidea, Ophiuroidea, Scaphopoda, Polyplacophora, Marine insects, etc. For further taxonomic level identification, samples were photographed with stereomicroscope in Wildlife

Institute of India. The status and validity of all taxa were checked and updated using the World Register of Marine Species (WoRMS Editorial Board 2016).

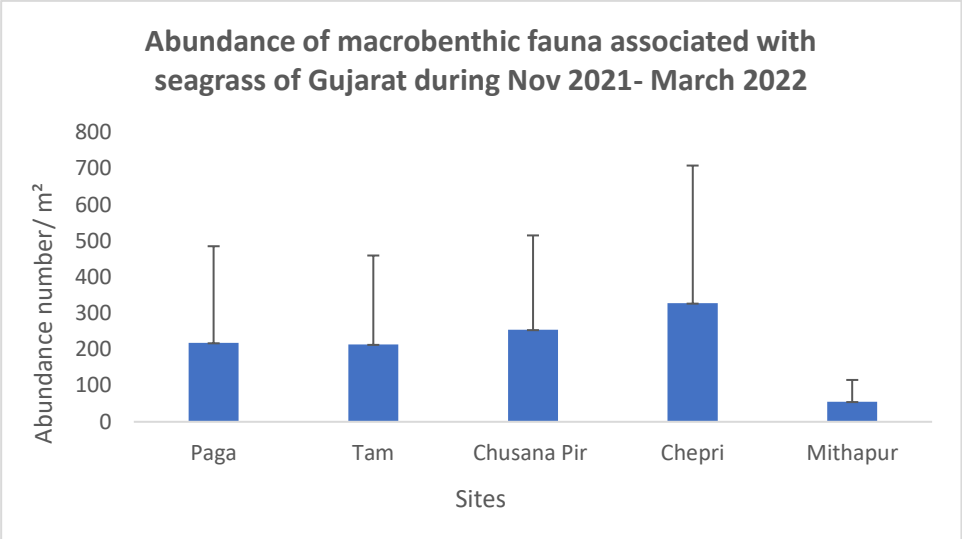


Figure 11. The abundance of macrobenthic faunal groups associated with seagrass of the Gulf of Kutch, Gujarat, from November 2021 – March 2022

Chepri reef, the site shows the highest abundance and Mithapur reef showed the lowest abundance from November 2021 to March 2022 (Figure 11). Tam reef showed the highest faunal richness and Chusana Pir showed the lowest faunal richness (Figure 12).

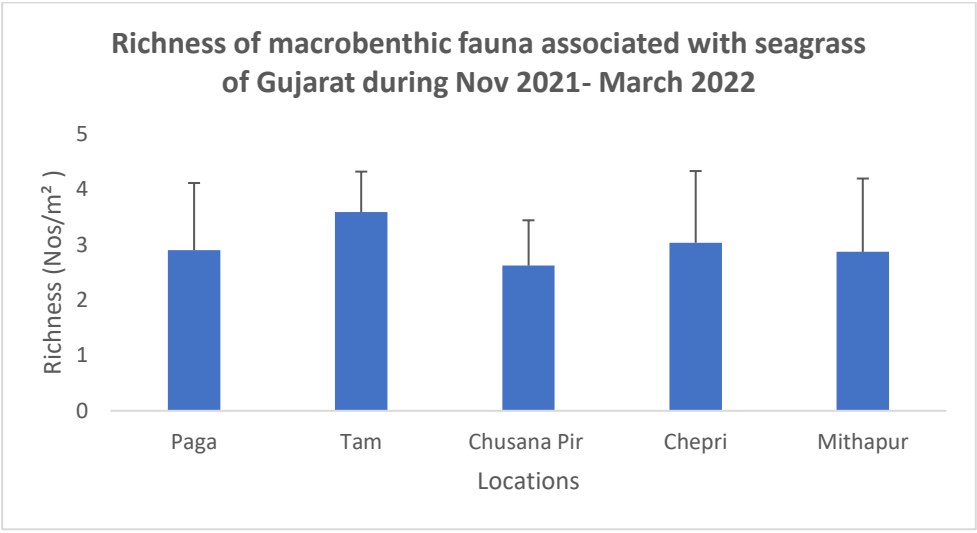


Figure 12. Richness of macrobenthic faunal groups associated with seagrass of the Gulf of Kutch, Gujarat, from November 2021 – March 2022

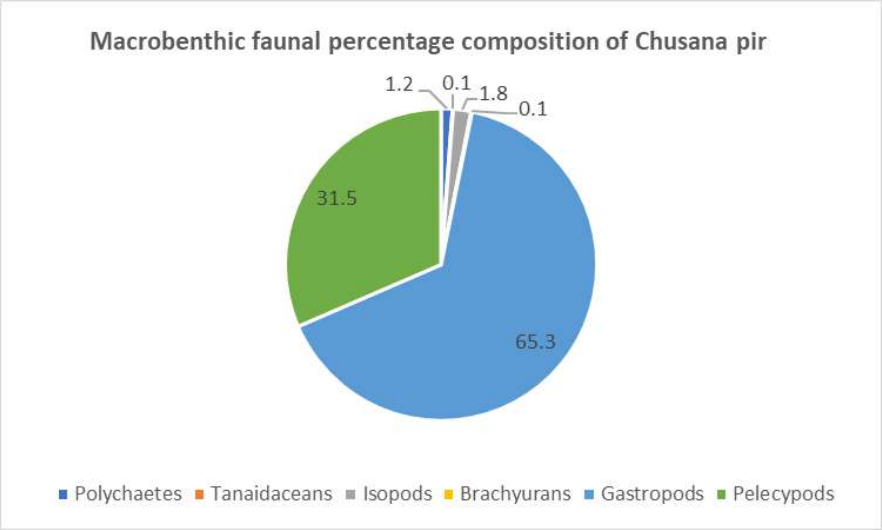


Figure 13. Benthic faunal percentage composition of Chusana pir, Gulf of Kutch, Gujarat

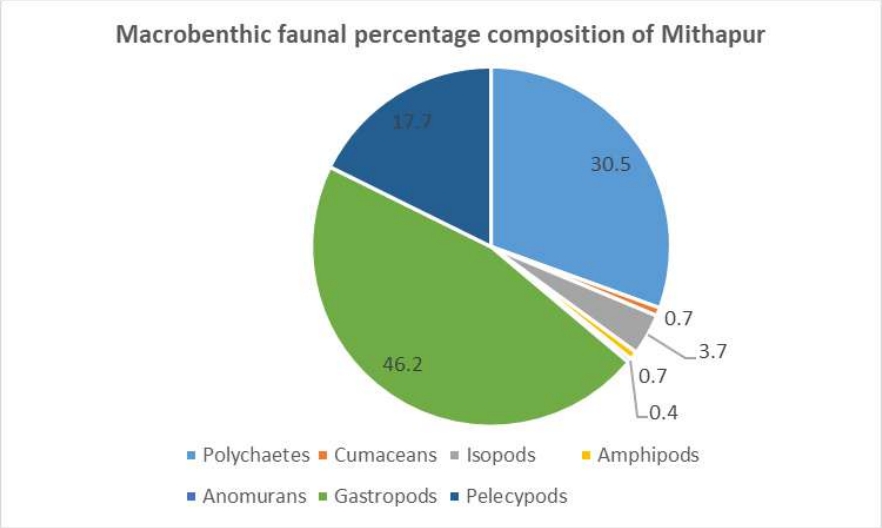


Figure 14. Benthic faunal percentage composition of Mithapur beach, Gujarat

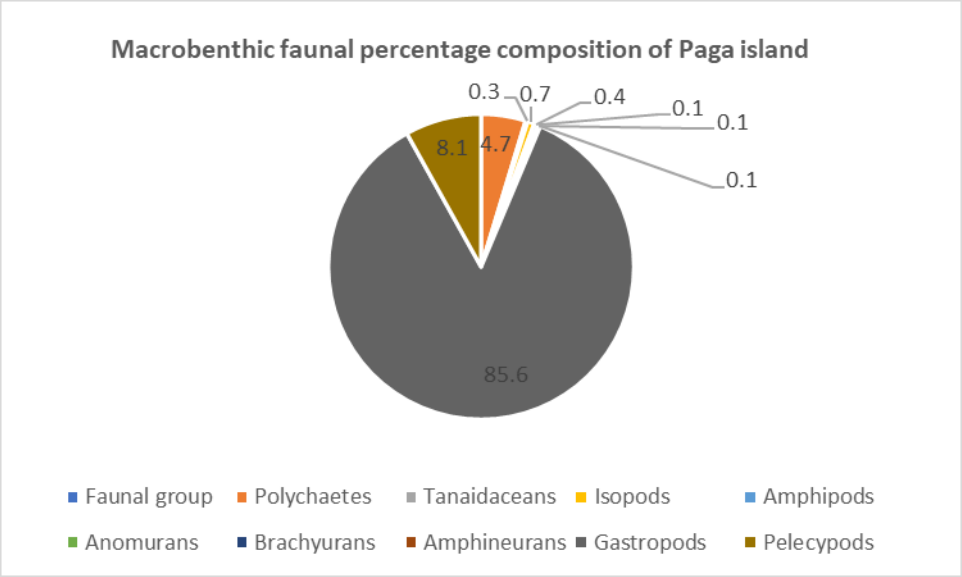


Figure 15. Benthic faunal percentage composition of Paga reef, Gujarat

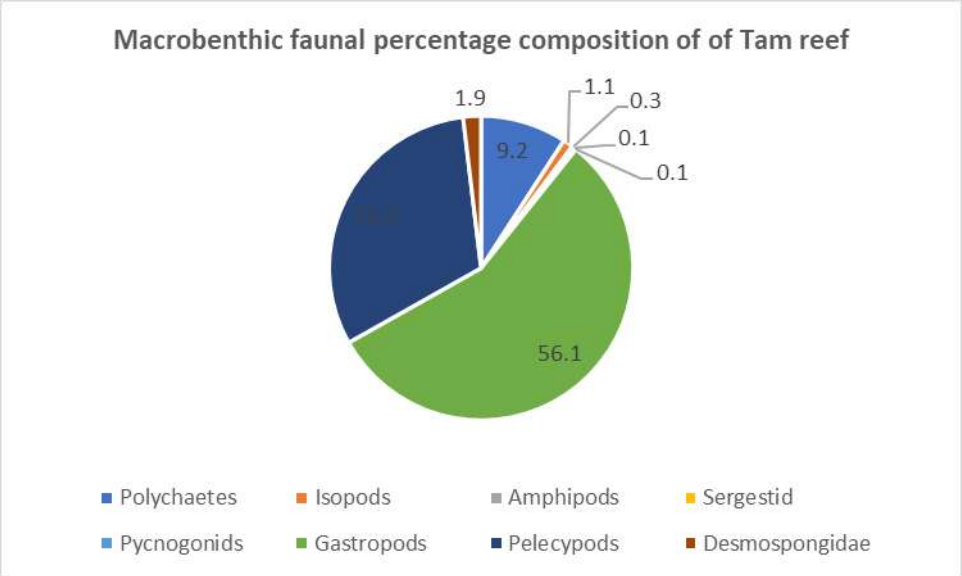


Figure 16. Benthic faunal percentage composition of Tam reef, Gujarat

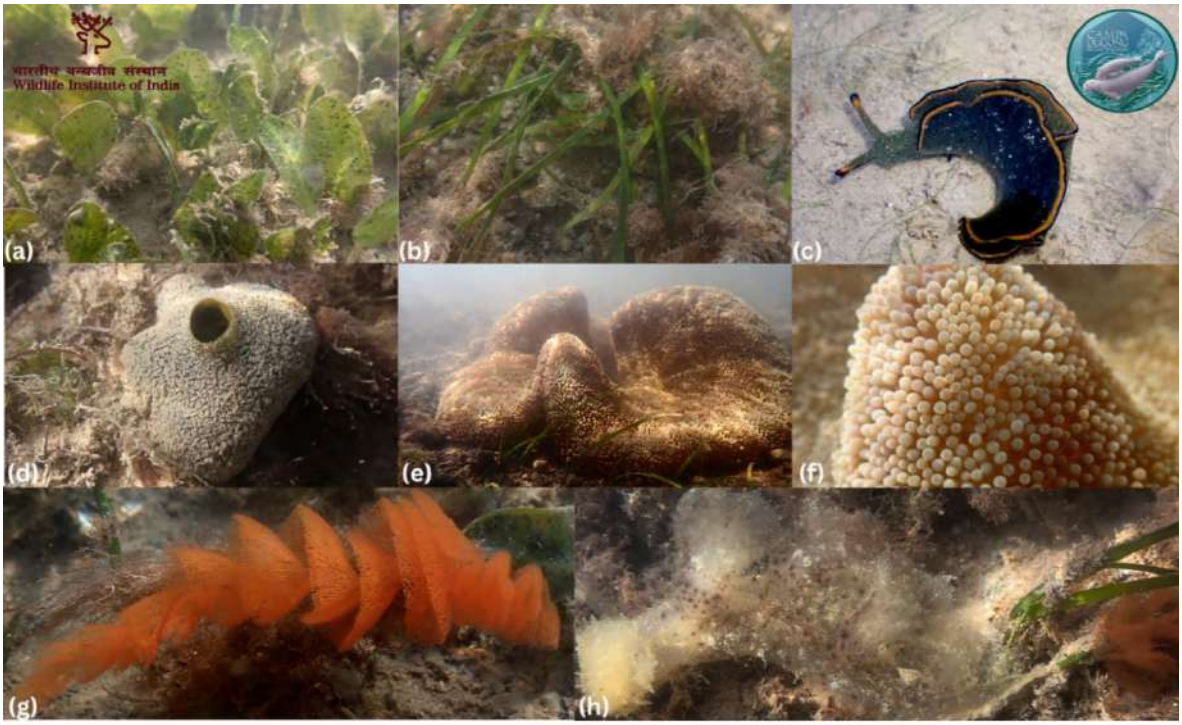


Figure 17. a) Halophila ovalis b) Halodule wrightii c) Elysia ornate d) e) Srichodactyla haddoni f) close-up of tentacles of Stichodactyla haddoni g) egg case of Melibe viridis f) Meribe viridis meadows in the Gulf of Kutch, Gujarat

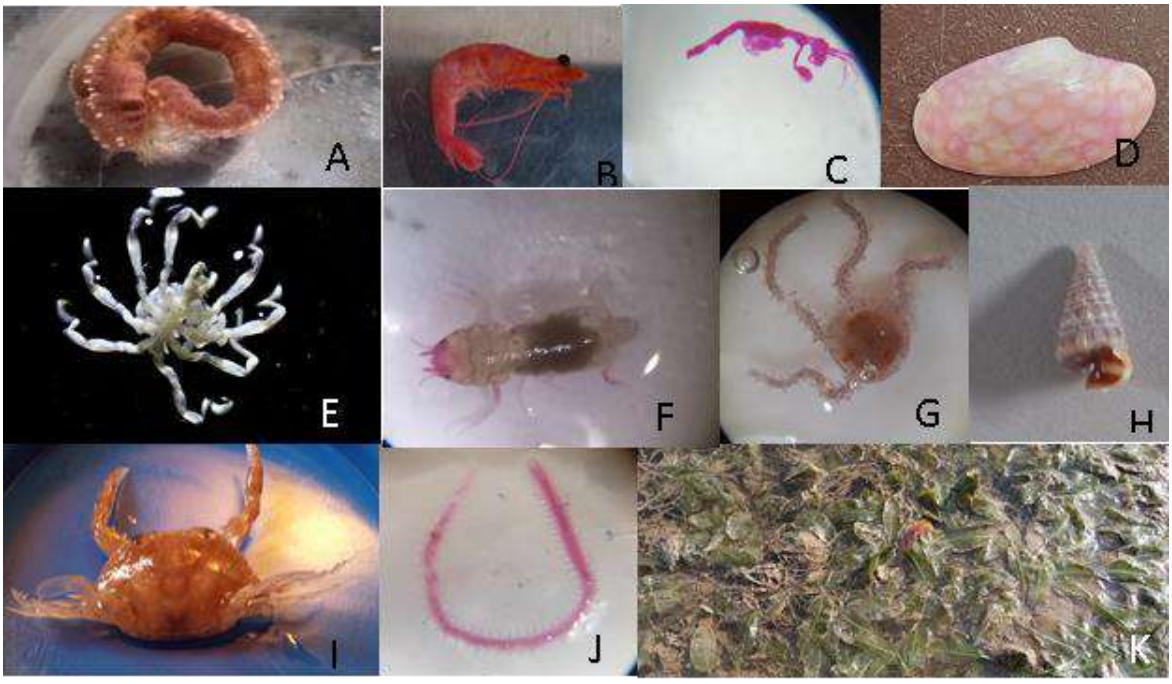


Figure 18. Macrobenthic fauna associated with seagrass A) Holothuria (Lessonothuria) pardalis B) Prawn C) Amphippd Caprella sp. D) Bivalve (Paratapes textilis) E) Sea spider F) Isopod (Gnathidae) *G) Ophioplocus imbricatus H) Gastropod I) Brachyuran crab (Portunidae) J) Polychaete K) Haliclona* sp *in Halophila ovalis*

Table 1. *The range and average faunal standing stock and composition of macrobenthos associated with seagrass*

Locations	**Parameter**					
	Population (no/m^2)		**Biomass (g/ m^2); wet weight**		**Groups (no.)**	
	Range	**Average**	**Range**	**Average**	**Range**	**Average**
Chusana Pir	16-1104	254.31	0.001-28.32	5.43	2-5	3
Mithapur	16-336	55.48	0.001-9.28	0.6	1-6	3
Paga reef	16-1040	217.93	0.001- 74.24	27.93	1-6	1
Tam reef	16- 1088	213.57	0.01-15.2	2.29	2-5	4
Chepri reef	16-1376	327.61	0.001-47.04	7.7	2-5	1

Table 2. *Diversity of macrobenthic faunal group associated with seagrass meadows in the Gulfof Kutch, Gujarat, from November 2021 — May 2022*.

Sl. no	**Faunal group**	**Chepri**	**Tam Reef**	**Paga reef**	**Chusana Pir**	**Mithapur**
Phylum Arthropoda						
1.	Amphipods	+	+	+	+	+
2.	Anomuran	-	-	+	-	-
3.	Tanaidaceans	+	-	+	-	+
4.	Brachyuran	-	+	+	+	+
5.	Isopod	-	+	+	-	+
6.	Cumaceans	+	-	+	+	+
7.	Sergestidae	-	+	+	-	-
8.	Pycnogonida	-	+	+	-	-
Phylum Echinodermata						
9.	Echinoids	+	-	-	-	-
10.	Holothuroidea	+	-	+	-	-

Sl. no	Faunal group	Chepri	Tam Reef	Paga reef	Chusana Pir	Mithapur
11.	Ophiuroids	+	-	+	-	-
12.	Asteroidea	-	-	-	-	-
Phylum Porifera						
13.	Desmospongidae	-	+	-	-	+
Phylum Arthropoda						
14.	Polychaetes	+	+	+	+	+
Phylum Mollusca						
15.	Gastropods	+	+	+	+	+
16.	Pelecypods	+	+	+	+	+
17.	Polyplacoplacophora	+	-	+	-	-
Note: +; Present, -; Absent						

1.1.4. Dugong feeding signs

Dugong feeding trails were observed by the WII team at Chepri and Noru Reef has recorded feeding trails of Dugong on the *Halophila ovalis* meadow in the Gulf of Kutch in April and December 2022 respectively.

Figure 19. Dugong feeding trails at Chepri reef in the Gulf of Kutch, Marine national park

1.1.5. Boat Survey for marine megafauna sightings

In collaboration with Gujarat Forests Department Marine megafauna survey was conducted from November-2022 to January-2023, in a 35 square kilometer area where

approximately 25 Indo-ocean humpback dolphins and 8-10 Green Sea turtles were observed foraging near the Bet Dwarka, Paga, Samiyani, Mithapur, and Arambada reefs.

Gujarat forest department Marine National Park organized a three-day survey for the 2022 Dolphin Census in the Gulf of Kutch. Gujarat team were invited to take part in this survey as a technical expert from the Wildlife Institute of India (WII). A brief opening ceremony was held in Mithapur on December 11th to discuss survey methods. All ten groups, each composed of a technical expert, two forest guard observers, and a forest officer leader, surveyed the area across the Marine National Park from December 12 to December 14 2022. Line transect was performed. A significant number of dolphins were sighted; the forest department will shortly publish a report on the surveyed data.

Figure 20. Glimpse of marine megafauna sighting in Gulf of Kutch, Gujarat

Figure 21. Glimpse of Dolphin census workshop in Gujarat

Figure 22. Indo Pacific Humpback dolphins Sousa plumbea, sighted during survey

1.1.6. Marine animals stranding records

1. One carcass of a male green sea turtle (*Chelonia mydas*) was observed during a field survey on Okha beach Island on 31.05. 2022.

Figure 23. Green sea turtle carcass washed ashore at Okha beach

Table 3: Morphometric measurements of stranded green sea turtle

Sl. No.	Parameters	Unit (in cm)
1.	Curved Carapace Length	52
2.	Curved Carapace Width	54
3.	Plastron length	73
4.	Plastron width	75

2. One carcass of a common dolphin was observed at Mithapur beach Island on 27.02.2023. It was an individual, most likely a male, who may have floated into the deep ocean. No measurements could be recorded because the carcass was not located again.

Figure 24. Common dolphin carcass at Mithapur

3. One carcass of Dwarf Sperm whale, *Kogia sima*, was reported from Mahuva town, Bhavnagar coast on 4th March 2023.

Figure 25. Carcass of Dwarf Pygmy sperm whale

1.2. AWARENESS AND OUTREACH ACTIVITIES

1.2.1. Summary of awareness and outreach events

In the field season 2021-2023, a total of 23 outreach and awareness activities were conducted to enlighten people about the species, its importance, and major project activities to the school and college students, teachers, locals, and fishermen. Out of 23 events, 21 events were conducted for awareness and scholarship and 2 meetings were conducted with different stakeholders like the forest department, marine police, and head of various schools to involve them in the conservation activity, as the involvement of local people is very crucial for any species conservation. The purpose of outreach activities was to sensitize our important stakeholders about the importance of marine biodiversity (flora and fauna), and the role and importance of seagrass and Dugong habitats in the marine ecosystem. The people also addressed the major threats to biodiversity. Dugong comic books and pamphlets were distributed in the schools where awareness events and scholarship programs were continued, as pictorial guides are a helpful and effective measure to convey an important message to common people.

Table 4. *Details of outreach and awareness activities conducted in different areas of the Gulf of Kutch, Gujarat in the year 2021-23.*

Sl. No.	Location	Date	Name of the event	Type of stakeholders	Total no. of attendees
1.	Gujarat	24th August 2021	Webinar	Bharatiya Vidya Bhavan college students and teachers	45
2.	Gujarat	7th September 2021	Webinar	Thakur College of Science and Commerce students and teachers	129
3.	Jamnagar	5th October 2021	Awareness program	Vidyasagar College students	120
4.	Gujarat	16th October 2021	Webinar	Zoology Department, Gujrat University	113

Sl. No.	Location	Date	Name of the event	Type of stakeholders	Total no. of attendees
				students, and teachers	
5.	Mandvi, Kutch	24th October 2021	Webinar	College Students	120
6.	Dwarka	23rd November 2021	Meeting	RFO Dwarka	2
7.	Okha	26th November 2021	Wall painting	CAMPA Dugong team	4
8.	Elysium marine campsite in Beyt Dwarka	25th December 2021	Awareness program	Tourists and locals	62
9.	Rajkot	11th February 2022	Webinar	Department of Bioscience, Saurashtra University College students and teachers	107
10.	Beyt Dwarka	21st February 2022	Awareness and scholarship program	Shree Kanyabeyt Primary School Students	80
11.	Ahmedabad	23rd February 2022	Webinar	Department of Zoology, ST. Xavier's College students, teachers, and principal	135
12.	Okha	13th March 2022	Webinar	Locals	38
13.	Jamnagar	21st March 2022	Meeting	DCF Sir Senthil Kumaran	2
14.	Okha	15th March 2022	Webinar	IIOSC international delegates and national delegates	50
15.	Beyt Kanya Shala	28th May 2022	Awareness and scholarship	Beyt Girl school students	56

Sl. No.	Location	Date	Name of the event	Type of stakeholders	Total no. of attendees
16.	Dwarka	27th April 2022	Awareness and scholarship	Shri Rupen Bandar Primary School students	40
17.	Okha	28th May 2022	World Dugong Day	Locals	50
18.	Okha	16th November 2022	Outreach program	Locals	60
19.	Gujarat	18th November 2022	Webinar	Locals	48
20.	Okha	5th December 2022	Awareness Program	Fisherman Community	70
21.	Gujarat	19th December 2022	Think wildlife foundation Webinar	Local	125
22.	Okha	11th January 2023	Awareness program	Fisheries dept	7
23.	Mumbai	27th and 28th January 2023	National Conference	College students and research scholars	200

Figure 26. Glimpse of awareness programs conducted at Gulf of Kutch, Gujarat

1.2.2. Dugong scholarship program

A unique participatory program, the Dugong Scholarship Scheme, was initiated to engage local fisherfolk communities at the grass-root level. This program targets school-going children of local fisherfolk communities and provides them with a scholarship of Rs. 500 / month for two years to support their education. The motive

behind the Dugong Scholarship program is to encourage fisherfolk students to study and financially help them. This scheme has helped us to build a strong network of informants. The beneficiaries are selected through the competitive written examination followed by several participatory programs conducted at schools to raise awareness about Dugong and seagrass conservation. In Gujarat, we have completed this program for five years, from October 2022 to March 2023. Till now, 303 students have been awarded this scholarship, and the students selected under this program are identified as Dugong ambassadors. The list of Dugong ambassadors is attached as annexure III.

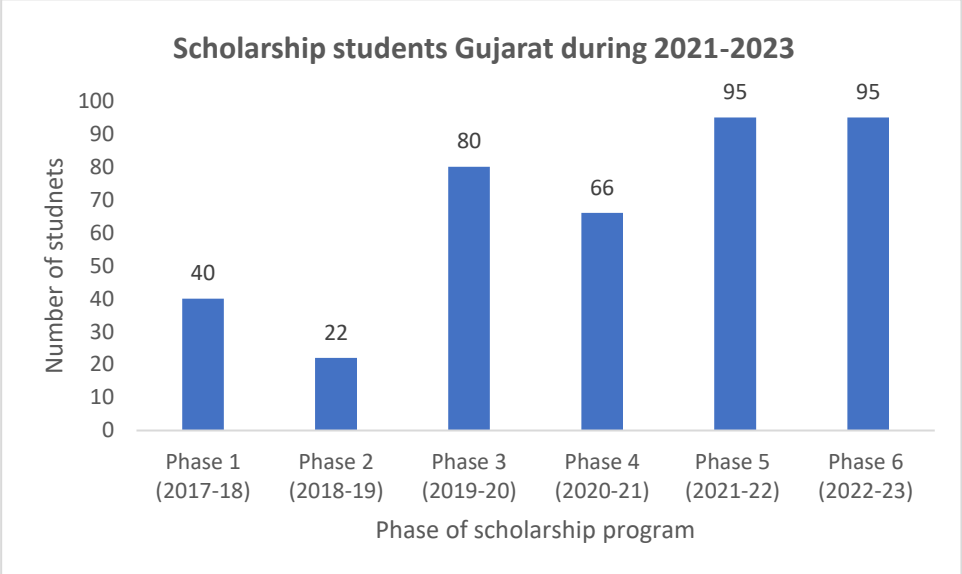


Figure 27. Number of scholarship students over five years in the Gulf of Kutch, Gujarat

Table 4. *Details of Dugong scholarship programs in Gujarat*

Sl. No.	Year	School Name	Village/Town	District	Phase					
					1	2	3	4	5	6
					2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
1	2017-2022	Mithapur High school and Higher Secondary School	Mithapur	Devbhumi Dwarka	3	5	4	4	8	8

Sl. No.	Year	School Name	Village/Town	District	Phase					
					1	2	3	4	5	6
					2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
2	2018-2022	Swaminarayan Highschool	Beyt- Beyt Dwarka	Devbhumi Dwarka	0	8	7	3	1	1
3	2017-2018-2019	Okha Grampanchayat High School and Higher Secondary School	Okha	Devbhumi Dwarka	6	7	10	4	0	0
4	2017-2018-2019-2020	PVM Girls High and Higher Secondary School	Dwarka	Devbhumi Dwarka	8	2	8	7	0	0
5	2017-2018	NDH School	Dwarka	Devbhumi Dwarka	1	0	0	0	0	0
6	2017-2012	Government High School- Vasai	Vasai	Devbhumi Dwarka	9	0	0	0	3	3
7	2017-2018	Government High School- Bharana	Bharana	Devbhumi Dwarka	13	0	0	0	0	0
8	2020-2021	Shri Karmayog Madhyamik Shala Varvala	Varvala	Devbhumi Dwarka	0	0	5	4	0	0
9	2020-2021	Shree Dwarka Taluka School 1	Dwarka	Devbhumi Dwarka	0	0	1	1	0	0
10	2020-2021	Shree Varvala Wadi Primary School	Varvala	Devbhumi Dwarka	0	0	11	11	0	0
11	2020-2021	RMSA Government Highschool Vasai	Vasai	Devbhumi Dwarka	0	0	3	3	0	0
12	2020-2022	Nagar Palika Sanchalit Okha Primary School	Okha	Devbhumi Dwarka	0	0	13	13	3	3
13	2020-2022	Shree Varvala Primary School	Varvala	Devbhumi Dwarka	0	0	7	6	15	15
14	2020-2022	Shree Rupen Bandar Primary School	Varvala	Devbhumi Dwarka	0	0	11	10	10	10
15	2021-2022	Kasturba Gandhi Balika Vidhyalay	Bhimarana	Devbhumi Dwarka	0	0	0	0	1	1
16	2021-2022	Balapur Kumar Govt school	Balapur	Devbhumi Dwarka	0	0	0	0	2	2

Sl. No.	Year	School Name	Village/Town	District	Phase					
					1	2	3	4	5	6
					2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
17	2021-2022	Kendriya Vidyalaya Dwarka	Dwarka	Devbhumi Dwarka	0	0	0	0	1	1
18	2021-2022	Model School Dwarka	Dwarka	Devbhumi Dwarka	0	0	0	0	3	3
19	2021-2022	Prathmik Shala no.1 Bhunga	Bhunga	Devbhumi Dwarka	0	0	0	0	1	1
20	2021-2022	Shree Aarambhada Kanya shala	Aarambadha	Devbhumi Dwarka	0	0	0	0	4	4
21	2021-2022	Shree Aarambhada prathmik shala	Aarambadha	Devbhumi Dwarka	0	0	0	0	8	8
22	2021-2022	Shree Beyt Kanya School	Dwarka	Devbhumi Dwarka	0	0	0	0	3	3
23	2021-2022	Shree Beyt Kumar School	Dwarka	Devbhumi Dwarka	0	0	0	0	15	15
24	2021-2022	Shri Bhimrana Primary School	Bhimarana	Devbhumi Dwarka	0	0	0	0	7	7
25	2021-2022	Shri Saraswati Shishumandir	Surajkaradi	Devbhumi Dwarka	0	0	0	0	2	2
26	2021-2022	Shri Surajkaradi Kanya Shala	Surajkaradi	Devbhumi Dwarka	0	0	0	0	2	2
27	2021-2022	Surajkaradi Taluka School	Surajkaradi	Devbhumi Dwarka	0	0	0	0	2	2
28	2021-2022	V.A. English medium school Okha	Okha	Devbhumi Dwarka	0	0	0	0	2	2
29	2021-2022	Shree Kanya School	Dwarka	Devbhumi Dwarka	0	0	03	0	2	2
		Total			**40**	**22**	**80**	**66**	**95**	**95**

1.3. OUTPUTS AND ACCOMPLISHMENT

1.3.1. Research and monitoring Seagrass surveys

- Seagrass exploratory surveys were extended till Mithapur and new seagrass meadows were discovered at Mithapur reef.

- A first phenological baseline study conducted on topographically different Dugong foraging habitats.
- Over nine intertidal and subtidal Dugong foraging habitats and refuges were found and mapped.
- Preliminary analysis of dugong habitat use based on seagrass abundance, tidal cycle, and seagrass quality.
- Preliminary observations of green sea turtle and Dugong meadow cohabitation and use between intertidal and subtidal seagrass morphology.
- Extent and abundance mapping of over 15 meadows across the Southwestern Gulf region. The northwestern region remains to be studied entirely.
- New regional record of *Halophila decipiens* meadow.
- Three strandings, two subsequent necropsies, and two live sightings have confirmed the presence of a small relict population.
- Gut content analysis to ascertain foraging areas.
- First seagrass-associated benthic faunal study recorded 17 groups in the Gulf of Kutch, Gujarat.
- First report of dietary differences in Indian dugongs through an opportunistic gut sampling of stranded individuals.

1.3.2. Outreach and awareness

A total of 23 outreach programs were conducted which majorly covered school and college students, along with major stakeholders viz forest department, fisheries department, Coastguard, fishermen, college and school students. We reached out to 1767 people through outreach and awareness campaigns this field season. Most of the awareness efforts were published and highlighted in the local Newspapers and News channels., World Dugong Day, World Wildlife Day, was celebrated to create awareness regarding wildlife and Environment conservation among school and college students.

1.3.3. Dugong scholarship program

In Gujarat, we have completed five years of this program from July 2017 to March 2023. Till now, 398 students have been awarded this scholarship and the students selected under this program are identified as Dugong ambassadors.

1.4. MANAGEMENT RECOMMENDATIONS

We recommend increased threat monitoring efforts in the southeastern zone of the Gulf of Kutch. Overall, seagrass meadows of the Gulf of Kutch have a high turnover rate which gives it the resilience needed to re-colonize post-monsoon, after a shedding period in monsoon. Detrimental activities like sedimentation and subsequent seagrass burial due to trawling and illegal docking in 'seagrass-priority areas' like North Beyt-Dwarka should be stopped and measures should be taken to forestall it.

Trawler docking in Beyt-Dwarka also causes sediment resuspension which could increase the turbidity of associated coral outcrops in the Balapur cove and North Beyt-Dwarka. Such docking also uproots seagrasses and has been heavily criticized by the native community which depends on seagrass meadows for small-scale crab fishing.

Some areas falling under the Marine National Park, Paga reef, and Bhaidar Island, need to be monitored for infiltrating activities like illegal poison fishing and beach seining. Although, these activities may be minimal in number but have the potential to leave a long-lasting effect on corals and seagrass meadows. The use of mangrove branches as stakes for building a seine has been observed.

Dugong sighting and monitoring efforts need to be increased in 'Critical Dugong habitats' like Chepri and Taam reefs. The connecting habitats between foraging meadows need to be established and monitored regularly using a drone and boat-based surveys.

The frontline staff of the Gujarat Forest Department needs to be trained in conducting seasonal seagrass monitoring surveys and marine mammal monitoring surveys. We plan to organize such training in the upcoming season for state forest department personnel and other key stakeholders.

2. Gulf of Mannar, Tamil Nadu
Annual field report 2021-23

1.5. RESEARCH AND MONITORING

1.5.1. Dugong population estimation

1.5.1.1. Aerial Survey Report of Gulf of Mannar and Palk Bay

Unmanned Aerial Vehicles (UAVs) are widely undertaken in the study of marine mammals globally, as they cover larger spatial scales in a shorter duration and significantly reduce the survey effort. They are also known to cause less disturbance to the wildlife and are a cheaper alternative thus they are widely used. UAV surveys serve as an extremely useful tool for marine mammal distribution and population studies, especially for species thriving in shallow coastal waters like dugongs. Dugongs being marine herbivores spend most of the seagrasses in coastal waters and surface every 5-6 minutes, making their detectability using drones much easier, as compared to oceanic marine mammals which dive for longer intervals in deep seas. The present survey effort was undertaken in the proposed Dugong Conservation Reserve using fixed width strip transects with an aim to detect dugongs in their habitats and quantify the potential threats densities. The study was carried out in Palk Bay Dugong Conservation Reserve which was declared by Tamil Nadu State Government, which stretches from Adhirampattinam to Ammapatinam which has been previously established as a Critical Dugong Habitat by Sivakumar and Nair in 2013. The area of the proposed conservation reserve is about 448 km^2.

Methodology: Aerial surveys were undertaken using the DJI Mavic 2 Pro UAV manufactured by SZ DJI Technology, which is a micro quadcopter with 4 rotors weighing 907g. The flights were planned systematically, with survey locations chosen at a distance of 2 km from each other. From every survey location, 2 flights were undertaken, with a transect length of 3 kms spaced 300 meters apart. The flights were planned using the Litchi Hub application. Fixed width transect sampling was undertaken according to the standard methodology suggested by Raoult *et al.* 2020 for studying sirenians. The altitude of the flight was kept constant at 100 meters with a speed of 35 km/hr. The width of the survey strip was 75 meters. Continuous video was recorded during each flight and the videos were then saved in external hard drives for further analysis. Surveys were undertaken with a glare less than 50% and sea-state of 0-4 on the Beaufort scale at morning or evening hours. These surveys were undertaken from November 2021 to January 2022 and November 2022 to February 2023.

Aerial surveys were undertaken using the DJI Mavic 2 Pro and DJI Mavic Zoom UAV manufactured by SZ DJI Technology, which is a micro quadcopter with 4 rotors weighing 907g and 905g respectively. Aerial Scan Focal Sampling was undertaken with the main objective to detect dugongs. After detection, the dugong was focal followed at an altitude of 30m at a camera angle of -90°. Video was recorded after each detection and saved in external hard drives for further analysis. This was with aim of studying the ecology of dugongs.

A total of 28 fixed width aerial transects were undertaken for the surveys. Replicate sampling of the survey effort was undertaken in 2022-23. The analysis of the 2022-23 sampling is ongoing. A total of 4 dugong sightings were recorded during the survey efforts.

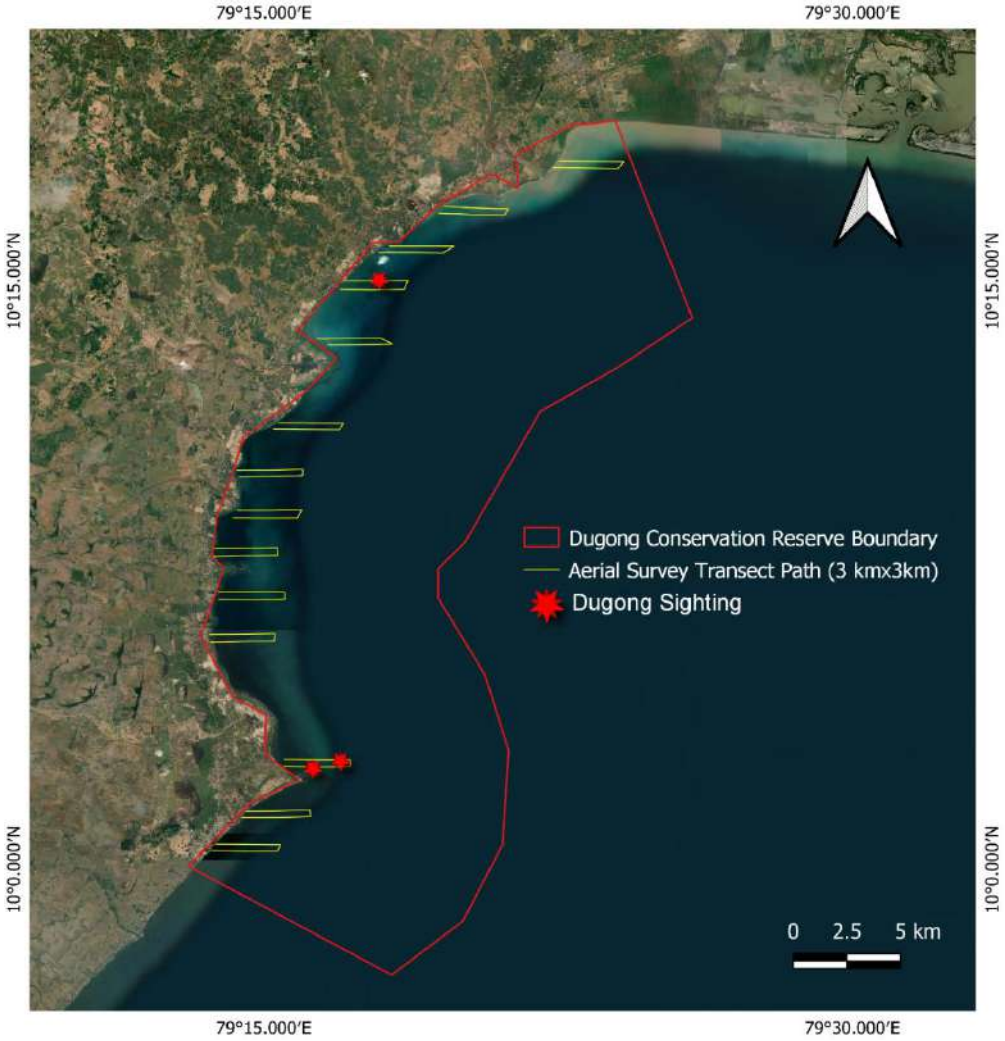


Figure 28. Fixed Width Aerial Survey Map and dugong sightings for 2021-22 surveys

Findings: In the total 28 transects of 3 km, a total of 4 dugongs were detected in the area surveyed in the conservation reserve.

Area surveyed in 1 strip transect = Length of the survey strip × Width of the survey strip

= 3 x 0.075 km

Area surveyed in 1 strip transect = 0.225 km^2

Thus,

Total area surveyed during the study =

Area surveyed during 1 transect × Total transect surveyed

= 0.225 × 28

Total area surveyed during the study = 6.34 km^2

A total of 4 dugongs (n=4) were detected during the surveys, including a mother and calf pair.

Observed encounter density of Dugongs = Total number of detections ÷ Total area surveyed

= 4 ÷ 6.3

Observed density of Dugongs = 0.6309/ km^2

A total of 8 sea turtles (n=8) were detected during the surveys

Encounter density of Sea Turtles = Total number of detections ÷ Total area surveyed

= 8 ÷ 6.3

Observed density of Sea Turtles = 1.2698/ km^2

A total of 68 (n=68) potential threats to marine megafauna were observed during the surveys.

Some major threats included Fishing nets, fishing boats, anchored boats, oil spill sleeks etc.

Encounter of threats to marine megafauna was calculated.

Threat density = Total number of threats ÷ Total area surveyed

= 68 ÷ 6.3

The density of threats in the area surveyed = 10.79365/ km^2

Density of fishing boats = Total number of threats ÷ Total area surveyed

= 7 ÷ 6.3

Density of fishing boats = 1.1041/ km^2

Density of fishing nets = Total number of threats ÷ Total area surveyed

= 40 ÷ 6.3

Density of fishing nets = 6.349/ km^2

Focal Follow: Dugongs that were detected were focal followed and behavioural observations were recorded in the form of videos. The behaviours of dugongs were classified and ethograms were made. The behaviour was classified as follows-

1) Feeding and Foraging – a) With feeding plumes and b) Without feeding plumes.
2) Travelling
3) Socializing
4) Herding
5) Mother and calf
6) Rolling
7) Surfacing

The behaviour analysis is currently ongoing with the help of Boris Software with Time Activity Budget graphs are being made. Average surfacing intervals of dugongs is also being calculated for more insights on dugong behaviour.

Figure 29. Aerial View of Seagrass meadows, offshore in Rajamadam

Figure 30. Damage caused by anchorage lines of fishing crafts in seagrass meadows at Sethubavachattram

Figure 31. Fishing Crafts observed fishing in Seagrass meadows

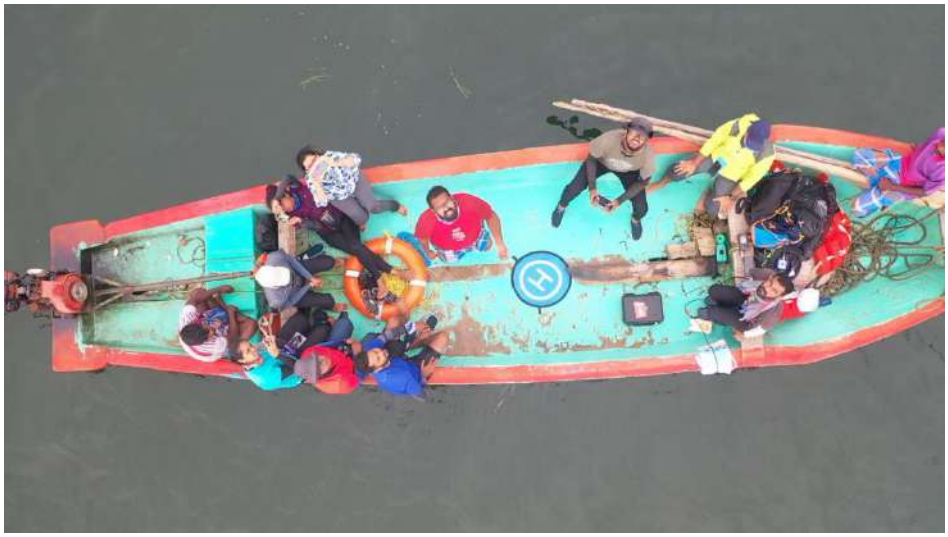


Figure 32. Team during the aerial survey effort

Figure 33. Dugong mother and calf observed at Sethubavachattram.

Figure 34. Dugong sighted at Kodimunnai, near Manamelkudi

1.5.2. Seagrass survey

1.5.2.1. Mapping of seagrass and seaweeds in selected dugong habitats

Remote sensing and GIS provide a handy tool to map such shallow coastal habitats, but in case of diverse conditions of Indian waters along the 7516.6 km coastline, it is important to evaluate various classification techniques for better mapping accuracy. We tried to evaluate the efficacy of different classification techniques in different water conditions, north Palk Bay (PB) and Gulf of Mannar (GoM), Tamil Nadu. To evaluate the efficacy of different classification techniques in different water conditions. The surveys were conducted at North Palk Bay (PB) and Gulf of Mannar (GoM), Tamil Nadu.

Methodology:

Component 1: Field to collect in-situ data

In situ data has been collected on seagrass and seaweed presence and absence from Karangadu to Toothukudi. A total of 508 points (every station with three replicates at >50m apart.) were collected. 250 points from South Palk Bay and 258 points from Gulf of Mannar regions respectively.

- Drop-down camera method was used to photograph and record the presence of seagrasses in the selected grids. A Hero GoPro 9 Silver Camera at the apex of a square-based pyramidal structure was used for the purpose.

- If present, the percentage cover was calculated from the GoPRO videos.
- Other physical parameters like depth, sea-surface temperature and transparency were also collected from every point.

Figure 35. Structure for drop down quadrat with GoPRO fixed on it. B. Assessing the transparency using a Secchi Disk. C. Dropping of the quadrat

Component 2: Classification and mapping

- We are currently working on analyzing the videos for presence-absence and calculating percentage cover. Consecutively, the data entry of the same is in process. The data from Gulf of Mannar has already been entered and a preliminary run with seagrass points was carried out.
- Cloud-based Google Earth Engine platform was used for classification. Sentinel-2 MSI Level-2A (Surface-reflectance) composites were developed, on which cloud-masking and land-masking were done by using Sentinel-2 Cloud Probability and by calculating the normalized difference of B3 (green) and B8 (Near-infrared) respectively.
- The collected data points will be segregated into 70:30 for training and validation purposes.
- The algorithm with highest accuracy will be selected for classification. Machine learning algorithms to be tested are: K-Means, Support Vector Machine (SVM), Maximum Distance (MD), Classification and Regression Trees (CART), Naives Bayes (NB) and Random Forest (RF).

Table 5. Metadata for Sentinel 2 imageries.

Satellite	Sentinel-2
Satellite number	A and B
Processing level	Level-2A
Product type	S2MSI2A
Instrument	Multispectral Instrument (MSI)
Bands used	Band 2 Blue (496.6 nm-S2A/492.1 nm-S2B)
	Band 3 Green (560 nm-S2A/559 nm-S2B)
	Band 4 Red (664.5 nm-S2A/665 nm-S2B)
	Band 8 NIR (835.1 nm-S2A/833 nm-S2B)
Spatial Resolution	10 m

Findings:

- As per the preliminary results, we expect a seagrass cover of 620 km2 (310 km2 in South Palk Bay and 307 km2 in the Gulf of Mannar) in the targeted area. Please note that the estimated area is very preliminary and may change once the final map is prepared after classification.

- Area coverage for seaweeds is yet to be calculated for both South Palk Bay and Gulf of Mannar.

- Gulf of Mannar region though having clearer waters has less seagrass cover (approximately 307 km2) in comparison to that of Palk Bay (approximately 310 km2 only in South Palk Bay).

- Change in seagrass or seaweed distribution is subjected to the availability of past data on distribution. Our study suggests that there is a gradual increase in seagrass distribution in seagrass distribution in both Gulf of Mannar and South Palk Bay.

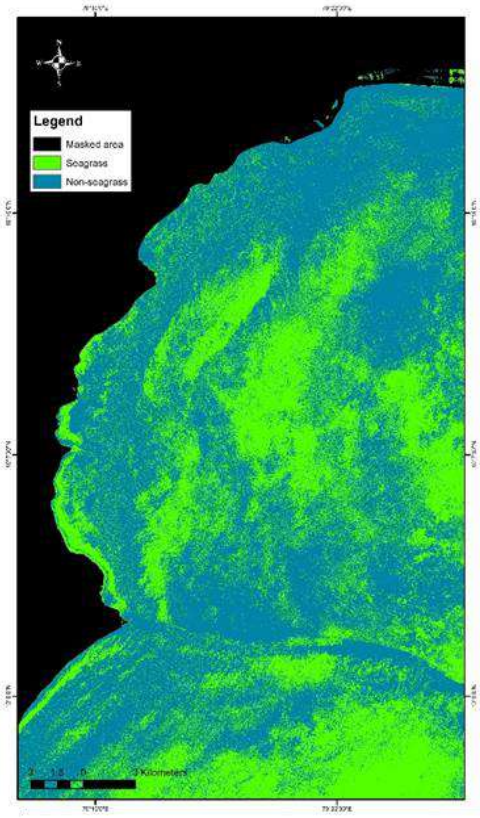


Figure 36. Seagrass map of North Palk Bay (accuracy=70%)

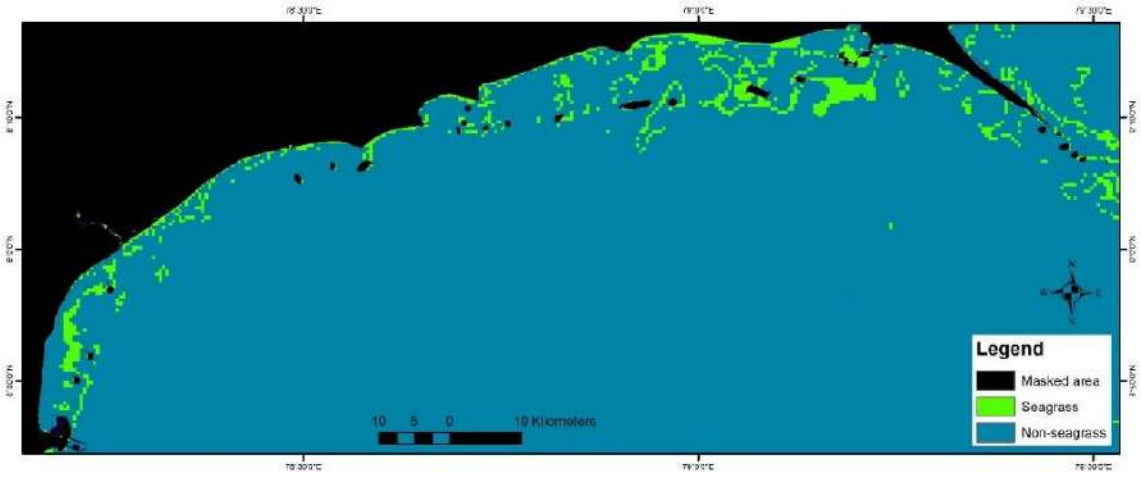


Figure 37. Seagrass map of Gulf of Mannar (accuracy=79%, kappa=0.47)

***Table 6.** Seagrass change dynamics with time from previous studies*

Gulf of Mannar		
Year	**Cover (km^2)**	**Reference**
1998	85.71	ICMAM PD (2001)
2004	26.58	Sridhar et al., (2010)

2005	57.1	Susila et al., (2012)
2007	13.27	Thangaradjou et al., (2008)
2023	**307**	**Current study by WII**
South Palk Bay		
2007-2009	175	Manikandan et al., (2011); Mathews et al., (2010)
2014	329.7*	Geevarghese et al., (2017)
2023	**310 (approx.)**	**Current study by WII**
*This study is for entire Palk Bay (both north and south)		

1.5.2.2. Seagrass assessment in Dugong Conservation Reserve

Seagrasses being the major diet of Dugongs, it is vital to understand various aspects of seagrass beds within their habitat. For sustainable management and effective conservation planning of dugongs and their habitats, gaining insights into seagrass ecology and the interactions between seagrasses, dugongs, associated organisms and other anthropogenic factors is crucial. Studying seagrasses in the Dugong Conservation Reserve can involve local communities in conservation efforts. It provides an opportunity to raise awareness about the importance of seagrass ecosystems, promote sustainable fishing practices, and involve communities in monitoring and conservation initiatives. This study focuses on understanding seagrass distribution, species composition and percentage cover throughout the conservation reserve. The study was conducted in the Dugong Conservation Reserve from Adirampattinam to Ammapattinam.

Methodology: We sampled the area of Dugong Conservation reserve intensively from Adirampattinam to Ammapattinam over ten transects perpendicular to the shore. These transects were 10 km in length and placed at a 5 km distance from each other. Hundred (Ten points per transect) were sampled for seagrass cover and composition by Van-veen Grab and Drop-down quadrat.

Findings:

Ten seagrass species belonging to four genera, viz., *Halophila, Cymodocea, Syringodium,* and *Halodule*, were recorded from the region. All these genera are part of the dugong diet. Seagrass species included *Cymodocea serrulata, Cymodocea rotundata, Halodule pinifolia, Halodule uninervis, Halophila beccari, Halophila*

decipines, Halophila ovalis, and Syringodium isoetifolium. We found that *Cymodocea serrulata* has the highest abundance, followed by *Halodule pinifolia* and *Halophila ovalis*. The average seagrass shoot density for DCR was 287.66/sqm. An average of more than 60% of the area is covered in seagrass.

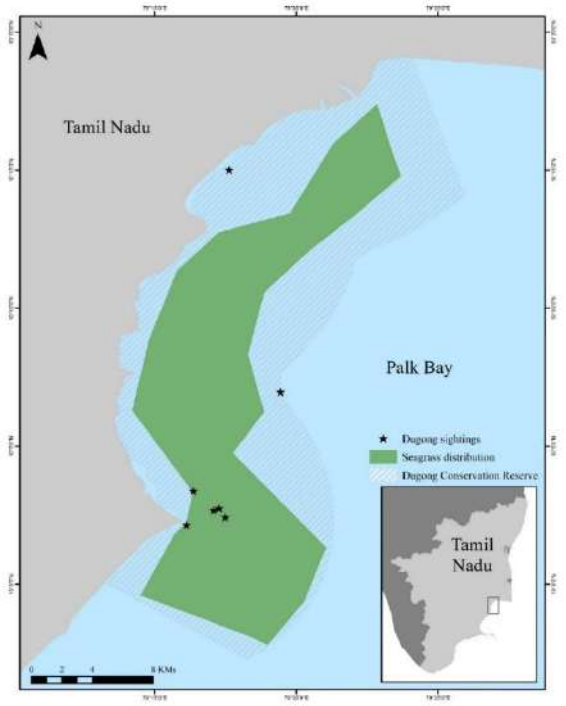


Figure 38. Seagrass Distribution and Dugong sightings in Dugong Conservation Reserve

Figure 39. Seagrass observed in Dugong Conservation reserve

Figure 40. Glimpses of seagrass assessment surveys

1.5.2.3. Nutrient analysis of Sediments of Dugong conservation reserve

Seagrass is a type of marine flowering plant that grows in shallow salty and brackish waters all over the world, except in Antarctica. There are 72 different species of seagrasses, 15 of which are present in India (Larkum et al. 2006, Novak et. al. 2020). Seagrass beds can be mixed (containing of different species) or monospecific (consisting of a single species). Seagrasses share the same organs and tissues as other blooming plants and have distinct above- and below-ground sections. Despite having leaves, they have correspondingly large underground stems and roots that hide up to 90% of their total biomass in sediments (Singh 2019). It is well acknowledged that seagrasses have a considerable impact on the chemical, physical, and biological environments and are consequently referred to as ecological engineer (Hoegh-Guldberg & Bruno 2010, Ondiviela et. al. 2014). Seagrass habitats can improve coastal protection by stabilising and trapping sediments, reducing wave energy, and allowing suspended particles to settle on the bottom and improve water clarity (Ondiviela et.al. 2014, Reynolds et. al. 2016).

Seagrasses sustain intricate habitat systems, which hundreds of other species rely on, and they offer the conditions or supplies necessary for species to complete their life cycles and preserve niche variety (Jackson et.al 2001). Seagrasses function as nutrient pumps by releasing significant molecules into nutrient-deficient areas. They are nutrient sinks, buffering or filtering excess pollutants. One square metre of seagrass can produce 10 litres of oxygen each day through photosynthesis, earning them the nick name as lungs of the sea. (Renold et. al. 2016). Additionally, the ocean is acknowledged as a significant carbon sink that may hold up to 55% of the carbon dioxide in the atmosphere (Nellemann et. al. 2009), mostly in a variety of seabed types such mangroves, salt marshes, and seagrass meadows (Singh 2019). It's frequently referred to as "blue carbon." In addition, seagrasses are thought to store carbon in the waters at a rate up to 18% higher than that of tropical rainforests (Mcleod et. al. 2011, Fourqurean et. al. 2012, Rohr et. al. 2016), helping to mitigate the effects of climate change and reducing greenhouse gas emissions.

The chemical makeup of the major seagrass species is crucial to understand because of their direct and indirect contributions to the coastal marine food web. There are, however, a limited number of publications that discuss the biochemical elements in different seagrass species (Dawes et al. 1979, Geneid et al 2006, Pradheeba et al 2011) The macronutrients nitrogen (N) and phosphorus (P), which are drivers of productivity and are related to nutrient limitation and disturbances like eutrophication, have been extensively researched for their effects on seagrass elemental composition (Duarte, 1990; Fourqurean and Zieman, 2002). Potassium (K), sodium (Na), and calcium (Ca) are crucial for osmosis control in all submerged macrophytes (Touchette, 2007; Olsen et al., 2016).

Because epiphytes are crucial to maintaining higher trophic levels, changes within epiphyte groups may have a greater impact on the ecosystem (Kitting et al. 1984, Mutchler et al. 2004). Nutrient input may alter the composition of the algal population, favouring species that may be more or less appetising or dangerous to herbivores (Simó., 2001). The study objectives are to; 1) recognize the nutrient-rich seagrass meadows; 2) comprehend the nutritional makeup of dominant seagrass, and, 3) understand the composition of seagrass in relation to sediment nutrient content. The

surveys were conducted at the 'Dugong conservation reserve' of Palk Bay from Adirampattinam to Ammapattinam.

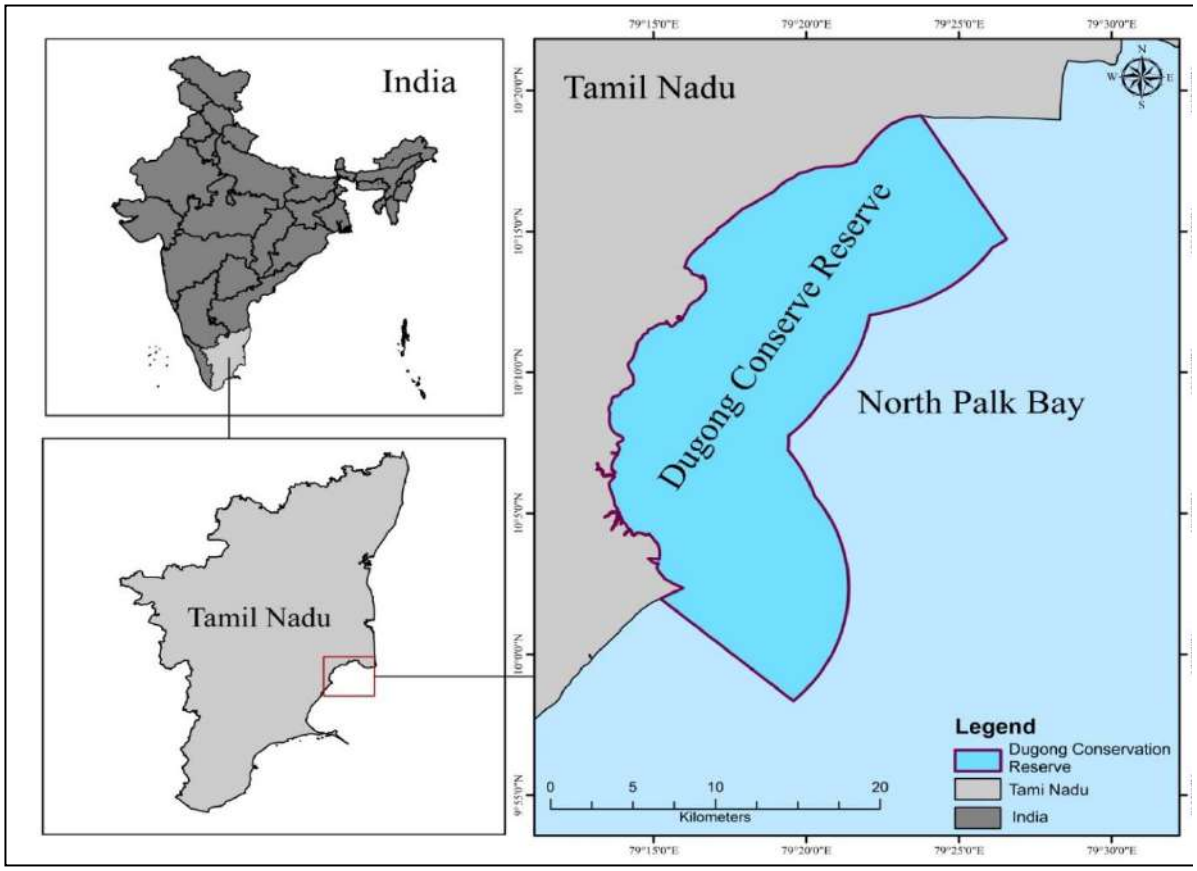


Figure 41. Study area

Methodology: We sampled ten transects with ten sampling stations on each of them. There is distance of one km between each sample point. Sediment and seagrass samples have been taken using a Van-Veen grab sampler. At each sampling point, three replicates were taken for sediment and seagrasses. Samples were air dried and sent to a lab for additional examination.

In order to release any trapped moisture, the samples were warmed in a hot air oven for a short period of time. The composite samples were then kept in airtight containers prior to analysis after being sieved using a 2 mm sieve to eliminate coarse silt and detrital debris. Total organic carbon in seagrass samples was evaluated using the dry combustion technique, whereas organic carbon in sediment samples was quantified using Walkley and Black (1934) quick titration method (Bojko and Kabala, 2016). The Kjeldahl technique was used to measure nitrogen (Miller and Houghton, 1945). The Flame Photometer technique was used to determine the amounts of sodium and

potassium (Barnes et al. 1945). For the analysis, 0.1 gm of seagrass and 1 gm of sediment samples was collected.

Figure 42. Nutrient analysis of seagrass and sediment

Findings:

Organic Carbon- There is no significant difference in organic carbon across seagrass and non-seagrass areas. Mono-species meadows show higher concentration of organic carbon.

Potassium - There is no significant difference in Potassium concentration observed between mono and mixed species seagrass meadows. Across vegetated and unvegetated areas, unvegetated areas show higher potassium concentration than vegetated meadows.

Sodium- There is no significant difference in Sodium concentration observed between mono and mixed species seagrass meadows. Across vegetated and unvegetated areas, unvegetated areas show higher sodium concentration than vegetated meadows.

Nitrogen- There is no significant difference in Nitrogen content observed between mono and mixed species seagrass meadows and seagrass vegetation type.

The higher quantities of OC in mono-species meadows might be due to greater biomass of mono-species meadows compared to mixed-species meadows. High terrestrial runoff, which is influenced by land use patterns around DCR, may be a contributing source for nutrients in coastal sediments. The higher concentration of Na and K in unvegetated areas than vegetated areas can be explained by the lower rates of nutrient cycling due to absence of vegetation. The concentrations of N across

vegetated and unvegetated areas may follow similar patterns as vegetation has very little effect on N concentration due to selective utilization of available nitrogen.

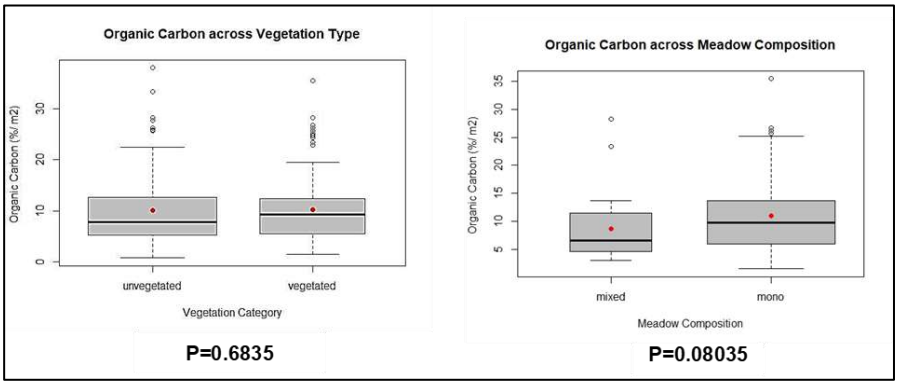


Figure 43. Organic carbon concentration in sediment collected from Dugong conservation reserve

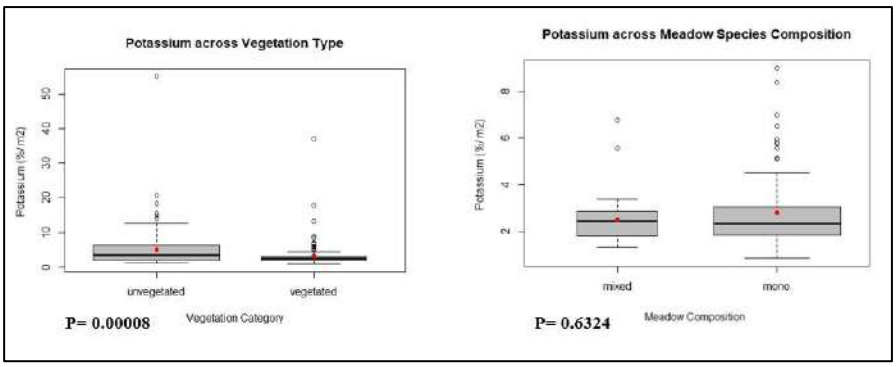


Figure 44. Potassium concentration in sediment collected from Dugong conservation reserve

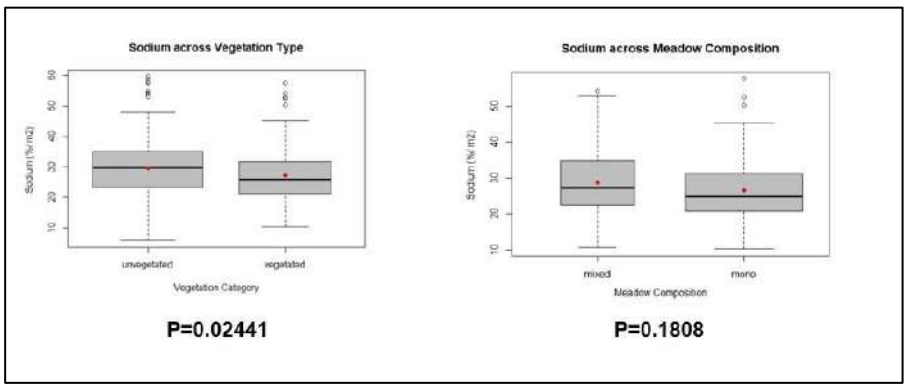


Figure 45. Sodium concentration in sediment collected from Dugong conservation reserve

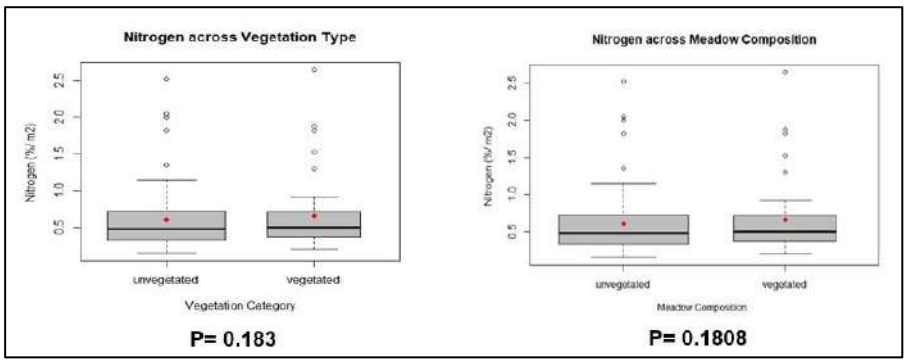


Figure 46. Nitrogen concentration in sediment and seagrass collected from Dugong conservation reserve

1.5.3. Seagrass associated fauna

1.5.3.1. Seagrass associated fish in Dugong conservation reserve

Seagrass meadows provide critical habitats for a diverse range of fish species. These fish depend on seagrass beds for shelter, feeding grounds, and nursery areas. Many of these fish species are commercially important, making seagrasses key fishing grounds for local communities. Therefore, understanding seagrass associated fish is important for managing and conserving seagrass habitats effectively. This study focusses on check listing seagrass associated fish species in the Dugong Conservation reserve.

Methodology: We assessed seagrass associated fish in Dugong conservation reserve by netting method. We deployed gill nets at three points with seagrass meadows on five transects. The nets were deployed before sunrise for 2 hours each. The fish were collected from nets and photographs with scale were taken for further identification.

Findings: Twenty-two fish species belonging to 18 families were recorded from seagrass meadows of Dugong conservation reserve (Table 6). *Terapon puta* (Small scaled Terapon) was found in most abundance (Figure 47). We found the most fish individuals in the 5–10 cm size range and the fewest in the 0–5 cm range (Figure 48).

Table 7. *Seagrass associated fish in Dugong conservation reserve observed by netting method*

Species	**Family**
Arius maculatus	Ariidae
Arothron immaculatus	Tetraodontidae
Atule mate	Carangidae
Brevitrygon imbricata	Dasyatidae
Chiloscyllium punctatum	Hemiscylliidae
Colletteichthys flavipinnis	Batrachoididae
Cynoglossus arel	Cynoglossidae
Gerres erythronus	Gerreidae
Gerres oyena	Gerreidae
Lethrinus lentjan	Lethrinidae

Mulloichdichthys vanicolensis	Mullidae
Pegasus volitans	Pegasidae
Pelates quadrilineatus	Terapontidae
Photopectoralis bindus	Leiognathidae
Psammoperca waigensis	Latidae
Sardinella brachysoma	Dorosomatidae
Scomberoides commersonnianus	Carangidae
Syngnathoides biaculeatus	Syngnathidae
Terapon puta	Terapontidae
Triacanthus biaculeatus	Triacanthidae
Upeneus tragula	Mullidae
Zebrias synapturoides	Soleidae
Unidentified	Unidentified

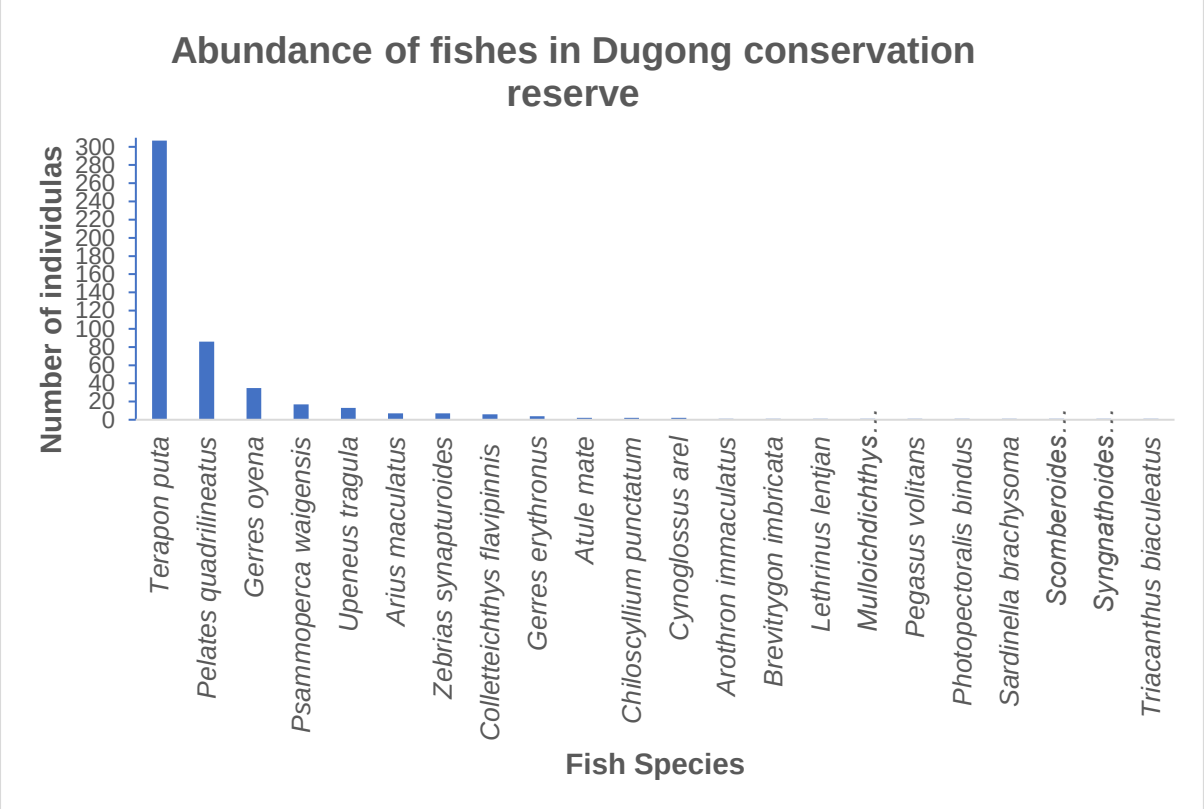


Figure.47. Abundance Seagrass associated fish in Dugong conservation reserve observed by netting method

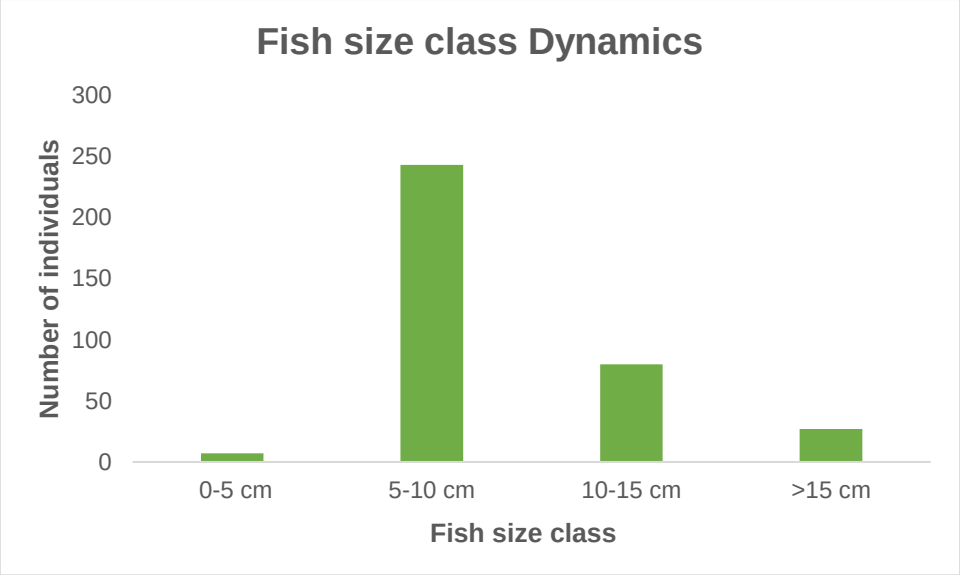


Figure. 48. Size class dynamics of Seagrass associated fish in Dugong conservation reserve observed by netting method

Figure 49. Fish netting in seagrass meadows of Dugong Conservation reserve

1.5.3.2. Assemblages of seagrass associated macrobenthic Fauna of Dugong Conservation Reserve, Palk Bay, Tamil Nadu

Seagrass habitat supports 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. Macrobenthos are invertebrates that live on or in sediment or are attached to a hard substrate. This study focuses on how macrobenthic community structure changes with seagrass meadows characteristics. The study focuses on - How macrobenthic community structure changes with respect to seagrass presence and seagrass species composition. The

surveys were conducted at the 'Dugong conservation reserve' of Palk Bay from Adirampattinam to Ammapattinam.

Methodology: We sampled ten transects with ten sampling stations on each of them. There is distance of one km between each sample point. Sediment samples have been taken using a Van-Veen grab sampler. At each sampling point, three replicates were taken. The sediment samples collected were further sieved using a 500µm sieve and segregated in the base camp. From each sediment sample, 25% of whole sample is segregated for sorting of macrobenthic organisms. Later in Laboratory of Wildlife Institute of India, all 300 samples of the macrobenthic organisms were sorted till group level and preserved with 70% ethanol. The individuals have been identified and sorted to group level and its diversity has been analysed per m².

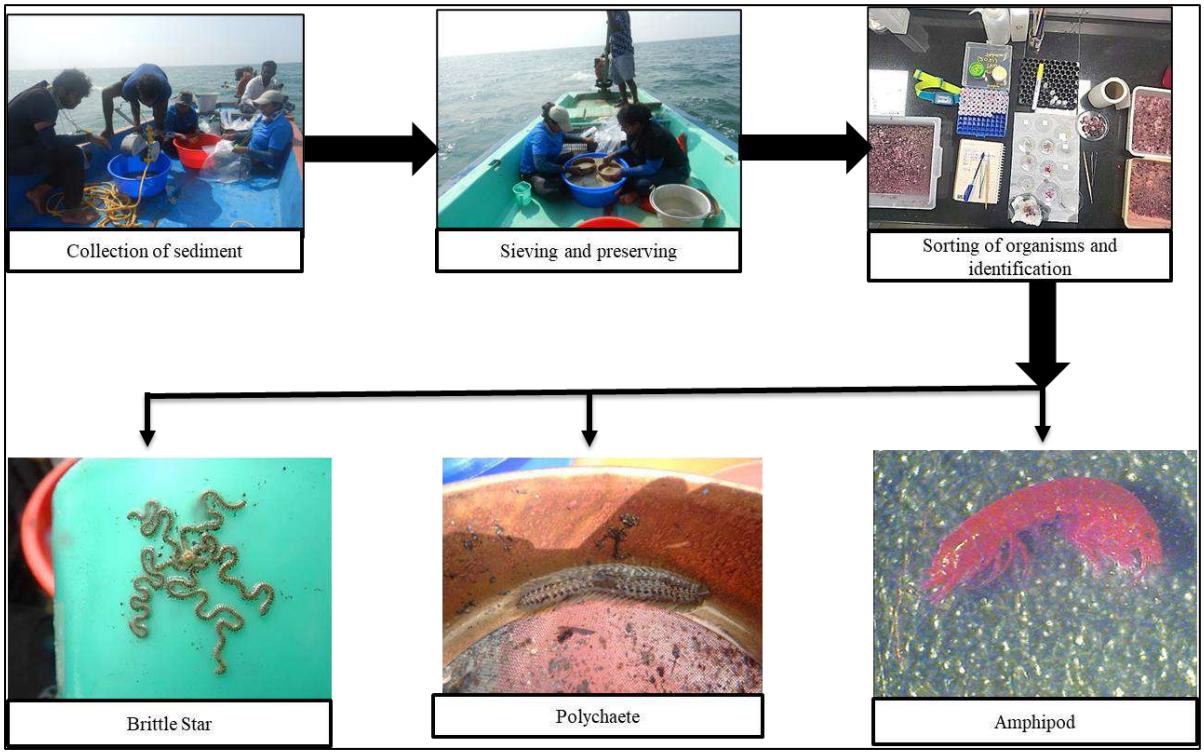


Figure 50. Methods for Seagrass associated macrobenthos assessment

Findings:

Vegetation Type: The average number of macrobenthic individuals are more in vegetated (seagrass) areas where as it is less in unvegetated (non-seagrass) areas.

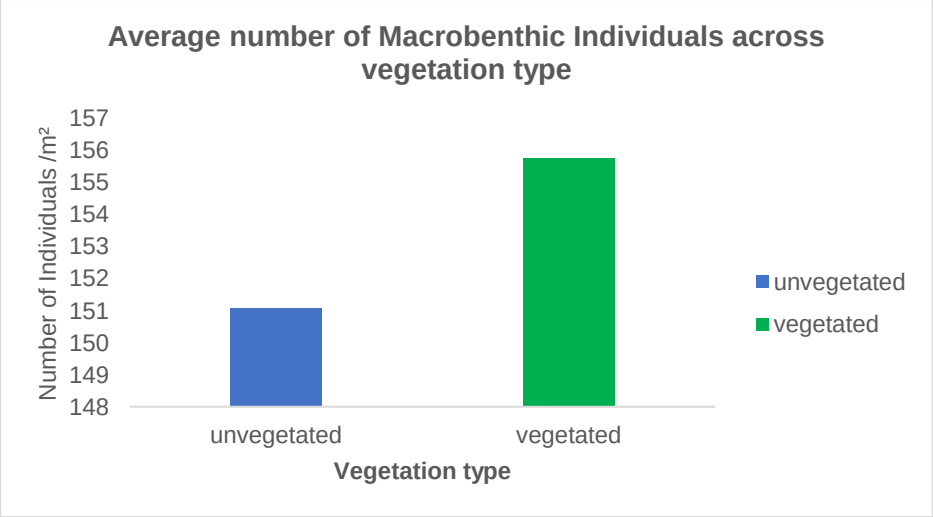


Figure 51. Average number of macrobenthic individuals found in respective vegetation type

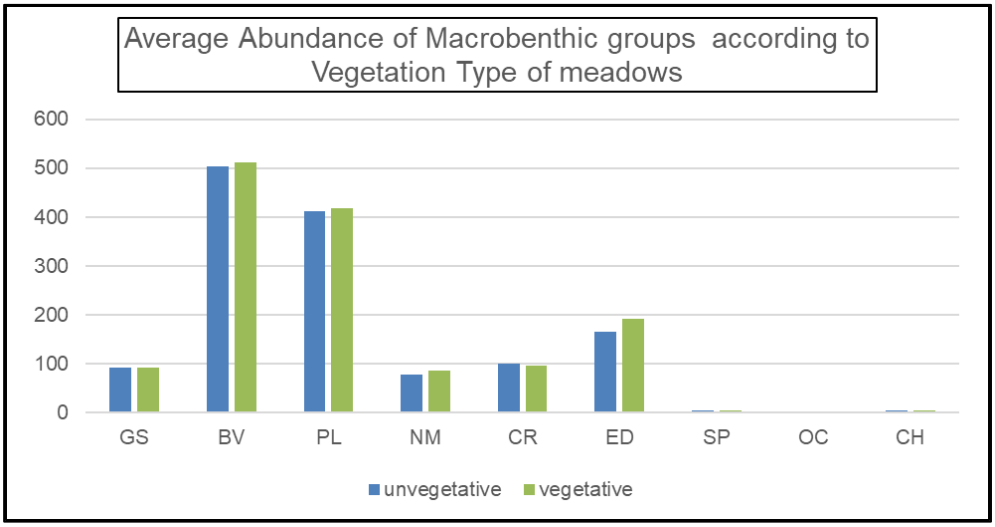


Figure 52. Average Abundance of Macrobenthic groups according to Vegetation Type

Species Composition of seagrass meadows: The composition of seagrass species can have influence on assemblages of Macrobenthic fauna. Species composition comprises of mixed and mono species i.e., Single seagrass species and multiple seagrass species respectively. Abundance of Gastropods, bivalves and Crustaceans are the high in mono species seagrass beds compared to mixed species seagrass beds. Number of polychaetes and nematodes do not differ according to vegetation type.

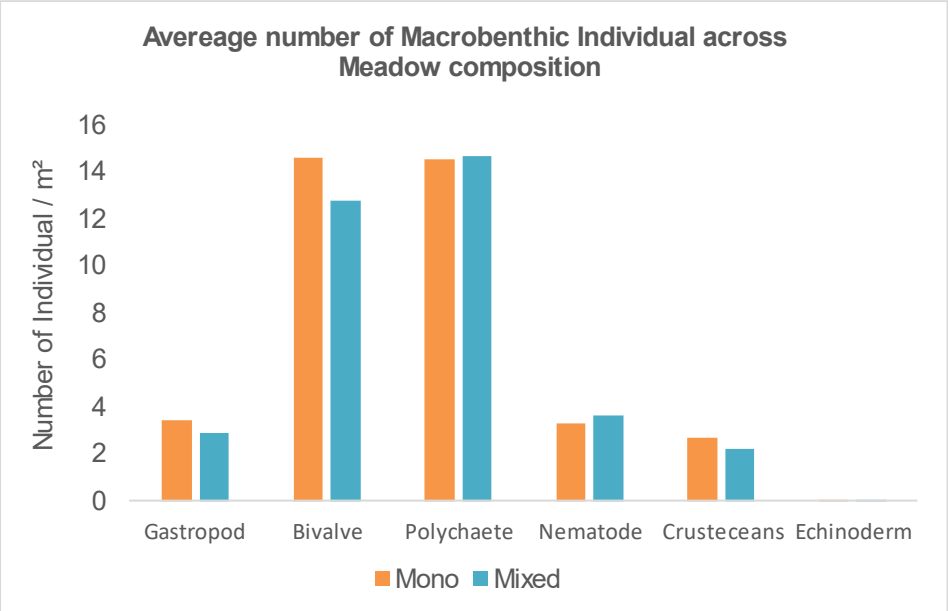


Figure 53. Average number of macrobenthic individuals found in mono and mixed seagrass species areas

1.5.4. Threat mapping in seagrass meadows

We assessed threats for dugongs and their habitats in Dugong Conservation Reserve by point counts at 10 sampling stations per transect. A total of 100-point counts were deployed for assessing threats. Two types of threats were recorded which are fishing activity and floating litter.

Findings: We observed a greater number of small boats than trawlers operating in Dugong conservation reserve (Figure 54). We observed various types of litter in the DCR in which Styrofoam litter was highest in count (Figure 55).

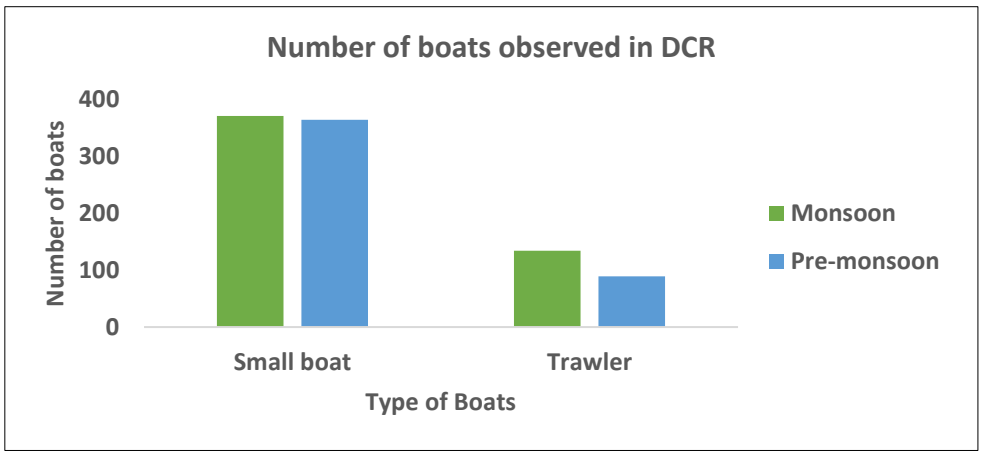


Figure 54. Number of boats observed in Dugong conservation reserve

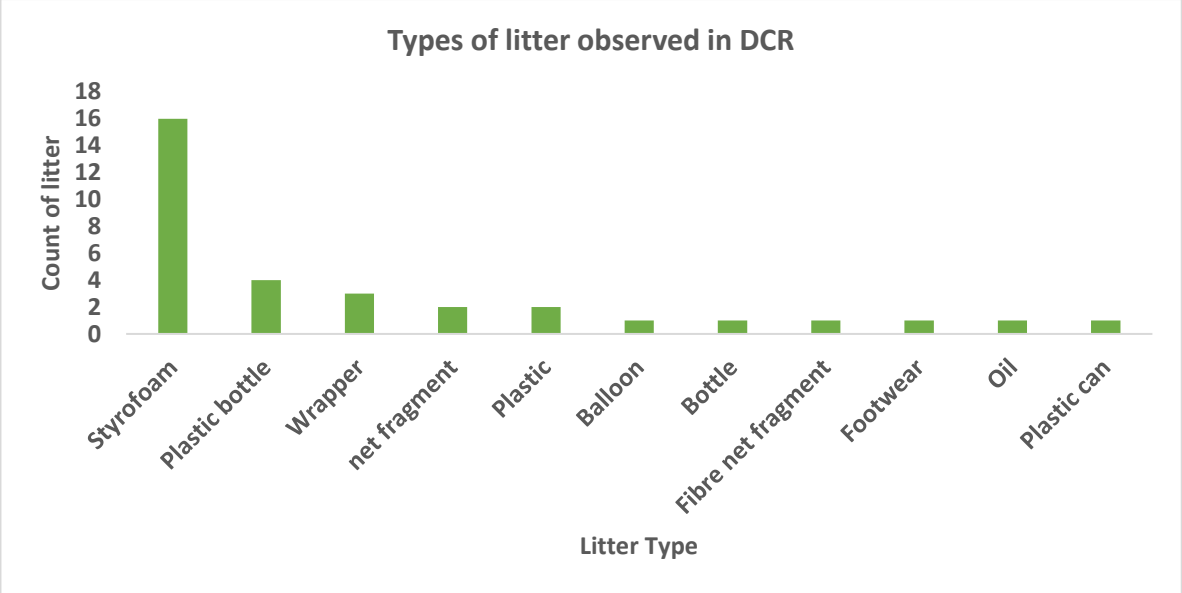


Figure 55. Types of litter observed in Dugong conservation reserve

Figure 56. Fishing Pressure and litter in Dugong conservation reserve

1.5.5. Marine mammal stranding records

1.5.5.1. Years; 2021 to 2022

A total of 9 deceased dugongs were reported between April 2021 and March 2022, seven of which were found in the Ramanathapuram district, one in Tuticorin and one in Tirunelveli district. One porpoise, one Kogia and three dolphins were found dead in the Ramanathapuram, Pudukkottai and Kanyakumari districts.

Table 8. *Information on dead dugongs reported in Palk Bay and the Gulf of Mannar in Tamil Nadu between April 2021 and March 2022*

Sl. No	Date	Place	District
1	11-05-2021	Pudumadam	Ramanathapuram
2	17-06-2021	Thondi	Ramanathapuram
3	05-09-2021	Kootapuli	Tirunelveli
4	08-09-2021	Mandapam	Ramanathapuram
5	08-09-2021	Mandapam	Ramanathapuram
6	11-09-2021	Pudupattinam	Ramanathapuram
7	27-09-2021	Mandapam	Ramanathapuram
8	19-10-2021	Tiruchendur	Tuticorin
9	14-03-2022	Periyapattinam	Ramanathapuram

Figure 57. 17-06-2021 Dugong stranded at Thondi

Figure 58. 22-10-2021 Dugong stranding at Tirchendur

Figure 59. 08-09-2021 Mother and calf stranding at Mandapam

Figure 60. 14-03-2022 Adult male stranded at Indra nagar beach, GOM

Figure 61. 06-07-2021 Kogia stranding at Kumarappanvayal village, Pudukkottai district

1.5.5.2. Years; 2022 to 2023

A total of 17 dead dugongs were reported between April 2022 and March 2023; Eight were from the Ramanathapuram district, five from Pudukkottai district, and two from Thanjavur district and two from Tuticorin district (Table 9).

Table 9. *Details of dead dugongs reported in Palk Bay and the Gulf of Mannar in Tamil Nadu between April 2022- March 2023*

Sl. No	Date	Place	District
1	08-04-2022	Thondi	Ramanathapuram
2	29-05-2022	Manora	Thanjavur
3	29-05-2022	Kilakarai	Ramanathapuram
4	30-05-2022	Kottaipattinam	Pudukkottai
5	05-06-2022	Sethubavachathiram	Thanjavur
6	07-06-2022	Pamban	Ramanathapuram
7	27-06-2022	Rajamadam	Ramanathapuram
8	26-07-2022	Avudiyarpattinam	Pudukkottai
9	31-08-2022	Tiruchendur	Tuticorin
10	14-10-2022	Pudumadam	Ramanathapuram
11	19-12-2022	Rameswaram	Ramanathapuram
12	21-12-2022	Pudumadam	Ramanathapuram
13	02-01-2023	Soliyakudi	Ramanathapuram
14	14-01-2023	Jegathapattinam	Pudukkottai
15	21-01-2023	Mumpalai	Pudukkottai
16	21-01-2023	Mumpalai	Pudukkottai
17	15-02-2023	Muthu Nagar	Tuticorin

Figure 62. Stranded Dugong necropsy was performed at Manora, Palk Bay

Figure 63. Stranded Dugong necropsy was performed at Manora, Palk Bay

Figure 64. Stranded Dugong necropsy was performed at Kilakara

Figure 65. Dugong stranding at Rajamadam

Figure 66. Dugong stranding at Avudiyarpattinam

Figure 67. Dugong stranding at Tiruchendur

Figure 68. Dolphin stranding at Therukku Pudukudi

Figure 69. Dolphin stranding at Avadaiyarpattinam

a) Dolphin stranding at Avadaiyarpattinam, Palk Bay

Date: 4th September 2022

Place: Avadaiyarpattinam

On 4th September, Dolphin stranding took place at Avadaiyarpattinam.

b) One rough toothed dolphin stranded in Kanyakumari coast on 23rd January 2022

Date: 23rd January 2022

Place: Kanyakumari

Figure 70. Rough toothed dolphin stranded in Kanyakumari

c) Porpoise has stranded on PV Pattinam coast

Date: 23rd January 2022

Place: Kanyakumari

A porpoise of about 1 and a half foot long has stranded on PV Pattinam coast very close to Thondi. It's 69 cm long (TL), 60cm (SL) and max. girth is about 42 cm.

Figure 71. Porpoise stranded at PV Pattinam

1.6. AWARENESS AND OUTREACH ACTIVITIES

1.6.1. Summary of awareness and outreach activities

In the field season 2021-2023, a total of 43 outreach and awareness activities were conducted to enlighten people about the species, its importance, and major project activities to the school and college students, teachers, locals, and fishermen. Out of 33 events, 22 events were conducted for awareness and scholarship and three meetings were conducted with different stakeholders like the forest department, dive schools and head of various schools to involve them in the conservation activity, as the involvement of local people is very crucial for any species conservation.

The purpose of outreach activities was to sensitize our important stakeholders about the importance of marine biodiversity (flora and fauna), and the role and importance of seagrass and Dugong habitats in the marine ecosystem. The major threats to biodiversity were also addressed by the people. Dugong comic books and pamphlets were distributed in the schools where awareness events and scholarship programs were continued, as pictorial guides are a helpful and effective measure to convey an important message to common people.

Table 10. *Details of outreach and awareness activities at Tamil Nadu.*

Sl. No.	Location	Date	Name of event	Type of stakeholders	Total number of people who attended the events
1.	Palk Bay	28th May 2021	World Dugong Day	School students and Locals	3000
2.	Karaikudi	2nd October 2021	Coastal Clean-Up Day Celebrations	Alagappa University teachers and students	40
3.	Thiruvarur	21st November 2021	World Fisheries Day	Locals	30
4.	Thanjavur	23rd December 2021	Fishermen felicitation program	Forest dept and fishermen	200

Sl. No.	Location	Date	Name of event	Type of stakeholders	Total number of people who attended the events
5.	Thondi	10th January 2022	Awareness program	School students	200
6.	Thondi	11th January 2022	Awareness program	School students	200
7.	Tamil Nadu	27th – 29th January 2022	Tamil Nadu Synchronized Bird Census-Phase I	College students	10
8.	Pariyathal	4th and 5th February 2022	Dugong conservation, sea turtle walk, and marine life awareness program	Forest department, college students, and school students	80+50=130
9.	Tamil Nadu	12th and 13th February 2022	Tamil Nadu Synchronized Bird Census-Phase II	College students	10
10.	Thanjavur	4th March 2022	Meeting with stakeholder	DFO, Thanjavur	3
11.	Tamil Nadu	5th to 11th March 2022	Webinar UNESCO Phase 1 Workshop	Fishermen community	14
12.	Tamil Nadu	21st March 2022	World forest day celebrations	Locals	14
13.	Kurusadai Island	27th April 2022	Biodiversity Awareness and Beach Cleanup	Divers, Athletes	100
14.	Tamil Nadu	30th April 2022	Biodiversity Awareness and Beach Cleanup	Locals	40

Sl. No.	Location	Date	Name of event	Type of stakeholders	Total number of people who attended the events
15.	Karaikudi	13th May 2022	Awareness program	Alagappa University Students	110
16.	Ramanathapuram	17th May 2022	Awareness program	Mohammed Sathak Dastagir B.Ed. college students	110
17.	Palk Bay	23rd May 2022	Awareness program	Fisher community	20
18.	Mandapam	23rd May 2022	Awareness program	Indian Coast Guard at Mandapam	12
19.	Palk Bay	23rd to 25th May 2022	Awareness programs	Fisher community	20
20.	Palk Bay	27th May 2022	Beach Cleanup programs and awareness rally	Dive school, Forest dept and school students (40)	60
21.	Palk Bay	28th May 2022	Dugong day celebration	School students	30
22.	Thondi	28th May 2022	Dugong awareness rally	Locals	50
23.	Palk Bay	28th May 2022	Awareness program	Fisher locals	40
24.	Tamil Nadu	5th June 2022	World Environment Day	Indian coast guard	80
25.	Kodimunnai	1st July 2022	Meeting for Opening ceremony of Kodimunnai Ecotourism	Forest department	15
26.	Palk Bay	28th May 2022	Dugong day celebration	School students	30

Sl. No.	Location	Date	Name of event	Type of stakeholders	Total number of people who attended the events
27.	Thondi	28th May 2022	Dugong awareness rally	Locals	50
28.	Palk Bay	28th May 2022	Awareness program	Fisher locals	40
29.	Tamil Nadu	5th June 2022	World Environment Day	Indian coast guard	80
30.	Kodimunnai	1st July 2022	Meeting for Opening Ceremony of Kodimunnai Ecotourism	Forest department	15
31.	Pirapanvalasai	6th July 2022	Meeting with stakeholders	Forest department and locals	3
32.	Ramnad	15th August 2022	Felicitation program	Forest dept and locals	150
33.	Thanjavur, Pudukudi, and Ramanathapuram	8-29th September 2022	Meeting with stakeholders	School teachers and principal	30
34.	Pirapanvalasai	12th September 2022	Awareness program	School students	60
35.	Pattukkottai	15th September 2022	Awareness workshop	College students and NGO	80
36.	Thoothukudi	26th September 2022	Meeting with stakeholder	Forest dept IFS officer	2
37.	Kumbakonam	4th October 2022	Meeting with stakeholders	IAS officer	4
38.	Ramnathpuram	17th November 2022	Meeting with stakeholders	IAS officer	4

Sl. No.	Location	Date	Name of event	Type of stakeholders	Total number of people who attended the events
39.	Ramnathpuram	30th November 2022	Meeting with stakeholders	IAS officer	4
40.	Manora	10th January 2023	Felicitation program	Forest department, locals	25
41.	Thangachimadam	2nd February 2023	Felicitation program	Forest department, locals	35
42.	Kalpar, Kuthukal Valasai, and Natarajapuram village	4th,5th and 7th March 2023	Awareness program	Fisher community, IFS Officers, Forest Department	231
43.	Manamelkudi	14th March 2023	Awareness program	Locals	50

In this field season 2021-2023, school and college students and locals were targeted as the children in the learning phase, and the understanding phase is our supreme stakeholder. Children's involvement is beneficial to save the species in the long run. The second highest targeted stakeholders were locals, as the knowledge and experience of fishermen and locals are important to conserve the species on the ground.

Figure 72. Activities conducted at Tamil Nadu.

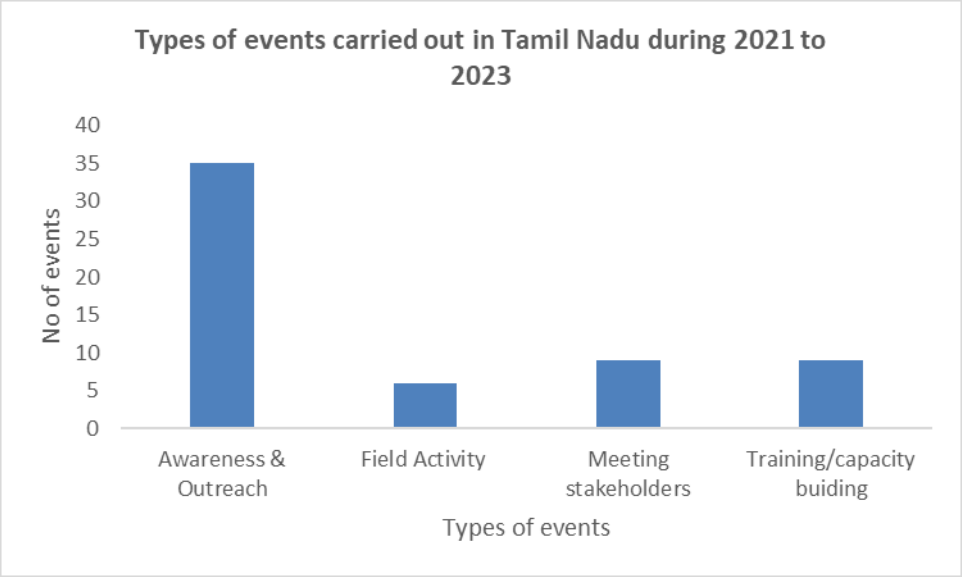


Figure 73. Details of various events conducted in Tamil Nadu during the field season

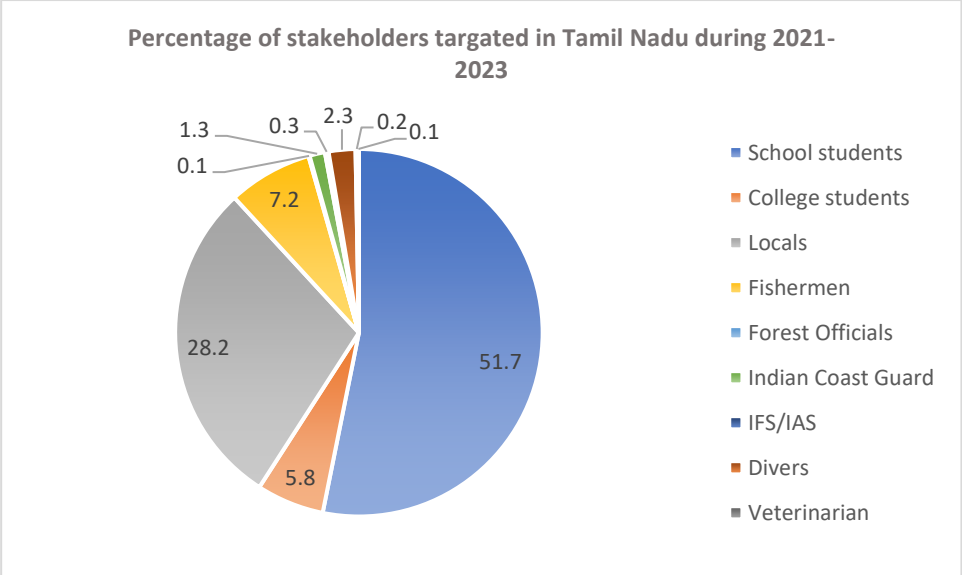


Figure 74. Percentage of stakeholders targeted in Tamil Nadu during 2021- 2023

1.6.2. Dugong Scholarship Program

One of the project's objectives is to get fishermen communities' support in conserving dugongs. In this context, it is planned to reach out to the fishermen's parents through their school-going children. In this connection, it is planned to provide 'Dugong Scholarships' to 60 schools-going children of fishermen communities for two years Rs.500/month, on a merit basis through a competitive exam. In Tamil Nadu, we have completed three years of the dugong scholarship program from July 2017 to July 2022.

Till now, a total of 447 students have been awarded the dugong scholarship and the students selected under this program are identified as Dugong ambassadors.

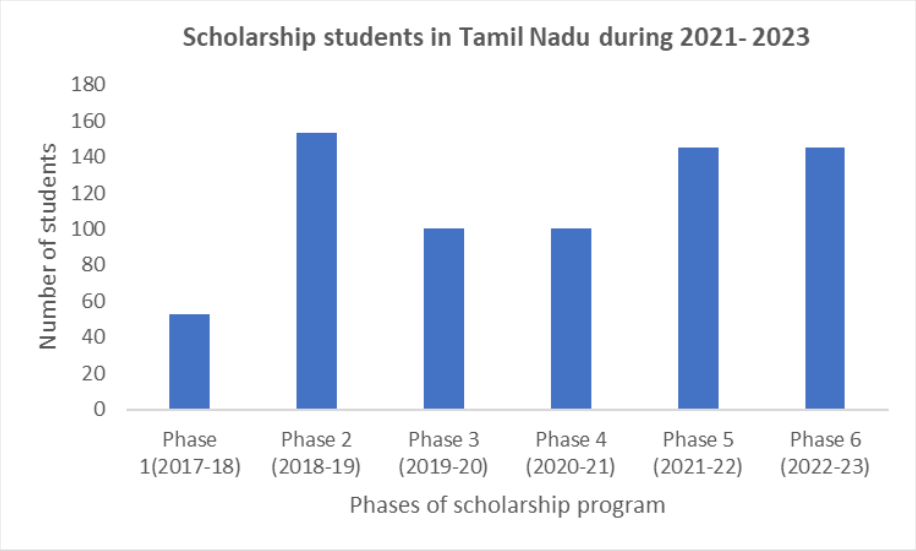


Figure 75. Number of students awarded scholarship over three years at Tamil Nadu

Table 11. *Details of Dugong Scholarship in different areas of Tamil Nadu*

Sl. No.	School Name	Village/ Town	District	Phase					
				1	2	3	4	5	6
				2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
1	Govt. Girls Hr. Sec. School, Adiramapattinam	Adiramapattinam	Thanjavur	**2**	**5**	**3**	**3**	**4**	**4**
2	Govt. Hr. Sec. School, Rajamadam	Rajamadam	Thanjavur	**4**	**5**	**1**	**1**	**6**	**6**
3	Govt. Hr. Sec. School	Mallipattinam	Thanjavur	**4**	**7**	**3**	**3**	**3**	**3**
4	Govt. High School, Sethuma Chathiram	Sethuma Chathiram	Thanjavur	**2**	**5**	**3**	**3**	**5**	**5**
5	Govt. High School, Pudutheru	Pudutheru	Thanjavur	**2**	**3**	**1**	**1**	**2**	**2**
6	Govt. Hr. Sec. School, Kattumavadi	Kattumavadi	Pudukkottai	**4**	**6**	**2**	**2**	**3**	**3**
7	Govt. Boys Hr. Sec. School, Manamelkudi	Manamelkudi	Pudukkottai	**4**	**5**	**1**	**1**	**2**	**2**
8	Govt. Girls Hr. Sec. School, Manamelkudi	Manamelkudi	Pudukkottai	**4**	**6**	**2**	**2**	**6**	**6**

Sl. No.	School Name	Village/ Town	District	Phase					
				1	2	3	4	5	6
				2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
9	Govt. Hr. Sec. School, Jagathapattinam	Jagathapattinam	Pudukkottai	**2**	**3**	**1**	**1**	**1**	**1**
10	Govt. Hr. Sec. School, Kottaipattinam	Kottaipattinam	Pudukkottai	**4**	**5**	**1**	**1**	**1**	**1**
11	Govt. Hr. Sec.	Gopalapattina	Pudukkottai	**0**	**1**	**1**	**1**	**1**	**1**
12	Govt. Hr. Sec. School, Mimisal	Mimisal	Pudukkottai	**4**	**6**	**2**	**2**	**3**	**3**
13	Govt. High School, Vattanam	Vattanam	Ramanathapuram	**2**	**3**	**1**	**1**	**2**	**2**
14	Govt. Hr. Sec. School, S.P. Pattinam	S. P. Pattinam	Ramanathapuram	**1**	**2**	**1**	**1**	**1**	**1**
15	Govt. Hr. ec. School, Solaganpett ai	Solaganpettai	Ramanathapuram	**1**	**1**	**0**	**0**	**1**	**1**
16	Wilhelm High School, Thondi	Thondi	Ramanathapuram	**1**	**1**	**0**	**0**	**0**	**0**
17	IMMS HR. Sec. School, Thondi	Thondi	Ramanathapuram	**2**	**2**	**0**	**0**	**0**	**0**
18	S. M. Govt. Hr. Sec. School, Thondi	Thondi	Ramanathapuram	**4**	**6**	**2**	**2**	**2**	**2**
19	Govt. Girls Hr. Sec. School, Thondi	Thondi	Ramanathapuram	**2**	**4**	**2**	**2**	**4**	**4**
20	Govt. High School, Nambuthalai	Nambuthalai	Ramanathapuram	**2**	**4**	**2**	**2**	**1**	**1**
21	Amala Annai Hr. Sec. School, Karangkadu	Karangkadu	Ramanathapuram	**2**	**5**	**3**	**3**	**4**	**4**
22	Govt. Hr. Sec. School, Uppoor	Uppoor	Ramanathapuram	**0**	**3**	**3**	**3**	**1**	**1**
23	Govt. Hr. Sec. School, Tiruppalaikudi	Tiruppalaikudi	Ramanathapuram	**0**	**3**	**3**	**3**	**1**	**1**
24	Govt. High School, Sambai	Sambai	Ramanathapuram	**0**	**1**	**1**	**1**	**1**	**1**
25	Govt. Hr. Sec. School, Devipattinam	Devipattinam	Ramanathapuram	**0**	**1**	**1**	**1**	**2**	**2**
26	Mohamedia Hr. Sec. School, Chittar Kottai	Chittar Kottai	Ramanathapuram	**0**	**2**	**2**	**2**	**2**	**2**
27	Govt. High School, Palanivalasai	Palanivalasai	Ramanathapuram	**0**	**1**	**1**	**1**	**1**	**1**

Sl. No.	School Name	Village/ Town	District	Phase					
				1	2	3	4	5	6
				2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
28	Arabi Oliyullah High School, Puduvalasai	Puduvalasai	Ramanathapuram	0	1	1	1	1	1
29	Govt. Girls Hr. Sec. School, Panaikulam	Panaikulam	Ramanathapuram	0	2	2	2	2	2
30	Bahrurdin Govt. Boys High School, Panaikulam	Panaikulam	Ramanathapuram	0	1	1	1	2	2
31	Govt. Hr. Sec. School, Alagankulam	Alagankulam	Ramanathapuram	0	2	2	2	1	1
32	Govt. Hr. Sec. School, Uchipulli	Uchipulli	Ramanathapuram	0	3	3	3	1	1
33	Govt. Hr. Sec. School, Irumeni	Irumeni	Ramanathapuram	0	2	2	2	3	3
34	Govt. Hr. Sec. School, Vedalai	Vedalai	Ramanathapuram	0	5	5	5	3	3
35	Govt. Hr. Sec. School, Mandapam Camp	Mandapam Camp	Ramanathapuram	0	1	1	1	3	3
36	Govt. Girls Hr. Sec. School, Mandapam	Mandapam	Ramanathapuram	0	4	4	4	5	5
37	Govt. Hr. Sec. School, Pamban	Pamban	Ramanathapuram	0	1	1	1	2	2
38	Govt. Hr. Sec. School, Thangachimadam	Thangachimadam	Ramanathapuram	0	3	3	3	3	3
39	Punitha Yagappar Hr. Sec. School	Thangachimadam	Ramanathapuram	0	4	4	4	5	5
40	Govt. Hr. Sec. School, Rameswaram	Rameswaram	Ramanathapuram	0	6	6	6	2	2
41	Govt. High School, Karaiyur	Karaiyur	Ramanathapuram	0	2	2	2	2	2
42	Govt. Hr. Sec.	Pudumadam	Ramanathapuram	0	2	2	2	2	2
43	Govt. Girls Hr. Sec. School, Pudumadam	Pudumadam	Ramanathapuram	0	1	1	1	2	2
44	Govt. High School, Thamaraikul am	Thamaraikulam	Ramanathapuram	0	1	1	1	2	2
45	Govt. Hr. Sec. School, Periyapattinam	Periyapattinam	Ramanathapuram	0	2	2	2	5	5
46	Govt. high School, Kalimankun du	Kalimankundu	Ramanathapuram	0	1	1	1	1	1

Sl. No.	School Name	Village/ Town	District	Phase					
				1	2	3	4	5	6
				2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
47	Govt. Hr. Sec. School, Thinaikulam	Thinaikulam	Ramanathapuram	**0**	**2**	**2**	**2**	**4**	**4**
48	Mahdhoomi a Hr. Sec. School, Kilakarai	Kilakarai	Ramanathapuram	**0**	**1**	**1**	**1**	**2**	**2**
49	Islamiah High School, Kilakarai	Kilakarai	Ramanathapuram	**0**	**1**	**1**	**1**	**1**	**1**
50	Hameediah Girls Hr.Sec. School, Kilakarai	Kilakarai	Ramanathapuram	**0**	**2**	**2**	**2**	**3**	**3**
51	Hameediah Boys Hr. Sec. School, Kilakarai	Kilakarai	Ramanathapuram	**0**	**1**	**1**	**1**	**2**	**2**
52	Govt. Hr. Sec. School, Ervadi	Ervadi	Ramanathapuram	**0**	**6**	**6**	**6**	**4**	**4**
53	Govt Hr Sec School, Thirupullani	Thirupullani	Ramanathapuram	**0**	**0**	**0**	**0**	**2**	**2**
54	Govt High School, Valinokkam	Valinokkam	Ramanathapuram	**0**	**0**	**0**	**0**	**2**	**2**
55	Govt Hr Sec School, T.Mariyur	T.Mariyur	Ramanathapuram	**0**	**0**	**0**	**0**	**4**	**4**
56	Govt Hr Sec School, Kannirajapuram	Kannirajapuram	Ramanathapuram	**0**	**0**	**0**	**0**	**1**	**1**
57	Govt Hr Sec School, Sayalkudi	Sayalkudi	Ramanathapuram	**0**	**0**	**0**	**0**	**1**	**1**
58	Govt. High School, Chozhaganpettai	Chozhaganpettai	Nagapattinam	**0**	**0**	**0**	**0**	**1**	**1**
59	Govt Hr Sec School, Vembar	Vembar	Thoothukudi	**0**	**0**	**0**	**0**	**1**	**1**
60	St.Louis Hr Sec School, Keezhavaippar	Keezhavaippar	Thoothukudi	**0**	**0**	**0**	**0**	**6**	**6**
61	Govt Hr Sec School, Tharavaikulam	Tharavaikulam	Thoothukudi	**0**	**0**	**0**	**0**	**3**	**3**
	Total			**53**	**153**	**100**	**100**	**144**	**144**

1.7. CAPACITY BUILDING PROGRAMS CONDUCTED AT TAMIL NADU

Community perspectives and conservation needs for dugongs. Various approaches, from stakeholder consultations, orientation workshops, oral presentations, community workshops, hands-on training, field visits, etc, were utilized to sensitize and train the stakeholders in dugong conservation and seagrass habitat monitoring. In the field

season 2021-22, we conducted nine capacity-building programs around Palk Bay and the Gulf of Mannar, Tamil Nadu to raise awareness about the importance of dugongs and their habitats and the need for conservation. Out of these events, five were conducted for awareness, and scholarship and five meetings were conducted with different stakeholders (Table 11). The dugong recovery program has been supported by multiple stakeholders across Tamil Nadu.

Table 12. *Details of capacity-building programs conducted in different areas of Tamil Nadu in the year 2021-22*

SN	Location	Date	Name of event	Type of stakeholders	The total no of people who attended the events
1.	Tamil Nadu	18th May 2021	Underwater marine biodiversity monitoring training	The state forest department, fisheries department, and coastal security group	35
2.	Coimbatore	7th October 2021	Field Training	State Forest Service Officers	30
3.	Thondi	11th and 23rd October 2021	Demonstration of drone operation	Marine police	5
4.	Thanjavur	23rd October 2021	Drone Orientation Workshop	Forest Department	18
5.	Pudukottai	27th October 2021	Drone Orientation Workshop	Forest Department	21
6.	Raweswarm	9th to 15th March 2022	Training on alternative livelihood	Local coastal communities	30

SN	Location	Date	Name of event	Type of stakeholders	The total no of people who attended the events
7.	Gulf of Mannar	11th to 14th July 2022	Diploma IFS training	IFS	10
8.	Tamil Nadu	15th September 2022	Dugong Conservation Workshop	College Students	85
9.	Rameswaram	17th to 19th October 2022	Marine Mammal Stranding Response Workshop	Forest dept, Veterinarians	15

1.8. OUTPUTS AND ACCOMPLISHMENTS

1.8.1. Research and Monitoring

- Intensive aerial monitoring for understanding dugong distribution and threat density in was conducted in Dugong Conservation Reserve (DCR), North Palk Bay.
- Sightings of a dugong herd and a mother-calf pair emphasize DCR's significance as a vital breeding habitat for the species.
- Our findings also highlight the importance of seagrass habitats as fishing grounds.
- The baseline biodiversity survey of DCR has been translated into a detailed management plan for better management of country’s first dugong conservation reserve.
- Maps of seagrass distribution in Palk Bay and Gulf of Mannar have been created.

1.8.2. Outreach, awareness and Capacity Building

- Around 5000 people across Palk Bay and Gulf of Mannar were sensitized through 43 awareness events.

- 250 people were trained in different capacity building activities such as Underwater marine biodiversity monitoring training, Drone trainings, training on alternative livelihood etc.,
- The first national level Marine mammal stranding response workshop for forest officers and veterinarians which included hands-on training for stranding response for both live and dead marine mammals.
- A Manual on Marine Mammal Stranding Response was published detailing handling protocols for stranded marine mammals has been published.
- Twenty-one forest officials were trained for drone flying and its implications in marine biodiversity surveys.

1.9. MANAGEMENT RECOMMENDATIONS

In the Dugong Conservation reserve (DCR) area, competent management in accordance with the detailed management plan is important. Field observations indicate that threats to dugongs and seagrasses must be controlled through constant patrolling and tighter enforcement of existing rules and regulations. A continuous monitoring for dugongs and their habitats through modern approaches such as aerial surveys will be key factor for conservation management.

As dugong mortality is prominent in the conservation reserve area, human induced threats such as nets, boat traffic and pollution need a better management implementation in the area. The mobile rapid response team should be set up to handle marine mammal stranding events in DCR as well as adjoining areas.

Alternative livelihood opportunities for fishermen should be introduced in order to lessen local communities' dependency on the DCR through fishing. The DCR is an ideal location for educational tourism focused on marine habitats. The DCR's tourism potential can be translated into a sustainable tourism strategy that involves local people and provides them with alternative livelihood options in sectors such as hotels, water sports, transportation, and so forth.

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1.10. RESEARCH AND MONITORING

1.10.1. Dugong population estimation

1.10.1.1. Understanding dugong distribution in the Islands through a Participatory multi stakeholder citizen science approach

Understanding dugong distribution in the islands is the pre-requisite to direct management interventions towards conserving the species. Owing to the geographical vastness, subsequent inaccessibility of sites and field limitations, a citizen science-based approach called the 'Dugong Monitoring Program' was initiated in 2017, targeting the sea-faring stakeholders. The primary mandate of this approach was to help understand dugong distribution in the Islands and identify key hotspots for dugong management and conservation.

Methodology: From 2021 to 2023, we spatially expanded our dugong monitoring program from the North & Middle Andaman to Great Nicobar Islands. Previously identified stakeholders such as, fishers, Forest Department, Indian Navy, Indian Coast Guard, Marine Police, Tribal Protection Police Force, and tourism allied sectors (SCUBA divers, glass bottom boat operators) were re-engaged. All the stakeholders involved in the dugong monitoring network were followed up monthly via phone call to collect data regarding dugong sightings. Details such as total number of individuals, age class, location, photographs, and videos of sighted dugongs were recorded to dugong occurrence hotspots in the islands.

Findings: A total of 26 programs were conducted targeting 771 personnel of the afore-mentioned stakeholder groups, through which we received a total of 203 dugong sightings (Table 13).

Table 13. *Summary of different stakeholders engaged in dugong monitoring network*

Type of Stakeholders	Number of Programs	Number of Participants
Fishers	9	285
Defence Bodies (Indian Navy and Indian Coast Guard)	7	236
Forest Department	8	200
Tribal Protection Police Force	2	50

Type of Stakeholders	Number of Programs	Number of Participants
Total	13	771

Fishers contributed the highest number of sightings, i.e., 47.79%, followed by defence bodies (Indian Navy and Indian Coast Guard) (25.74%), and remaining by forest department, and tourism allied sectors (Figure 1). Maximum reported sightings were of solitary individuals (73.13%) followed by pairs (19.40%) and remaining 7.27 % constituted aggregating herds of 3-5 individuals (Figure 1). Citizen scientists from the Indian Coastguard also provided a one-time report of a herd of 13 individuals, a very rare observation (Gole et al., 2023). Additionally, we also received sightings Little Andaman, and Nicobar region where dugongs were speculated to be locally extinct (D'Souza et al., 2013; Figure 162).

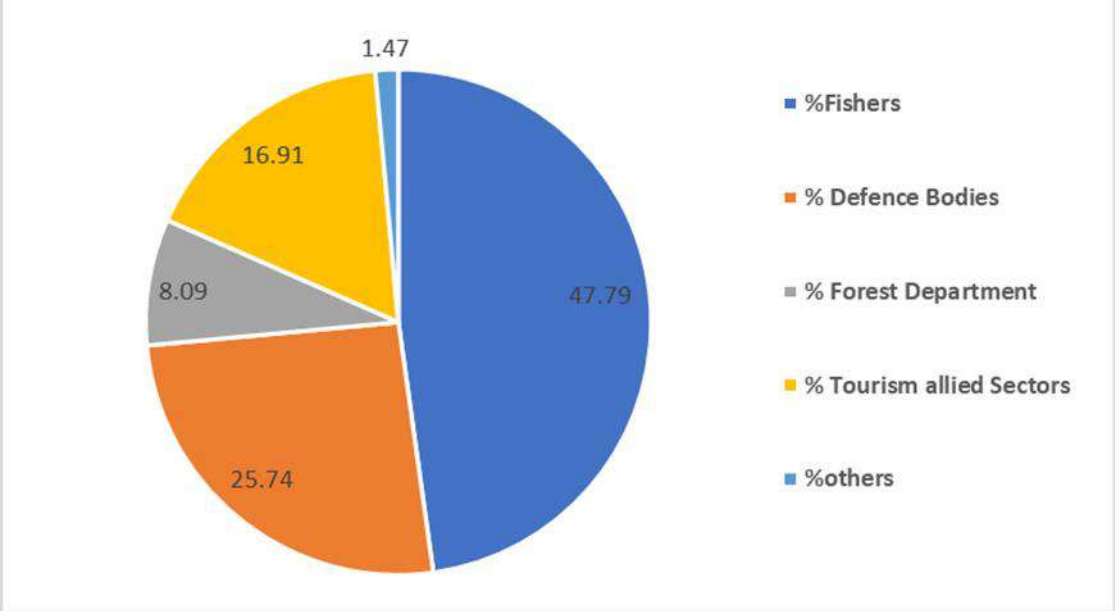


Figure 76. Stakeholders specific sighting reports in the Andaman & Nicobar Islands, India

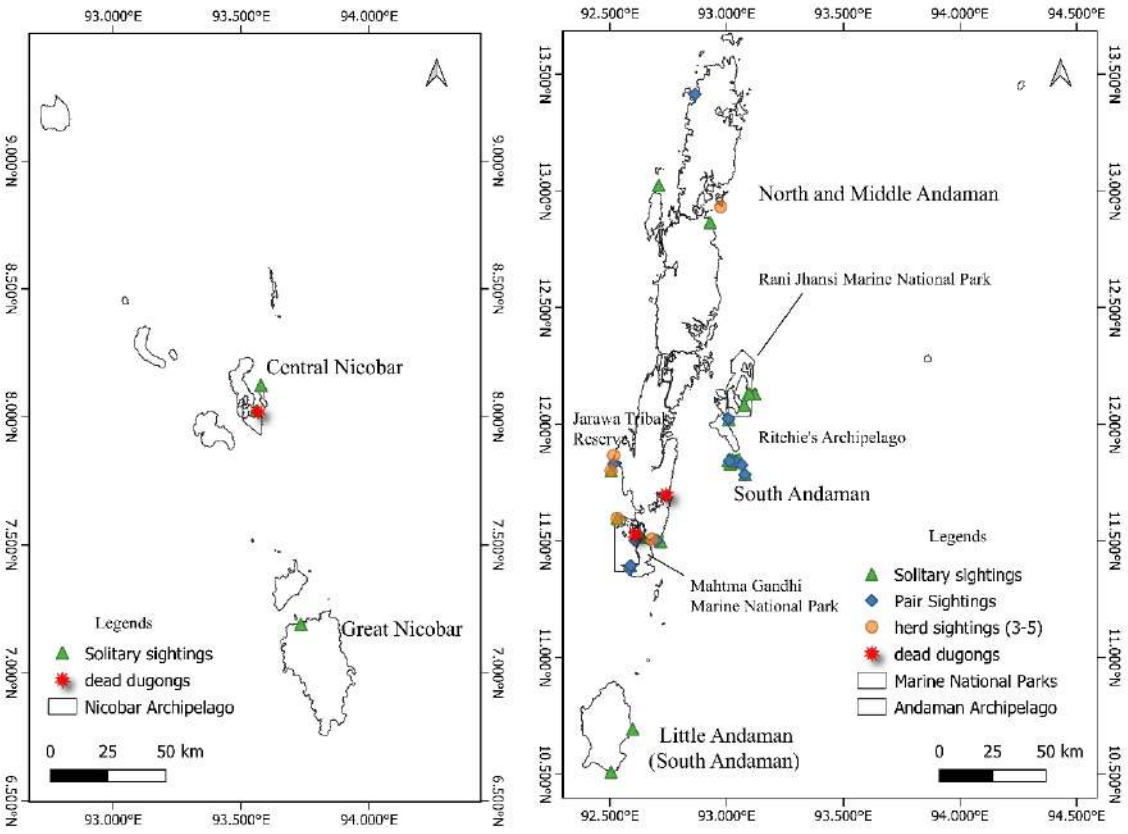


Figure 77. Dugong distribution in the Andaman and Nicobar Islands based on the marine citizen science database

Major Outcomes:

1) Presence of dugongs confirmed from Little Andaman, this being the first photo-documented validation after Indian Ocean tsunami, 2004

2) Dugong distribution coldspots filled, since many of the sightings are from tribal protected areas and defence restricted regions.

1.10.1.2. Aerial Survey Report of Andaman Nicobar Islands

Unmanned Aerial Vehicles (UAVs) are widely undertaken in the study of marine mammals globally, as they cover larger spatial scales in a shorter duration and significantly reduce the survey effort. They are also known to cause less disturbance to the wildlife and are a cheaper alternative thus they are widely used. UAV surveys serve as an extremely useful tool for marine mammal distribution and population studies, especially for species thriving in shallow coastal waters like dugongs. Dugongs being marine herbivores spend most of the seagrasses in coastal waters and surface every 5-6 minutes, making their detectability using drones much easier,

as compared to oceanic marine mammals which dive for longer intervals in deep seas. The surveys were conducted to attempt an assessment of dugong population. The study was carried out in Critical Dugong Habitats of Andaman and Nicobar Islands, in North Andaman, South Andamans and Central Nicobar Group of islands. In North Andaman Islands, areas around Diglipur, namely Table Dalgerno Island, Table Excelsior Island and Turtle Island. In South Andamans, surveys weren undertaken at Mahatma Gandhi Marine National Park at Wandoor, Grub Island, Redskin Island, Alexandria Island, Boat Island, Tarmugli Island, Jollybuoy Island, Rutland and Pungibalu. Surveys were also undertaken at Badabalu, Chidyatapu, Kurmadera beach and Collinpur beach. In Ritchie's Archipelago, surveys were undertaken across Swaraj Dweep, Shaheed Dweep, Sir Henry Lawrence Island, Juaa Tikrii and Inglis Island. In Central Nicobar Islands, surveys were undertaken at Pilpillow, Kakana, Trinket Basti, Nikalang, Safed balu, Navy Dera, Vikas Nagar or Chota Inak.

Methodology:

Systematic Aerial Surveys

Aerial surveys were undertaken using the DJI Mavic 2 Pro UAV manufactured by SZ DJI Technology, which is a micro quadcopter with 4 rotors weighing 907g. The flights were planned systematically, with survey locations chosen at a distance of 2 km from each other. From every survey location, 2 flights were undertaken, with a transect length of 3 kms spaced 300 meters apart. The flights were planned using the Litchi Hub application. Fixed width transect sampling was undertaken according to the standard methodology suggested by Raoult et al. 2020 for studying sirenians. The altitude of the flight was kept constant at 100 meters with a speed of 35 km/hr. The width of the survey strip was 75 meters. Continuous video was recorded during each flight and the videos were then saved in external hard drives for further analysis. Surveys were undertaken with a glare less than 50% and sea-state of 0-4 on the Beaufort scale at morning or evening hours. These surveys were undertaken from November 2021 to Jan 2022.

Aerial Scan Focal Sampling

Aerial surveys were undertaken using the DJI Mavic 2 Pro and DJI Mavic Zoom UAV manufactured by SZ DJI Technology, which is a micro quadcopter with 4 rotors weighing 907g and 905g respectively. Aerial Scan Focal Sampling was undertaken

with the main objective to detect dugongs. After detection, the dugong was focal followed at an altitude of 30m at a camera angle of -90°. Video was recorded after each detection and saved in external hard drives for further analysis. This was with aim of studying the ecology of dugongs.

Figure 78. Aerial Survey Study design representation

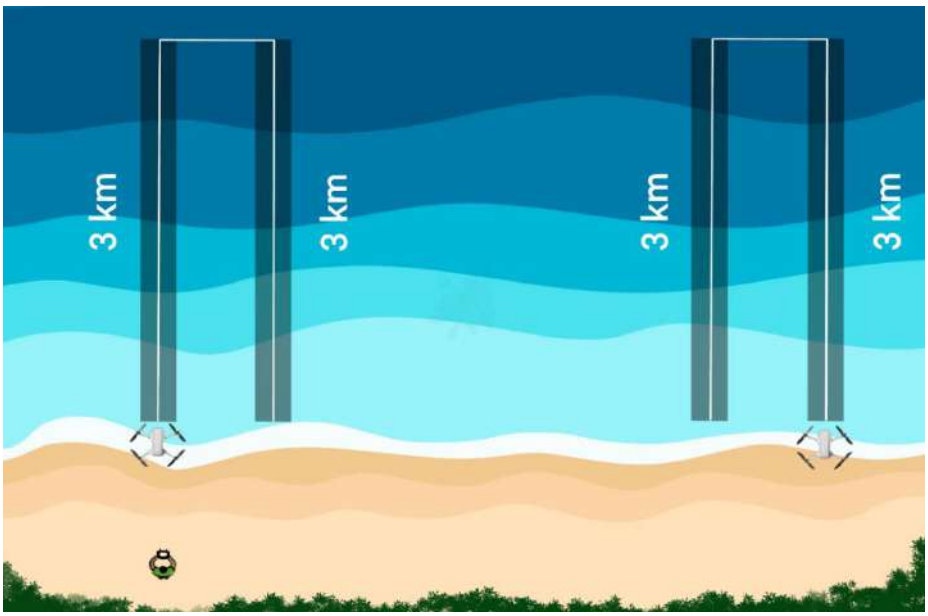


Figure 79. Representation of aerial sampling using fixed winged aerial transects

Figure 80. View of the drone footage during focal follow sampling.

Findings: A total of 16 transects were undertaken in North Andamans, 36 transects in Mahatma Gandhi Marine National Park and Chidyatapu, Pungi Balu and Collingpur, 30 Transects in Ritchie's Archipelago and 28 transects in Central Nicobar Island.

Dugongs were detected during the surveys in North Andamans, South Andamans and in Ritchie's Archipelago. No dugongs were detected in Central Nicobar Group. The videos were recorded and analysed. The dugong encounter rates were calculated for Ritchie's Archipelago to be 1 dugong detection per 0.6 km^2. The dugong encounter rates were calculated for Mahatma Gandhi Marine National Park to be 1 dugong detection per 1.85 km^2. The videos of North Andamans are being analysed. The threats were recorded and the threat intensities are being analysed.

Figure 81. Herd of dugongs sighted at Tarmugli Island, Mahatma Gandhi MNP.

Figure 82. Dugong sighted with a non-pigmented skin scar/markings at Henry Lawrence Island

Figure 83. Dugong sighted at Swaraj Dweep at Vijay Nagar Beach during behavioural focal sampling.

Figure 84. Dugong sighted at Swaraj Dweep at Vijay Nagar Beach during behavioural focal sampling

Figure 85. Pod of Dolphins sighted at Table Dalgerno Island, North Andaman

Focal Follow

Dugongs detected were focal followed, and behavioural observations were recorded in the form of videos. The behaviors of dugongs were classified and ethograms were made. The behavior was classified as follows-

1) Feeding and Foraging – a) With feeding plumes and b) Without feeding plumes.
2) Traveling
3) Socializing
4) Herding
5) Mother and calf
6) Rolling
7) Surfacing

The behaviour analysis is currently ongoing with the help of Boris Software with Time Activity Budget graphs are being made. Average surfacing intervals of dugongs is also being calculated for more insights on dugong behaviour.

1.10.2. Seagrass survey

1.10.2.1. Habitat Characterization of seagrass habitats in 'Critical Dugong Habitats

Seagrasses are globally recognized as crucial marine ecosystems which are known to offer an array of socio-ecological services. Seagrasses provide nursery grounds for

commercially important species (fishes and invertebrates) and act as only direct food source for megaherbivores like dugongs. In this crucial ecological context, understanding seagrass distribution and status, and delineating important dugong foraging grounds is critical to dugong conservation in the Islands. Seagrass meadows in the Andaman & Nicobar Islands are equally vulnerable to natural stressors (recurrent cyclones/ tsunami), as they are to anthropogenic pressures. In addition, the nature of seagrass exploration is sporadic, due to conducting field-based surveys, remoteness of the regions, funds, and logistics. This critically hinders comparison to understand the changes and status of these meadows over space and time. Since, there is no long-term seagrass monitoring program in the Islands, it is imperative to consistently perform seagrass exploration to complement previous research, which collectively could offer a robust management baseline. With a similar aim, we carried out seagrass exploration in the Islands, particularly targeting the data-deficient regions.

Methodology:

Intensive Seagrass exploratory surveys: Intertidal (on foot) and sub-tidal (using SCUBA)

For seagrass meadow characterization, we deployed 50 m Line Intercept Transects (LIT), and recorded species composition, seagrass cover, and habitat profile. LIT'S (n=78) were laid perpendicular to shore and at each site three replicates were taken spaced apart 150-200m. On this line at every 5m; a 50 X 50 cm quadrat was used to record the meadow characteristics. For biomass, shoot density and shoot length estimation three samples (from 0m, 25m and 50m on the transect line) were collected using a 20 X 20 cm quadrat area within the larger (50 x 50cm) quadrat of one shoot length, total biomass (above and below ground, dry weight) and non-epiphytic algal cover using McKenzie and Yoshida (2012) LIT.

Findings: Total 11 species were recorded from the present study such as; *Enhalus acoroides, Halophila ovalis, Halophila beccarii, Halophila decipiens, Halophila minor, Halodule pinifolia, Halodule uninervis, Syringodium isoetifolium, Cymodocea serrulata, Cymodocea rotundata,* and *Thalassia hemprichii*. Seagrasses were observed distributed from intertidal (0.4 m) to shallow waters (~ 5 m), out of which 70 % of the meadows were mixed-species, while remaining were mono-species. Highest

number of species (n=8) were recorded from the shallow subtidal meadow at Altaiyak, Nancowry.

Highest seagrass percentage cover was observed at Safed Balu, Trinket (94.5 %), and the least cover was recorded from *Halophila ovalis* and *Halophila decipiens* dominated meadows at Pilpilow, Kamorta (3.6 %; Figure 135). Highest shoot densities were recorded from Ship wreck, Little Andaman (4686.7 ± 1290.47 shoots/ m^2) and while highest biomass was contributed by mixed-species meadow at Kardip, Kamorta respectively (3180 gm/ m^2). Nine of the 26 seagrass meadows investigated are newly reported from the Andaman and Nicobar Islands, filling the seagrass cold-spots of the region.

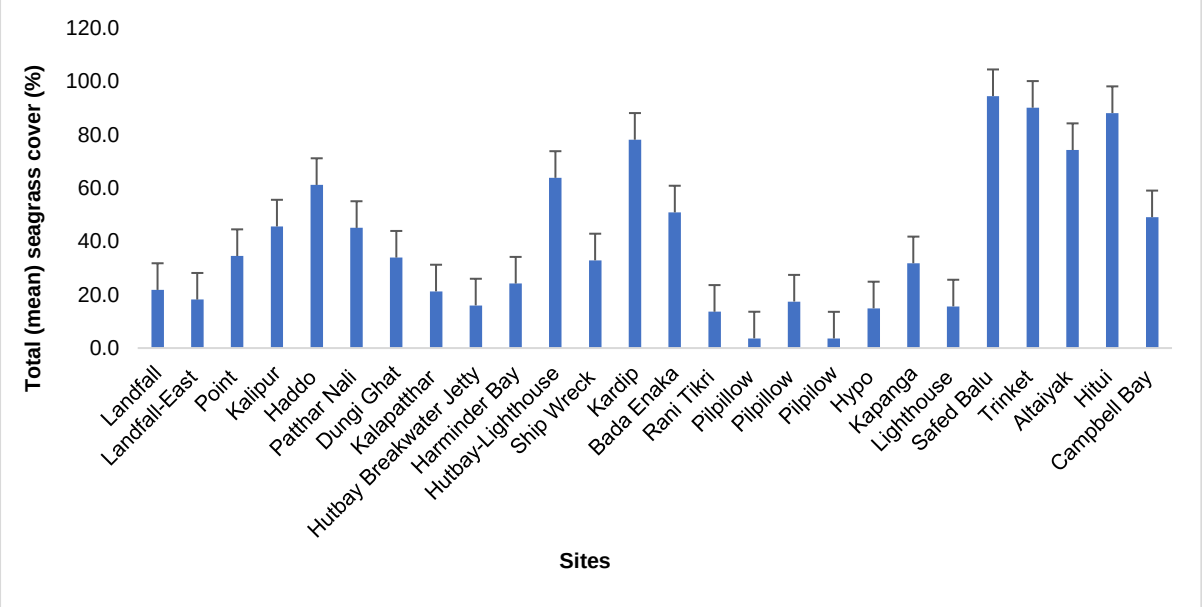


Figure 86. Island-specific seagrass cover across study sites in Andaman

1.10.2.2. Seagrass mapping

Remote sensing and GIS provide a handy tool to map such shallow coastal habitats, but in case of diverse conditions of Indian waters along the 7516.6 km coastline, it is important to evaluate various classification techniques for better mapping accuracy. We tried to evaluate the efficacy of different classification techniques in different water conditions, namely South Andamans (SA), Andaman & Nicobar Island, north Palk Bay (PB) and Gulf of Mannar (GoM), Tamil Nadu. The surveys were conducted at Mahatma Gandhi Marine National Park (MGMNP), Rutland and Chidiya Tapu. Intertidal surveys were conducted in Haddo and Burmanallah.

Methodology:

Component 1: Field to collect in-situ data

- In situ has been collected from South Andamans as a temporal replicate of 2020-21. Boat surveys were conducted in Mahatma Gandhi Marine National Park (MGMNP), Rutland and Chidiya Tapu. Intertidal surveys were conducted in Haddo and Burmanallah.
- Drop-down camera method was used to photograph and record the presence of seagrasses in the selected grids. A Hero GoPro 9 Silver Camera at the apex of a square-based pyramidal structure was used for the purpose.
- If present, the percentage cover was calculated from the GoPRO videos.
- Other physical parameters like depth, sea-surface temperature and transparency were also collected from every point.

Component 2: Classification and mapping

- We are currently working on analysing the videos for presence-absence and calculating percentage cover. Consecutively, the data entry of the same is in process. The data from Gulf of Mannar has already been entered and a preliminary run with seagrass points was carried out. The output map is attached (Fig.1).
- Cloud-based Google Earth Engine platform was used for classification. Sentinel-2 MSI Level-2A (Surface-reflectance) composites were developed, on which cloud-masking and land-masking were done by using Sentinel-2 Cloud Probability and by calculating the normalized difference of B3 (green) and B8 (Near-infrared) respectively.
- The collected data points will be segregated into 70:30 for training and validation purposes.
- The algorithm with highest accuracy will be selected for classification. Machine learning algorithms to be tested are: K-Means, Support Vector Machine (SVM), Maximum Distance (MD), Classification and Regression Trees (CART), Naives Bayes (NB) and Random Forest (RF).

Table 14. *Metadata for Sentinel 2 imageries.*

Satellite	Sentinel-2
Satellite number	A and B
Processing level	Level-2A
Product type	S2MSI2A
Instrument	Multispectral Instrument (MSI)
Bands used	Band 2 Blue (496.6 nm-S2A/492.1 nm-S2B)
	Band 3 Green (560 nm-S2A/559 nm-S2B)
	Band 4 Red (664.5 nm-S2A/665 nm-S2B)
	Band 8 NIR (835.1 nm-S2A/833 nm-S2B)
Spatial Resolution	10

Findings: With comparatively clearer waters in South Andamans, highest accuracy of 96% was obtained by using CART, followed by Random Forest (94%). In specific water conditions like transparent waters, CART is the best-fit algorithm, whereas Random Forest is the most general algorithm for seagrass classification, irrespective of any water conditions. Bathymetric profile of Andaman Islands varies to a large extent, hence preparing a depth-invariant image composite is an important exercise before running the classification for seagrass. Also, we infer that turbidity negatively affects the classification accuracy to a major extent. The output map of seagrass distribution (Fig. 136) reports South Andaman has sporadic seagrass distribution with lesser cover in comparison to Tamil Nadu, hence supporting the localised dugong populations in the islands.

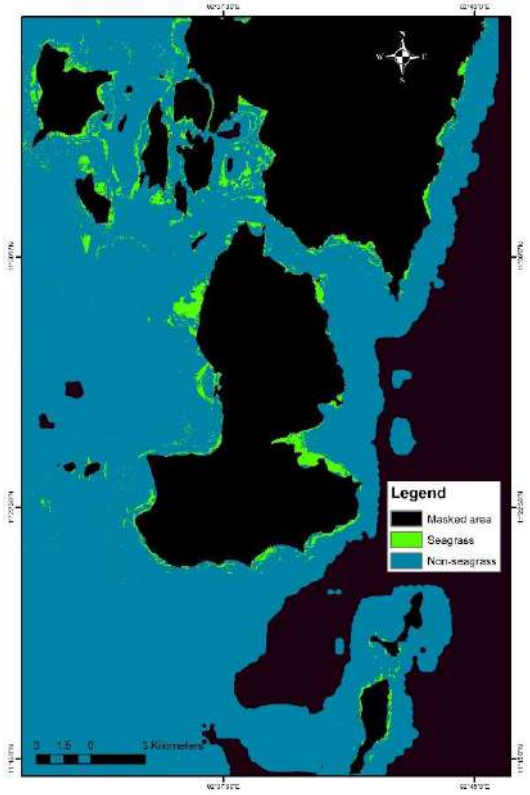


Figure 87. Seagrass map of South Andaman (accuracy=96%)

1.10.2.3. Seagrass ecosystem nutrient dynamics

The ocean is acknowledged as a significant carbon sink that may hold up to 55% of the carbon dioxide in the atmosphere (Nellemann et. al. 2009), mostly in a variety of seabed types such mangroves, salt marshes, and seagrass meadows (Singh 2019). Further, seagrasses are thought to store carbon in the waters at a rate up to 18% higher than that of tropical rainforests (McLeod et. al. 2011, Fourqurean et. al. 2012, Rohr et. al. 2016), helping to mitigate the effects of climate change and reducing greenhouse gas emissions. The present study was thus, carried out to understand the nutrient dynamics in the seagrass meadows. The study objectives are to; 1) recognize the nutrient-rich seagrass meadows; 2) comprehend the nutritional makeup of dominant seagrass; 3) and, study the composition of seagrass in relation to sediment nutrient content.

Methodology: Sediment samples were collected from the same 20x20 cm² quadrant. Around 50 g of samples were collected from each quadrant. Care was taken to avoid excavating sediment from the same area as seagrass samples. The samples were air-dried. The samples were sieved through a 200 mm sieve to remove coarse sediment

and detrital materials. The samples were then ground and homogenized and stored in air-tight poly-bags before analysis.

In order to release any trapped moisture, the samples were warmed in a hot air oven for a short period of time. The composite samples were then kept in airtight containers prior to analysis after being sieved using a 2 mm sieve to eliminate coarse silt and detrital debris. Total organic carbon in seagrass samples was evaluated using the dry combustion technique, whereas organic carbon in sediment samples was quantified using Walkley and Black method, quick titration method (Bojko and Kabala 2016). The Kjeldahl technique was used to measure nitrogen. The Flame Photometer technique was used to determine the amounts of sodium and potassium (Barnes *et al.* 1945). For the analysis, 0.1 gm of seagrass and 1 gm of sediment samples was collected.

Findings: The concentration of sodium, organic carbon and organic matter varied among the study points in the sediment samples of Andaman and Nicobar Islands. The highest concentration of Nitrogen, sodium, and organic carbon, was observed in the samples of South Andaman whereas potassium was highest in North and middle Andaman.

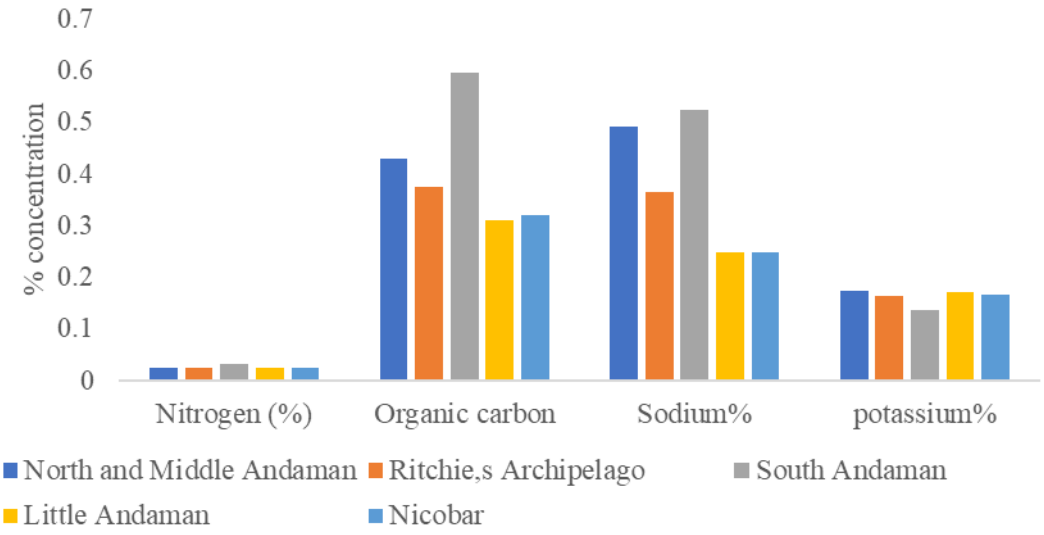


Figure 88. Site-specific nutrient dynamics in the seagrass meadows, Andaman & Nicobar Islands

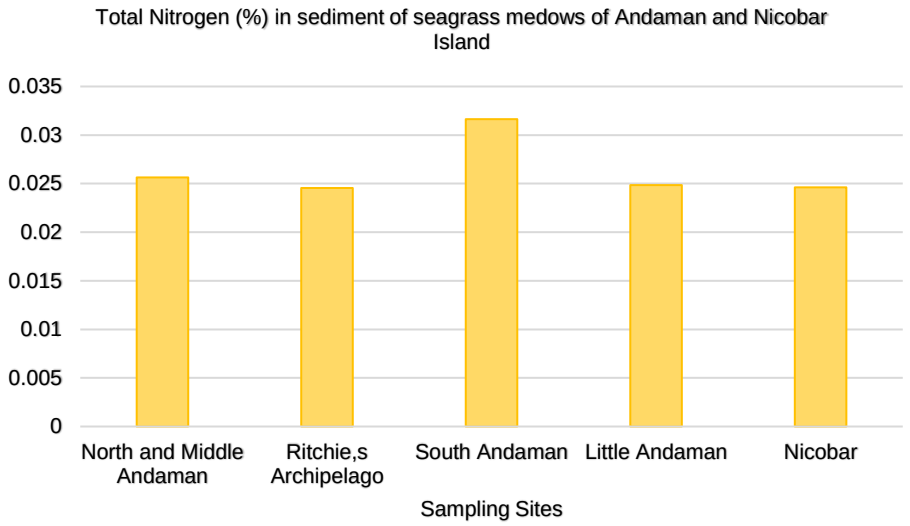


Figure 89. Total Nitrogen (%) in sediment of seagrass meadows of Andaman and Nicobar Island

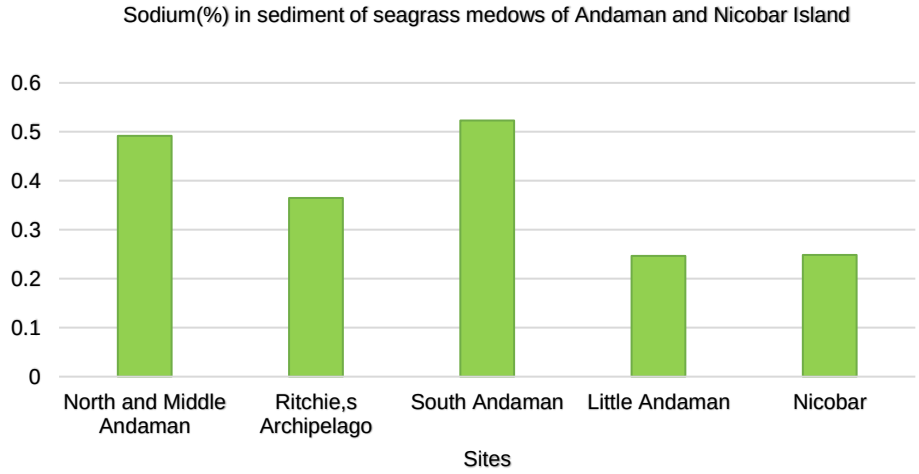


Figure 90. Sodium (%) in sediment of seagrass meadows of Andaman and Nicobar Island

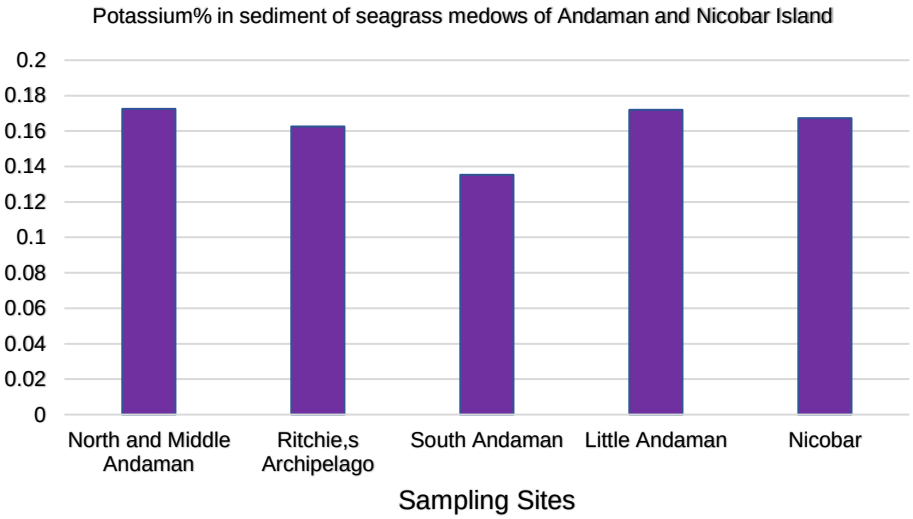


Figure 91. Potassium% in sediment of seagrass meadows of Andaman and Nicobar Island

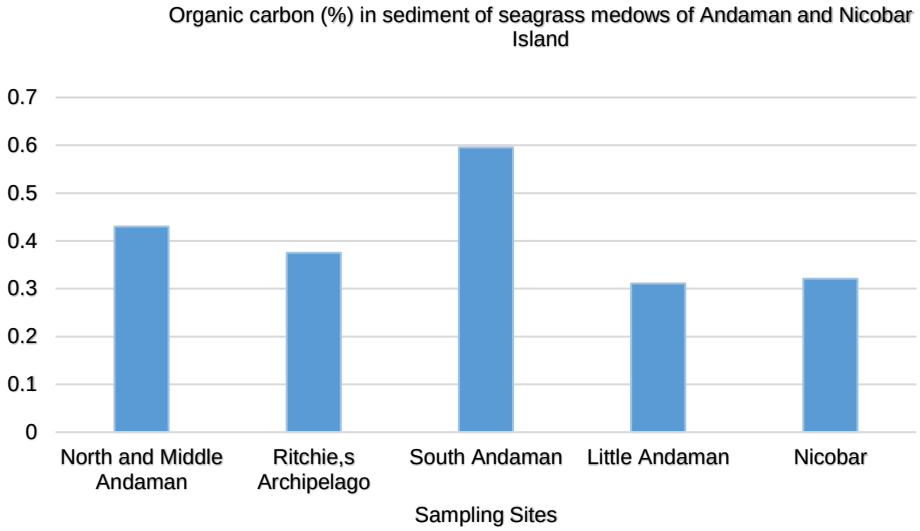


Figure 92. Organic carbon (%) in sediment of seagrass meadows of Andaman and Nicobar Island

Furthermore, it was observed that the concentration of sodium and potassium is inversely proportionate to each other in the samples. Sodium is higher in vegetated areas and lower in unvegetated areas whereas potassium is higher in unvegetated areas and lower in vegetated areas. The average concentration of the nutrients in sediment varies within unvegetated (non-seagrass) and vegetated (seagrass) areas. Organic Carbon is higher in vegetated area than non-vegetated areas. This may be due to the reason that seagrass itself contributes significantly to the C content in the sediment.

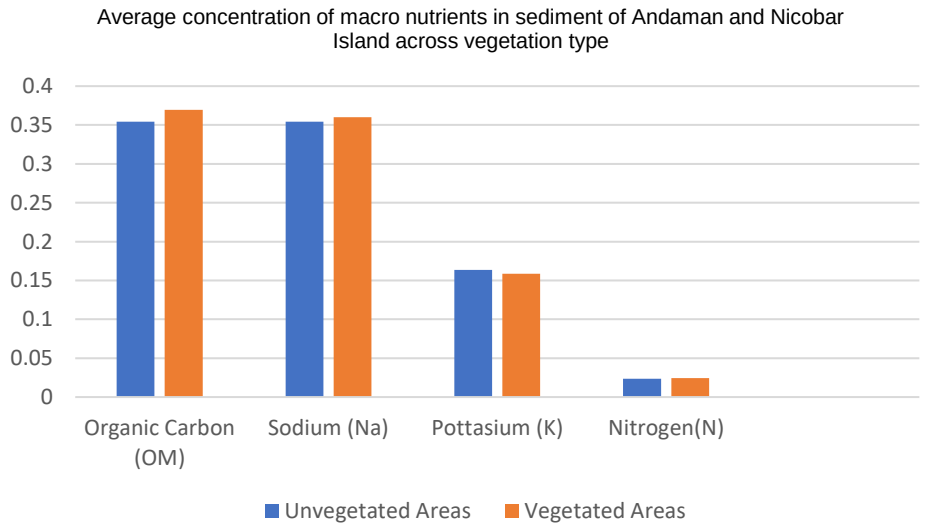


Figure 93. Average concentration of macro nutrients in sediment of Andaman and Nicobar Island across vegetation type

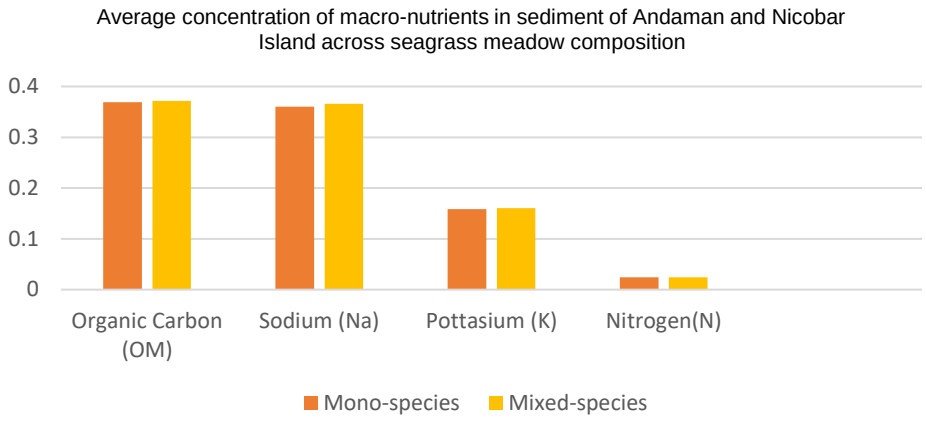


Figure 94. Average concentration of macro-nutrients in sediment of Andaman and Nicobar Island across seagrass meadow composition

Figure 95. Average concentration of sediment nutrients accroding to the seagrass species.

Organic carbon, nitrogen and potassium doesn't show significant difference between the mixed and mono species seagrass meadows. Even though the differences were minute, it was observed that the sodium concentration in mixed species seagrass meadows is higher as compared to mono species meadows.

A significant difference has been observed in sodium concentration of sediment according to the type of seagrass species present in the area. The concentration of sodium, potassium and organic carbon in sediment is highest where, *Cymodocea serrulata* is present, and lowest, where *Halodule pinifolia* is present. Nitrogen content is high, where *Cymodocea rotundata* is present, and low, where *Halophila decipens* is present.

1.10.3. Seagrass associated fauna

1.10.3.1. Seagrass associated infaunal assemblages

Seagrass habitat supports high macrofaunal diversity, then adjacent unvegetated habitats. Macrobenthos are invertebrates that live on or in sediment. Due to their affinity to seagrass meadows and sensitivity towards conducive growth environment, macrobenthic invertebrates are comprehended as important indicator species (Thayer et al., 1978). These communities are known to play an important role in ecosystem services as they help in bioturbation in areas where physical disturbance is low (Kristensen & Kostka 2005, Meysman et al., 2006). As a result, these communities help to alter physical and chemical conditions at the sediment-water interface, promote decomposition of sediment organic matter (OM), and are important mediators in nutrient recycling from the sediment to the water column through bioturbation and suspension feeding activities (Yingst & Rhoads 1980, Aller & Yingst, 1985, Blackburn 1988). This study thus, focused on documenting the diversity of seagrass-associated infaunal macrobenthic community structure, which is the first comprehensive baseline from the Islands.

Figure 96. Lab analysis of seagrass associated infaunal assemblages (A) Sorting of Macrobenthic Fauna B) Identification of macrobenthic fauna till group level

Methodology: A total of 233 samples were collected from all the 5 sampling areas. Samples were collected from a 20x20 cm quadrat from a seagrass bed. The collected sediments were hand-scooped from a 10 cm topsoil layer and were stored in zip lock bags and later preserved in 4% Rose Bengal buffered formaldehyde solution. The sediment samples were further sieved using a 500µ sieve and segregated in the lab at Wildlife Institute of India's Headquarters. The macrobenthic organisms were sorted and preserved in 2- and 5-ml tubes with 70% ethanol respectively. The individuals were identified and sorted up-to group level.

Findings: Total five dominant groups were identified in the present study such as gastropods (GS), bivalves (BV), polychaetes (PL), nematodes (NM), and crustaceans (CR). Bivalves (29%) were the dominant group in the North & Middle Andaman sites (Figure 174), whereas Gastropod (30%) dominated the seagrass beds in the Nicobar Islands (Figure 12). Polychaetes were the most numerically abundant group in the Ritchie's archipelago, Little Andaman, and South Andaman.

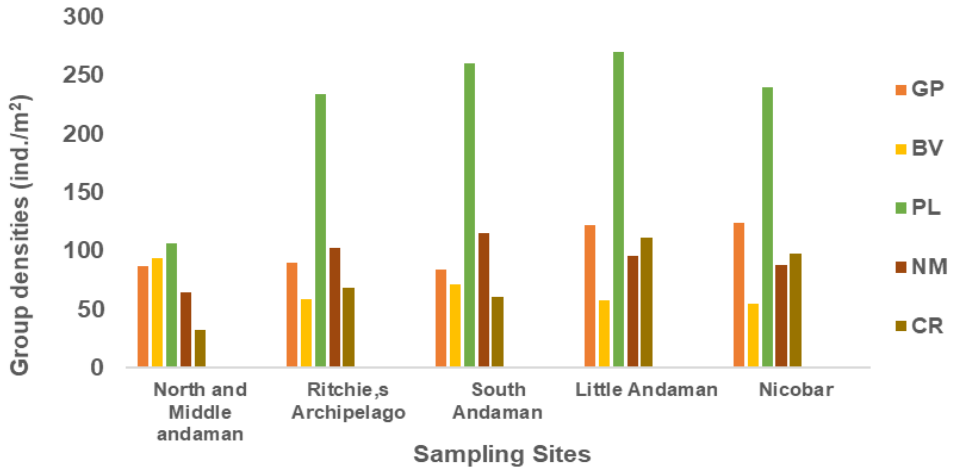


Figure 97. Site-specific percentage contribution of each infaunal group

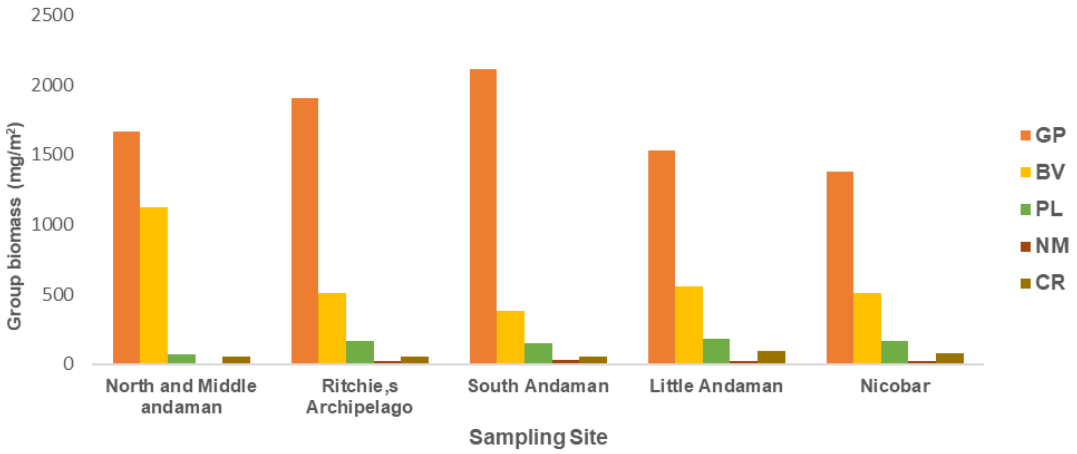


Figure 98. Site-specific biomass of each infaunal groups

In all the five sampling Island groups across the Andaman and Nicobar Islands, gastropods contributed to the highest biomass in all investigated seagrass meadows.

1.11. AWARENESS AND OUTREACH ACTIVITIES

1.11.1. Summary of activities

To ensure the success of the CAMPA-Dugong conservation project, the involvement of local communities and other sea-faring stakeholders is mandatory in species monitoring and in the case of rescue operations of dugongs. Thus, strengthening the local communities through workshops and training and awareness programs will enhance the understanding of dugong distribution and the performance of stakeholders in emergency response in the field. With a similar objective, CAMPA Dugong Project involves local communities in the dugong recovery program through mass sensitization and training through a capacity-building program.

In this field season, we conducted 17 outreach, awareness, and capacity-building programs and expanded the activity up to Little Andaman (Table 12).

Stakeholders for these programs were identified from the following sectors:

Local Communities (Fishers)

Forest Department

Indian Navy and Indian Coast Guard

Marine Police

Tribal Police Protection Force

Schools

Table15. *Details of Outreach, Awareness and Capacity Building Programme conducted in the Andaman Islands*

Sl. no.	**District**	**Location**	**Name of the event**	**Type of stakeholders**	**No. of attendees**	**Event type**
1	North and Middle Andaman	Durgapur fishing colony	Community Awareness Programme	Fisherman	15	Outreach and Awareness
2	North and Middle Andaman	Aerial Bay	Dugong Monitoring Follow up Programme	Indian Coast Guard	30	Capacity Building Programme
3	North and Middle Andaman	Shibpur, INS Kohassa	Dugong Monitoring Programme	Indian Navy	100	Capacity Building Programme
4	North and Middle Andaman	Diglipur	One day Orientation Programme on Dugong Awareness, Stranding Response and Monitoring Programme	Forest Department	20	Capacity Building Programme
5	South Andaman	Wandoor	Community Awareness Programme	Fisherman	30	Outreach and Awareness Programme
6	South Andaman	Wandoor	One day student workshop on ‘Island Biodiversity and	School Kids	50	Outreach and

Sl. no.	District	Location	Name of the event	Type of stakeholders	No. of attendees	Event type
			Dugong Conservation' with Government Middle School, Wandoor			Awareness Programme
7	South Andaman	Guptapara	Community Awareness Programme with Guptapara fishing Community	Fisherman	20	Outreach and Awareness Programme
8	South Andaman	Port Blair	Follow up Capacity Building Programme with Indian Navy, INS Utkrosh	Indian Navy	40	Capacity Building Programme
9	South Andaman	Wandoor	Orientation workshop on Dugong Awareness, Stranding response, and Capacity Building Programme with South Andaman Wildlife Division	Forest Department	25	Capacity Building Programme
10	South Andaman	Port Blair	Capacity Building Programme with Flying Unit,	Indian Coast Guard	20	Capacity Building Programme

Sl. no.	District	Location	Name of the event	Type of stakeholders	No. of attendees	Event type
			Indian Coast Guard			
11	South Andaman	Farm Tikrey, Little Andaman	Collaborative Community Interaction Programme with the Indian Coast Guard with Fisher Community	Fishers	50	Outreach and Awareness Programme
12	South Andaman	Harminder bay, Little Andaman	Student workshop on Island Biodiversity and Dugong Conservation'	School Kids	15	Outreach and Awareness
	South Andaman	Hutbay, Little Andaman	Capacity Building Programme with Indian Coast Guard	Indian Coast Guard	20	Capacity Building Programme
14	South Andaman	Hutbay, Little Andaman	Orientation workshop on Dugong Awareness, Stranding response, and awareness programme	Forest Department	30	Capacity Building Programme
15	South Andaman		Field activities of Certificate course trainees, Range Officers	Forest Department, Range Officers	30	Capacity Building Programme

Sl. no.	District	Location	Name of the event	Type of stakeholders	No. of attendees	Event type
			(Wildlife Institute of India)			
16	South Andaman	Port Blair	One-week compulsory training course for Indian Forest Service Officers on "Management of Coastal and Marine Biodiversity in India: Challenges and Prospects"	Indian Forest Service Officers	29	Capacity Building Programme
17	South Andaman	Tirur	Capacity Building Programme with Tribal Protection Police Force, Tirur	Police officers and Fishers	35	Capacity Building Programme

In this field season, most of the programme were conducted with patrolling based agencies which Involves Indian Navy, Indian Coast Guard and Tribal Protection Police Force (35%) followed by Forest Department to enhance the emergency response to dugongs and other marine mammals in stranding situation and 23% with fishing communities followed by 11.76% with Schools kids to raise an awareness about dugongs and seagrass importance and the need of conservation.

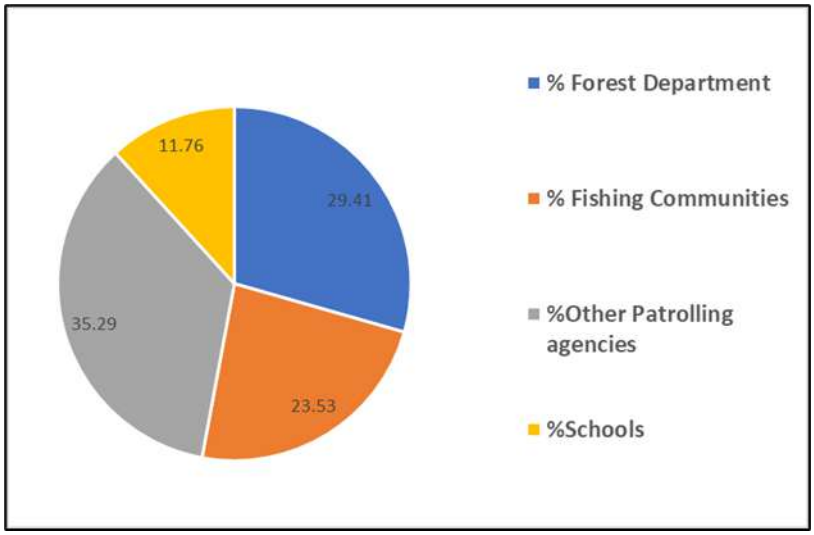


Figure 99. Pie chart showing percentage of events conducted with different stakeholders for Outreach, awareness, and capacity building programme

Figure 100. Pictures showing Programs conducted with different stakeholders from April 2021-March 2022 in the Andaman Islands

1.11.2. Dugong scholarship program

Dugong scholarship programme was initiated to provide financial support to school students from fishing backgrounds. It started in 2017. Since its commencement, 7 schools have been targeted across the Andaman Islands. In this field season due to the pandemic, we could not conduct any scholarship programs in schools. Till this field season, a total of 80 students have received the scholarship and the students selected under this program are identified as dugong ambassadors.

We shall be expanding the dugong scholarship program in this coming field season.

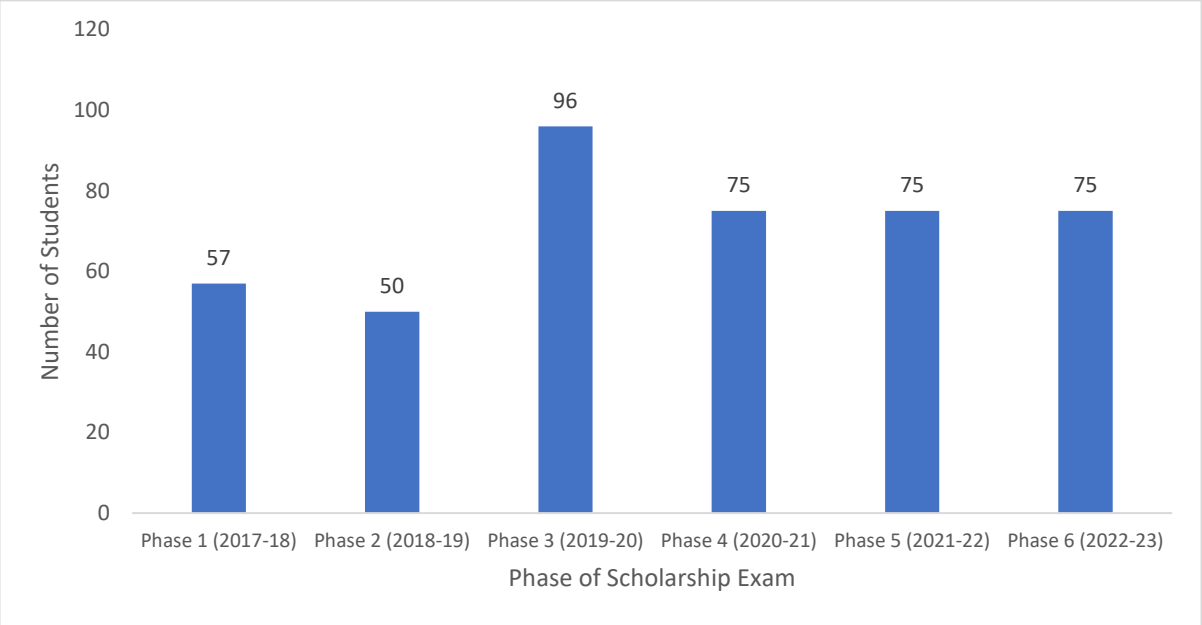


Figure 101. Number of scholarship students selected during 2021-2023 in the Andaman Islands

Table 16. *Details of Dugong Scholarship Programs in Andaman and Nicobar Islands*

School Name	Village/ Town	District	Students Phase						Village/ Town
			1	2	3	4	5	6	
			2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	
Government Secondary School	Shaheed Dweep (Neil)	South Andaman	19	18	15	11	11	11	Shaheed Dweep (Neil)
Government Middle School	Shaheed Dweep (Neil)	South Andaman	3	3	3	3	3	3	Shaheed Dweep (Neil)
Government Secondary School	Swaraj Dweep (Havelock)	South Andaman	35	28	22	21	21	21	Swaraj Dweep (Havelock)
Government Middle School	Guptapara	South Andaman	-	10	10	9	9	9	Guptapara
Government Middle School	Wandoor	South Andaman	-	9	9	8	8	8	Wandoor
Government Senior Secondary School	Rangachang	South Andaman	-	12	12	8	8	8	Rangachang
Government Senior Secondary School	Bamboo flat	South Andaman	-	16	16	15	15	15	Bamboo flat

1.12. OUTPUTS AND ACCOMPLISHMENTS

1) Presence of dugongs confirmed from Little Andaman, this being the first photo-documented validation after Indian Ocean tsunami, 2004. Dugongs in Little Andaman were speculated to be locally extinct after the devastation caused by the Indian Ocean tsunami, 2004.

2) Dugong distribution coldspots filled, since many of the sightings are from tribal protected areas and defence restricted regions.

3) Nine of the 26 seagrass meadows investigated are newly reported from the Andaman and Nicobar Islands, filling the seagrass cold-spots of the region.

4) Dugongs were detected during the surveys in North Andamans, South Andamans and in Ritchie's Archipelago.

5) First spatially spread, intensive assessment to understand the habitat importance (macrofaunal assemblages) of seagrass meadows beyond mega-herbivores like dugongs.

6) In Andaman and Nicobar Island, the group diversity of macrobenthic fauna was highest in Little Andaman and total biomass is higher in North and Middle Andaman as compared to South Andaman.

7) The concentration of Na, organic carbon and N are comparatively higher in South Andaman however, the concentration of potassium was recorded to be lowest in South Andaman as compared to the other sites.

1.13. MANAGEMENT RECOOMMENDATIONS

I) Immediate management interventions

1) Enhanced patrolling

Based on herd and calf sightings reported in our study, we speculate that two regions; the south-western coast of South Andaman and Ritchie's archipelago are critical for dugong calving mothers. Possibly, these regions are used by dugongs primarily for calf protection, since the distribution of resources (seagrasses) is available here and the waters are sheltered and protected. Of these regions we suggest that enhanced patrolling should be conducted by the patrolling agencies like the forest department, around Shaheed Dweep and Swaraj Dweep in the Ritchie's archipelago. These regions have a significant number of dugong herd sightings, and being tourist hotspots, are exposed to coastal habitat alteration (infrastructure development) and boat traffic (inter-island shipping lanes, high-speed boats, water jet skis). We suggest that these regions with a substantial interface of human-dominated dugong habitats be of priority for their conservation value.

2) Community-Based Conservation Approach

Success of the dugong conservation project depends on engaging local communities since there is an interface of fishing grounds and dugong habitats. Fisheries-driven factors like accidental net entanglement, direct consumption by locals (illegal), and the boat hits mostly threaten dugongs. For that, a bottom-up approach is required to save the dugongs. We recommend,

- Intensive community engagement through community workshops, especially in areas with high intensity of interface.
- The forest department should adopt incentivization schemes for the fishers to promote the rescue and release of dugongs in the Islands.

Target villages for the workshops: Central Nicobar Islands (Kakana, Bada Enaka, Champin Island, Derring, Pilpillow, Vikas Nagar (in Nancowry Islands), Harminder Bay, Vivekanandpur, Ramkrishnapur (In Little Andaman) Shaheed Dweep Island, Villages of Swaraj Dweep, Paschim Sagar, Kishori Nagar, Durgapur, Ram Nagar, North and Middle Andaman, Junglighat, Burmanallah, Rutland (In South Andaman)

2. IMPORTANT MILESTONES DURING 2021-2023

2.1. Overall awareness and outreach in 2021-2023

Under the project's mandate, several field activities are being conducted at the three field sites, viz. Andaman & Nicobar Islands, Gulf of Mannar & Palk Bay (Tamil Nadu), and Gulf of Kutch (Gujarat).

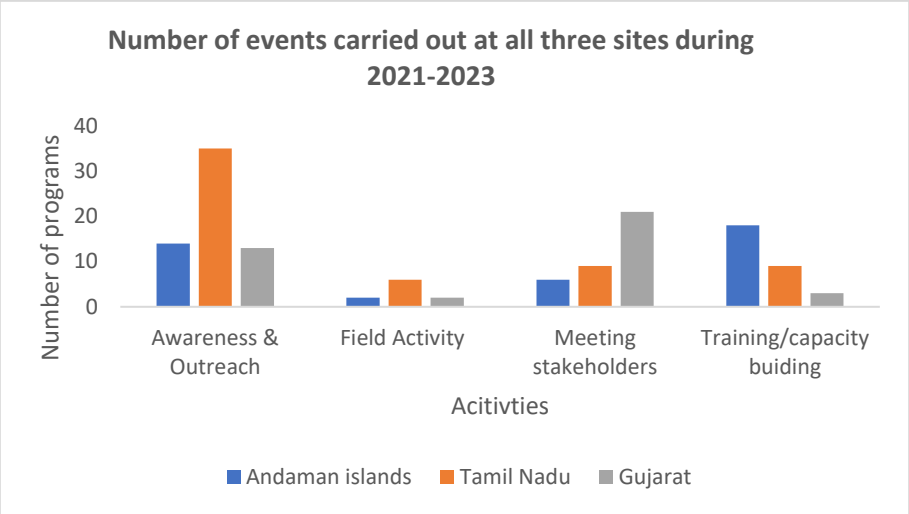


Figure 102. Field outreach activities conducted under the Dugong Recovery program at three field sites

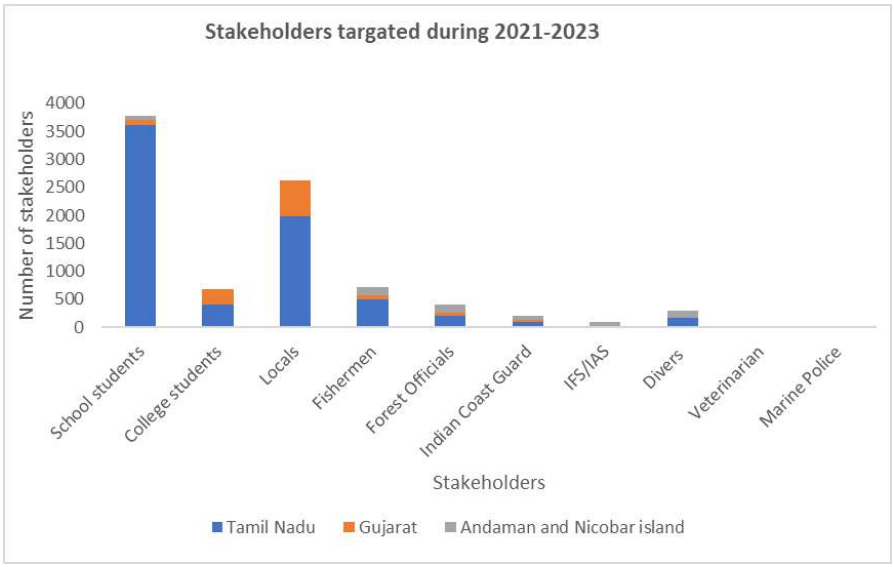


Figure 103. Stakeholders targeted during 2021-2023

The field activities are classified under three broad heads: Research & Monitoring, Participatory Management of Dugong and Seagrass Habitats and Capacity Building Activities. These activities have been conducted simultaneously at all the three field sites in coordination with respective State Forest Departments, local communities and

other stakeholders. The total reach of this awareness campaign was about 5415.Total ten stakeholders were targeted consisting maximum school children n=377, locals n=2816 Fishermen n=725, college students n=691 and coast guard n=197, Forest officials n=409, Navy= 140, and Fishery department n= 7, Marine Police = 25, Veterinarians=15.

2.2. Dugong Scholarship program in 2021-2023

Under the project's outreach and awareness component, a unique participatory program, the Dugong Scholarship Scheme was initiated to engage local fisherfolk communities at grassroot 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 a period of two years to support their education. Through this program, we have identified a total of 73 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 and integrates their families as part of the wider 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.

A total of 153 students were selected under this program in the Phase-I starting from July 2017-18. Out of these 153 students, 57 from Andaman & Nicobar Islands, 53 from Tamil Nadu and 40 students were selected from Gujarat field sites. Under phase II, 100 more students from Tamil Nadu and 46 students from Andaman & Nicobar Islands, and 22 students from Gujrat were selected as Dugong Ambassadors in 2018- 2019. Under Phase III, a Total of 100 students from Tamil Nadu, 87 students from Andaman and Nicobar Island and 79 students from Gujarat were selected as Dugong Ambassadors in 2019-2020. Under Phase IV, 100 students from Tamil Nadu,75 from Andaman and Nicobar Island, and 66 from Gujarat have been continued as Dugong Ambassadors in 2020-2021.

Under Phase V, 144 students from Tamil Nadu, 75 from Andaman and Nicobar Island, and 95 from Gujarat have been continued as Dugong Ambassadors in 2021-2022. Students from the 6th to 12th standard of age group 11-18 were selected, and 550 students were selected through a competitive examination. In Tamil Nadu, 92 girls, 52 boys, in Andaman and Nicobar Island 44 girls, and 36 boys, and in Gujrat 44 girls and 53 boys were selected. In Tamil Nadu, six dropouts were confirmed. For phase VI same students were continued.

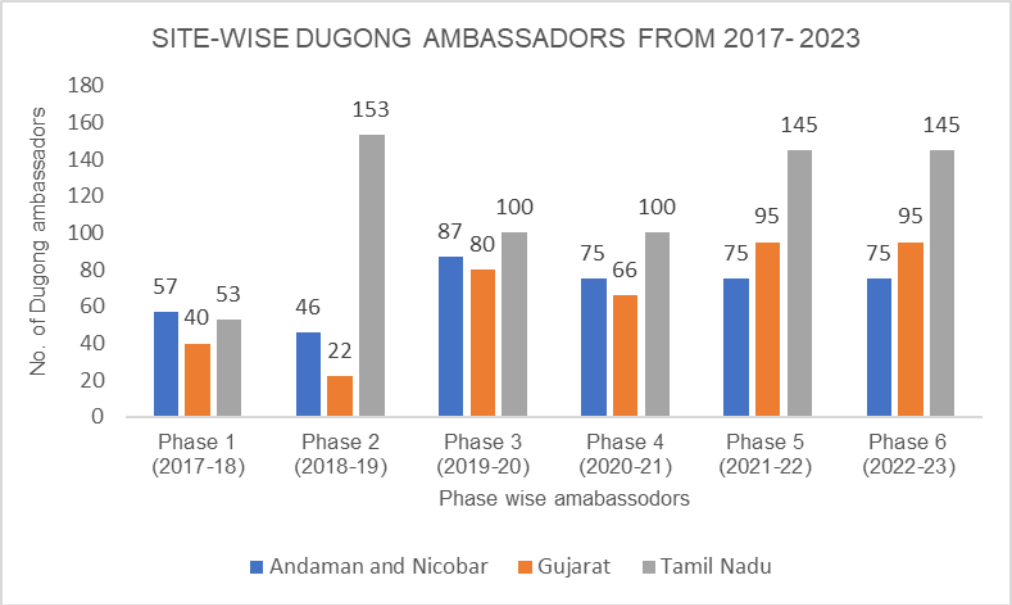


Figure 104. Dugong ambassadors' phase-wise

2.3. World Dugong celebrations 2021-2023

Dugong, a globally vulnerable and uncelebrated species, was dedicated to a day, 'World Dugong Day' in India on 28th May 2022. An initiative by the Wildlife Institute of India to spread awareness about

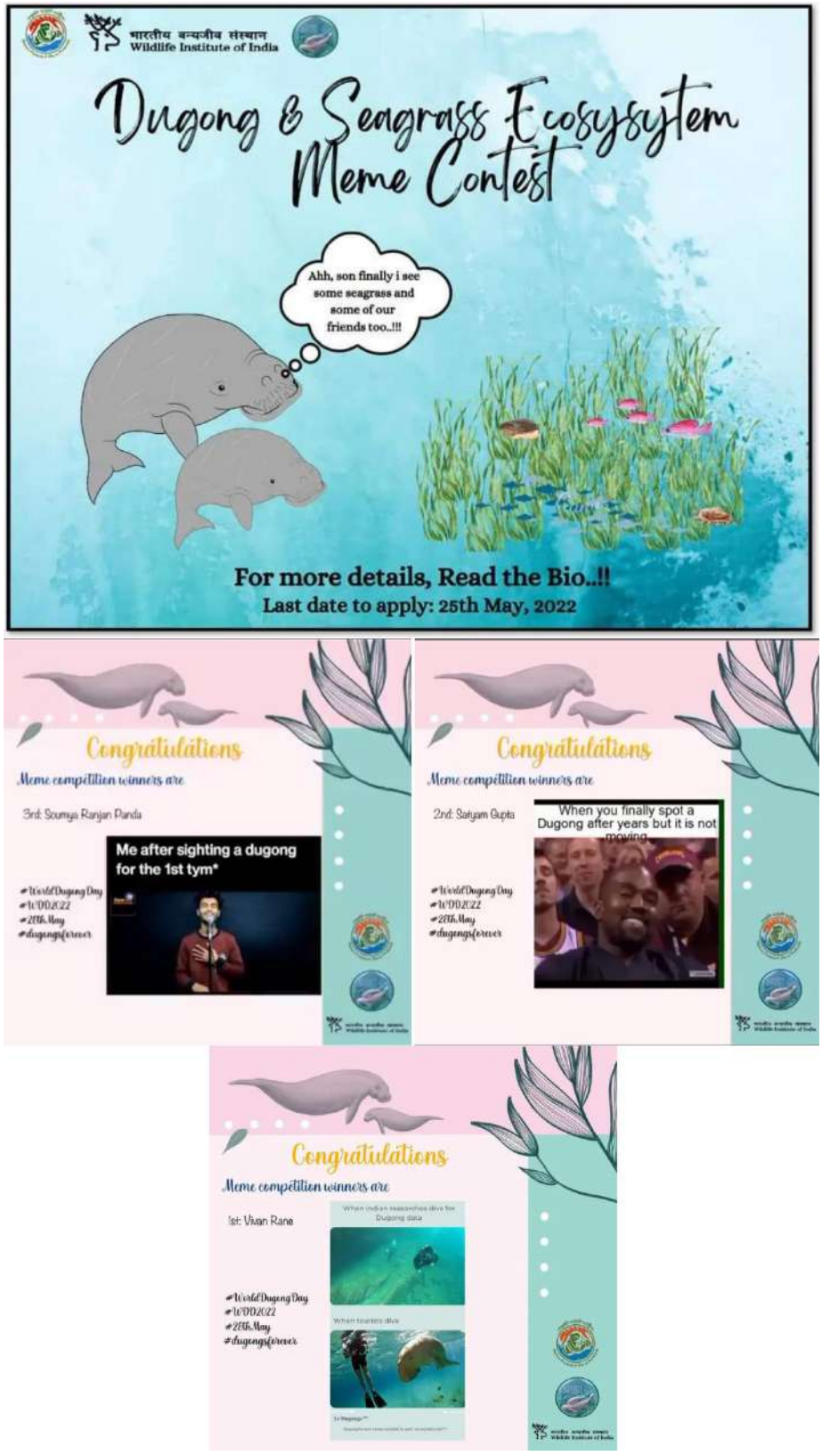


Figure 105. WDD meme contest announcement poster and winners

the importance and status of the species throughout the country. The species is protected under Schedule 1 of the Wild (Life) protection Act, 1972; India has signed a

non-legally binding Memorandum of Understanding (MoU) with CMS on the conservation and management of Dugongs and their habitats in India on 28th May 2008.

A month-long social media campaign was organized to commemorate Dugong Day from 27th April 2022 to 28th May 2022. The event aimed to educate the general public about Dugongs, their habitat, life cycle, distribution, and the current status of the species in the country. The event was organized was channelized through different platforms like the WII website, Facebook, Twitter, and Instagram. Daily two-three infographics about Dugongs and their habitats, stakeholders, and project achievements were posted on all the social media platforms.

On World Dugong Day, the Wildlife Institute of India organized a Dugong and seagrass ecosystem meme contest. A total of 40 people registered for the event. Participants were registered and were asked to create a meme about Dugongs or seagrass habitat and share it from their accounts with the hashtag #WDDMemecontest and tag the @dugongsforever Instagram account. Three of the best memes were selected, and the winners were awarded Dugong gift hampers.

To celebrate World Dugong Day; We organized events at all three project sites; Gujarat, Tamil Nadu, and Andaman & Nicobar. In Thondi, Tamil Nadu, our team conducted an awareness program. A meeting was conducted in the presence of Mr. Jagdish Sudhakar Bakan, WLW and DFO, Ramanathapuram and Dr. E. Kathavarayan, DD, Fisheries, Ramanathapuram. During this meeting, the dugong app was released. Following this, the awareness rally was flagged off. On the way, an awareness board was erected near the Thondi harbour by our Thondi team was unveiled by our chief guests in the presence of fishermen and school students who participated in the rally. The rally then continued and pamphlets were distributed by the students to fishermen and other people.

A village meeting at Somanathanpattinam, Tamil Nadu was arranged was arranged in joint efforts with the Forest Department and OMCAR Foundation. The villagers were sensitized for important marine habitats like the seagrass beds and mangrove forests along with Dugongs and other key megafauna of the region. We were whole heartedly welcomed by the villagers and they promised to work with us for the conservation reserve and pledged for marine life conservation.

Figure 106. Awareness board unveiling and rally commencement at Thondi, Tamil Nadu

Figure 107. Meeting organised at Somanathanpattinam, Tamil Nadu, in collaboration with the Forest Department and OMCAR Foundation

OMCAR Foundation kindly invited us to their Palk Bay centre. A painting competition-themed “Life Underwater” was arranged for the village kids. Children between the age of 9 and 15 participated in this event. We awarded stickers and T-Shirts to the winners of the competition.

Figure 108. Children participating in a painting competition organized by OMCAR Foundation

The Andaman and Nicobar team celebrated World Dugong Day by conducting an awareness program in Great Nicobar Islands with fishermen. They were sensitized on the importance of seagrass beds and how Dugongs play a vital role in maintaining them.

Figure 109. Awareness program in Great Nicobar Islands with fishermen.

An awareness rally, sand art competition, and citizen science approaches were successfully conducted in Okha by our Gujarat team and the Dugong ambassadors as a final event for World Dugong Day. The event drew a large number of youngsters and adults. To win the sand art competition, the kid's team created sand dugongs.

Both teams showed remarkable creativity in their sand artworks, so both of them were declared as champions and awarded sustainable glass mugs and books. All the participants pledged to protect marine life, including Dugongs in Gujarat.

Figure 110. An awareness rally, sand art competition, and citizen science approach conducted in Okha, Gujarat.

Apart from these presentations at national and global forums, talks were given at various meetings and consultations conducted under the outreach and capacity-building initiatives. These talks targeted stakeholders ranging from the scientific community as well as locals.

8th May 2022: Happy Mother's Day

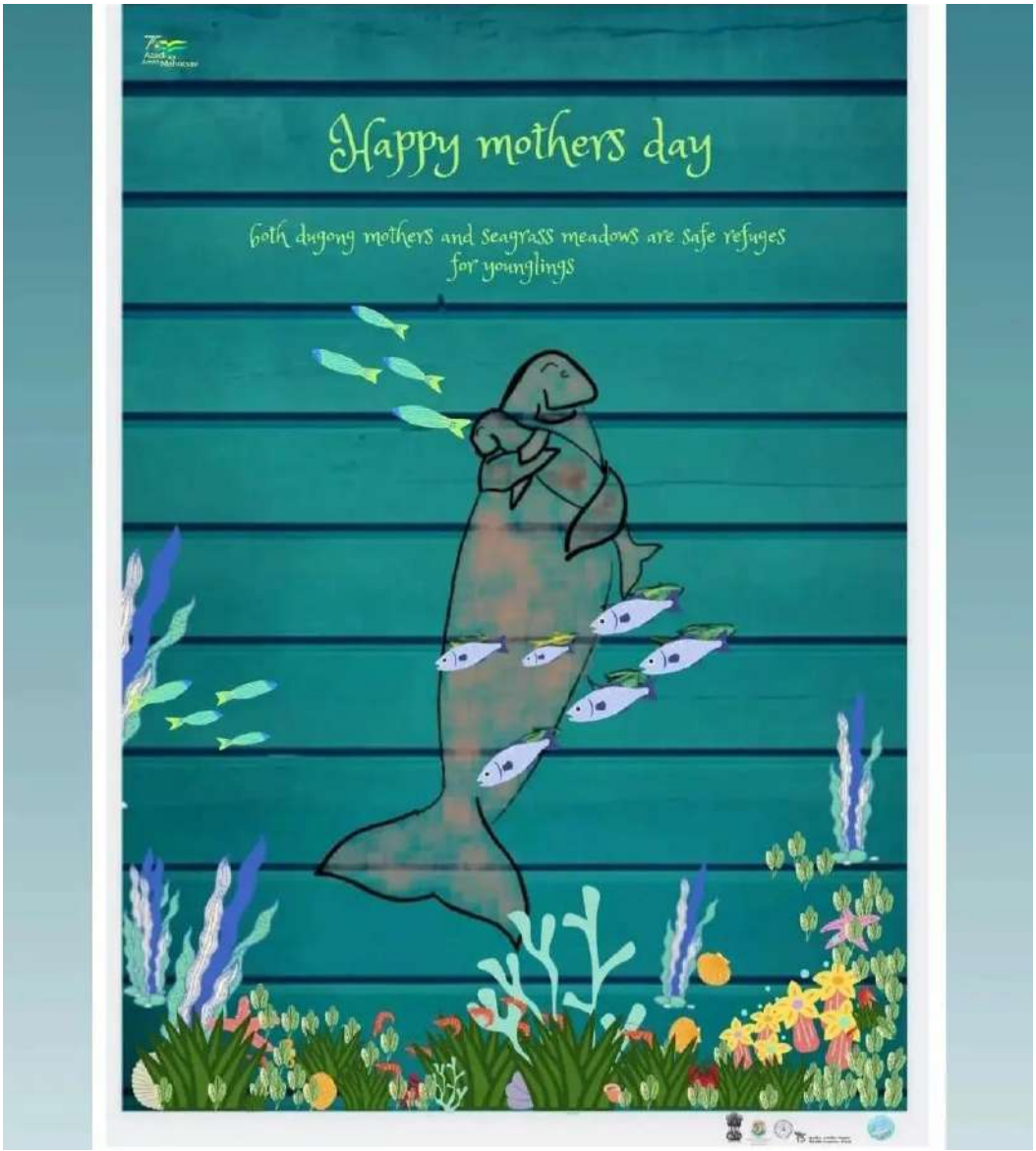


Figure 111. Happy Mother's Day post

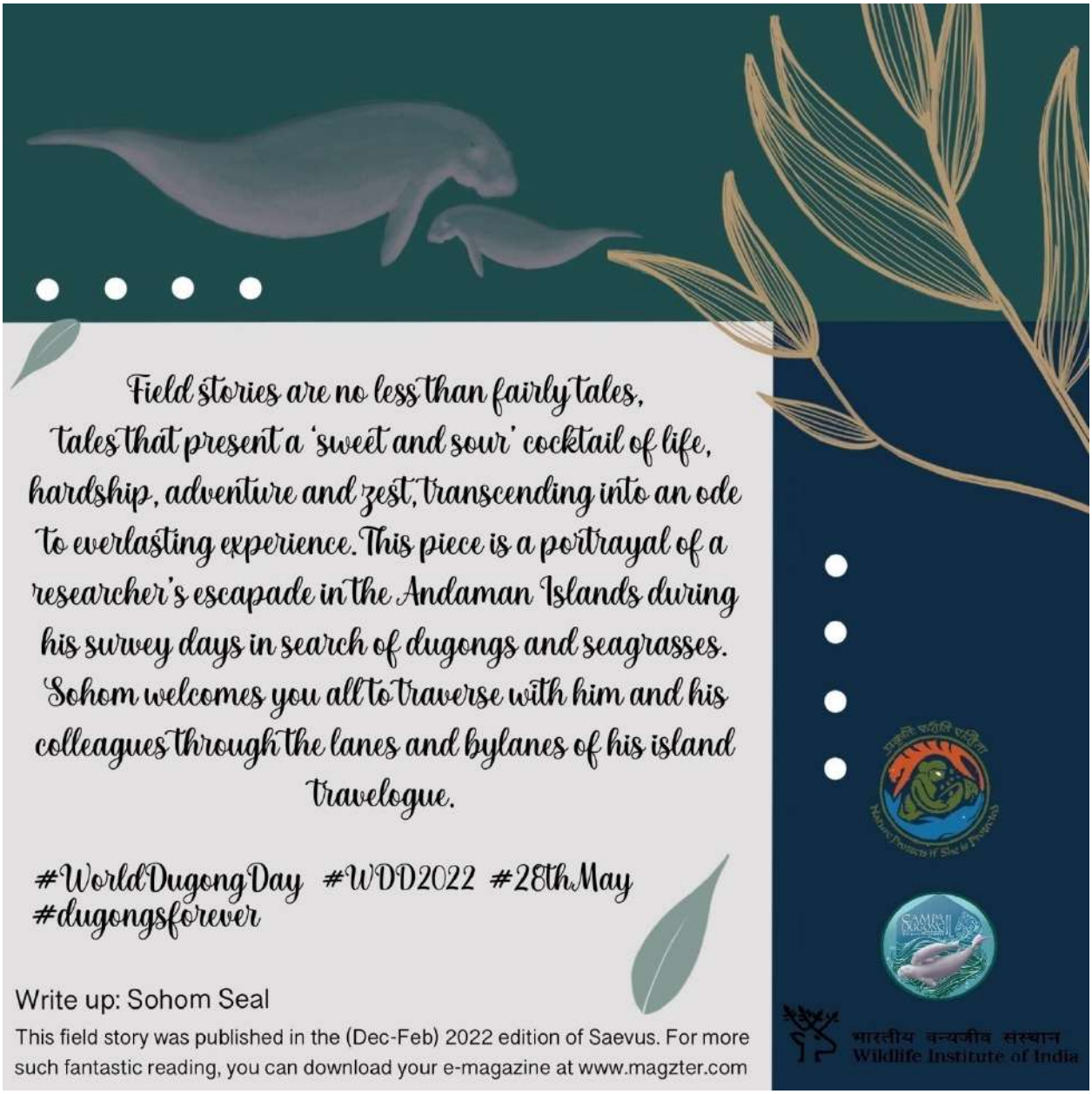


Figure 112. World Dugong Day post Day 1

11th May 2022: Rustic Islander by Swapnali Gole

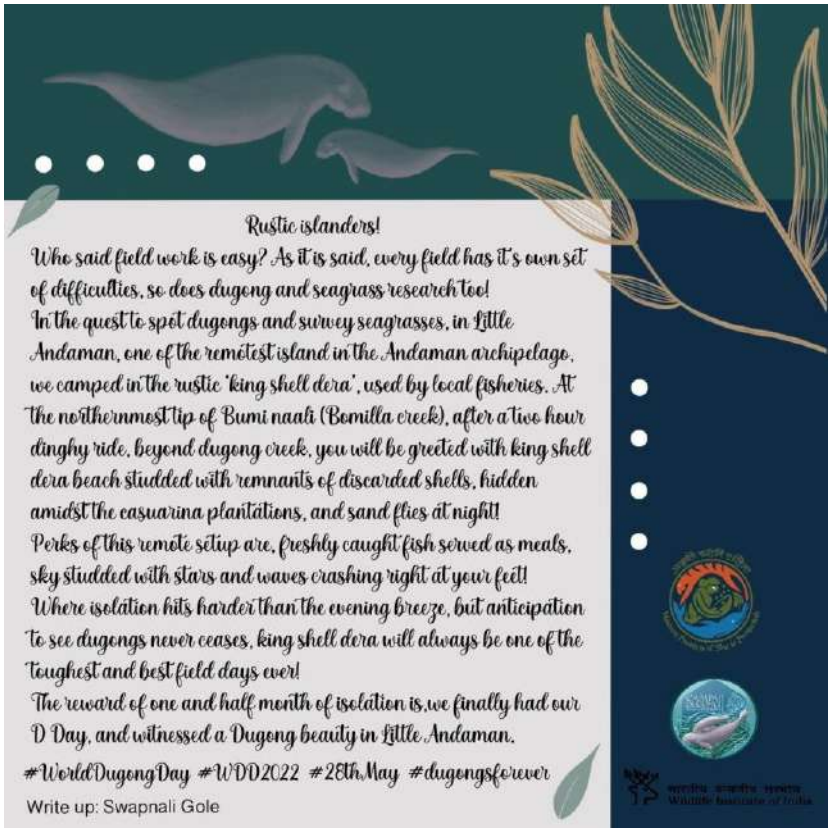


Figure 113. World Dugong Day post Day 3

12th May 2022: Meet the Dugong heroes: Ltd Cdr Prafful Itape (Indian Navy)

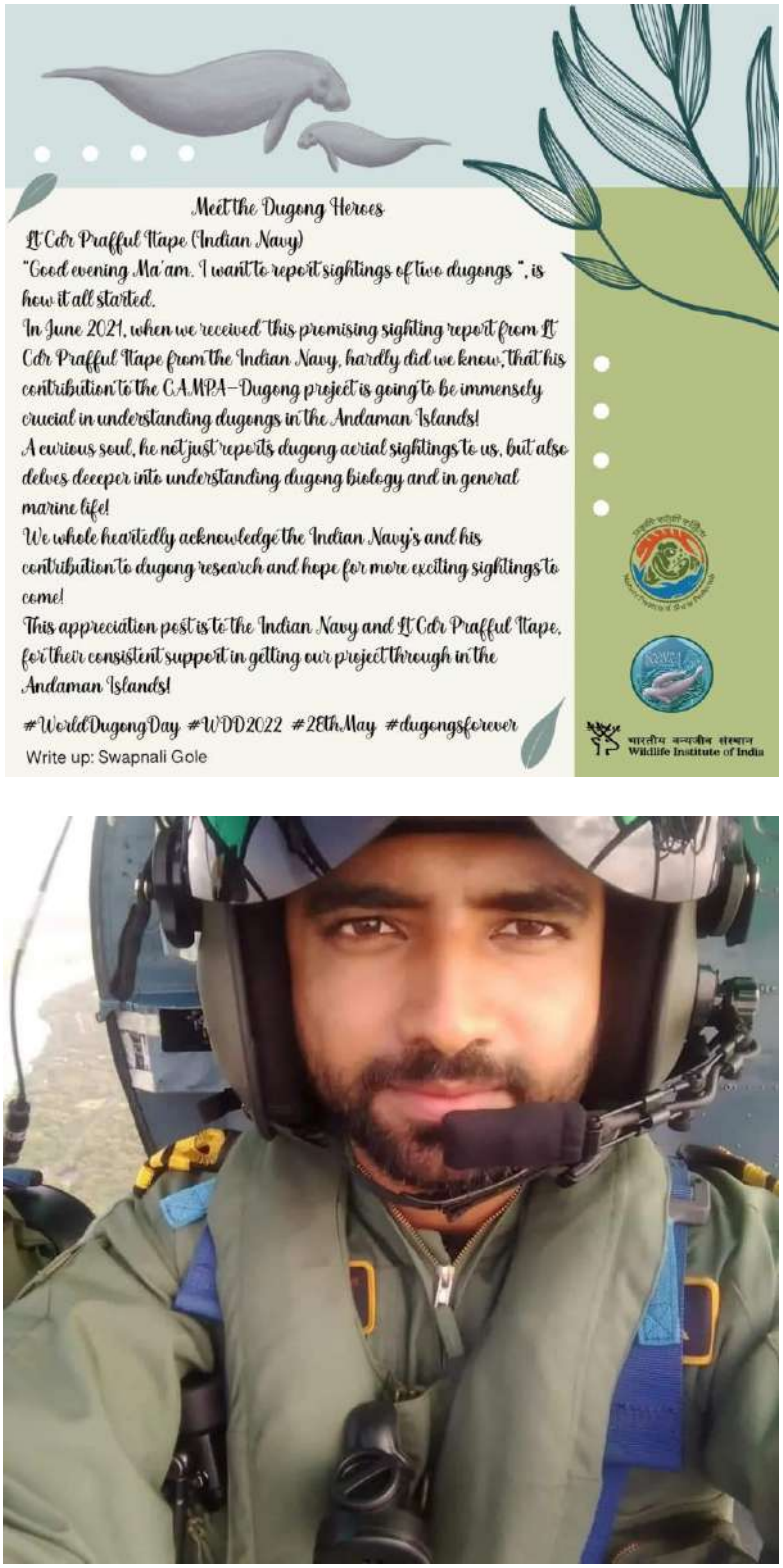


Figure 114. World Dugong Day post Day 4

13th May 2022: We recorded a live dugong for the first time in the Gulf of Kutch Gujarat

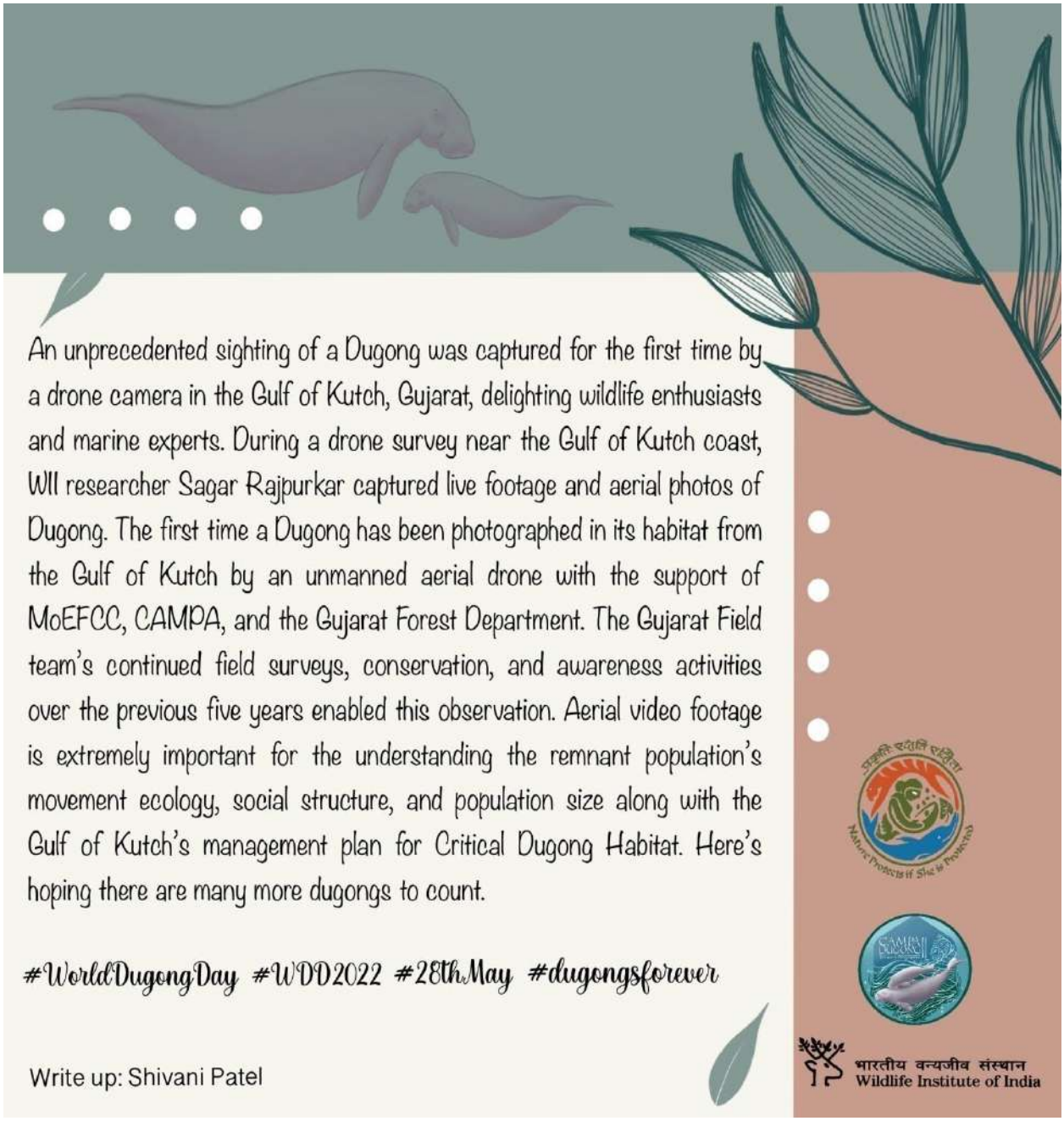


Figure 115. World Dugong Day post Day 5

Figure 116. Dugong photographed during drone survey in Gulf of Kutch, Gujarat

15th May 2022: Meet dugong heroes: Saw Tapori

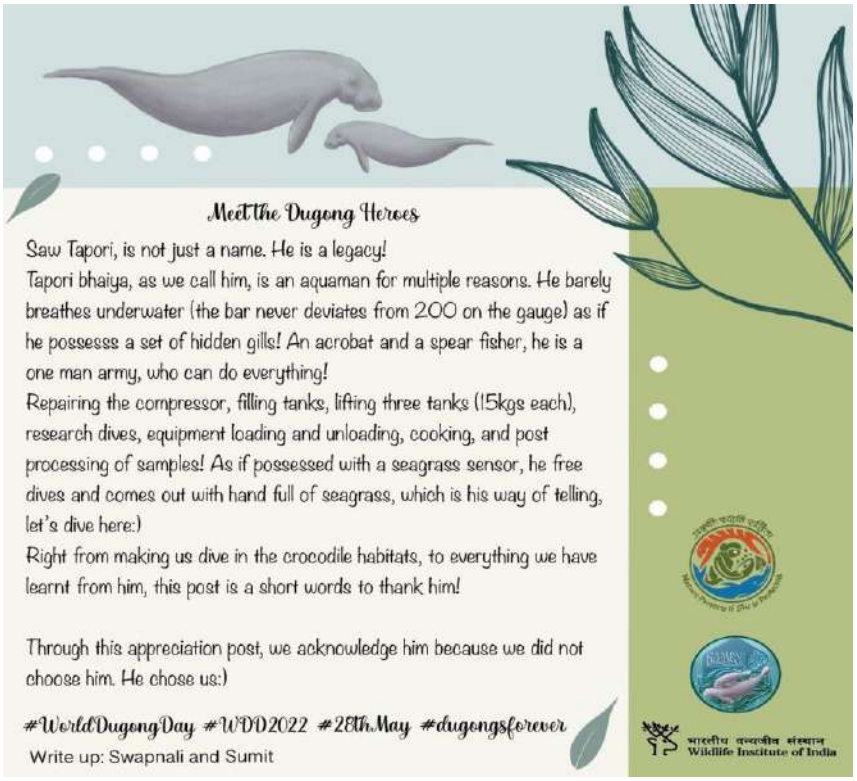


Figure 117. World Dugong Day post Day 7

On 18th May: Tamil Nadu team member Rukmini Shekar gave a talk at Alagappa University, Karaiudi to sensities students from Fisheries Department about the importance of Marine Biology concept in order to modify fisheries craft and gear to create as less harm as possible to other important marine life. Dugong and seagrasses were the main focus in our talk.

Figure 118. World Dugong Day post Day 10

18th May 2022: we gave a talk at Mohammed Sathak Dastagir B.Ed. College at Ramanathapuram. 110 enthusiastic B.Ed. students attented the talk and were very happy to learn about dugongs and seagrass, It gives us pledged to teach their students about the importance of marine life. A second standard boy, Rozario (one of the college lecturer's sons) was also present at the talk. He was extremely interested in the workshop and shared his knowledge about the steller's sea cow and other facts. Happy to announce that we have another little dugong ambassador.

Figure 119. World Dugong Day post Day 10

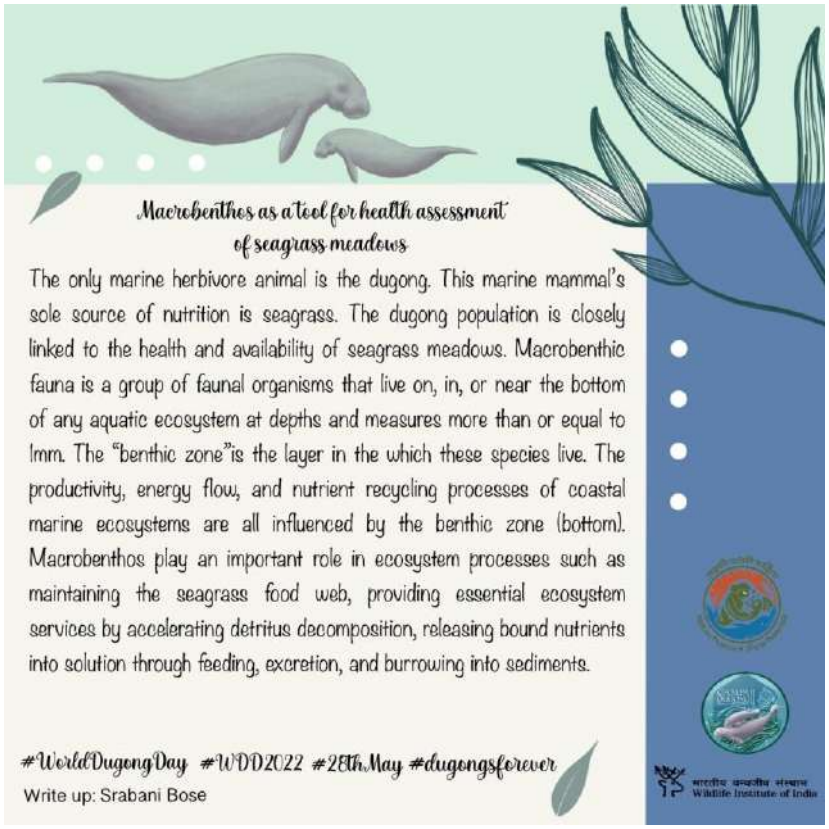
18th May 2022: Meet the dugong heroes: Sqn Ldr Amaedeep Kaur (Indian Coastguard)

Figure 120. World Dugong Day post Day 10

19th May 2022: Seagrasses and their interaction.

Figure 121. World Dugong Day post Day 11

20th May 2022: The little creatures that matters



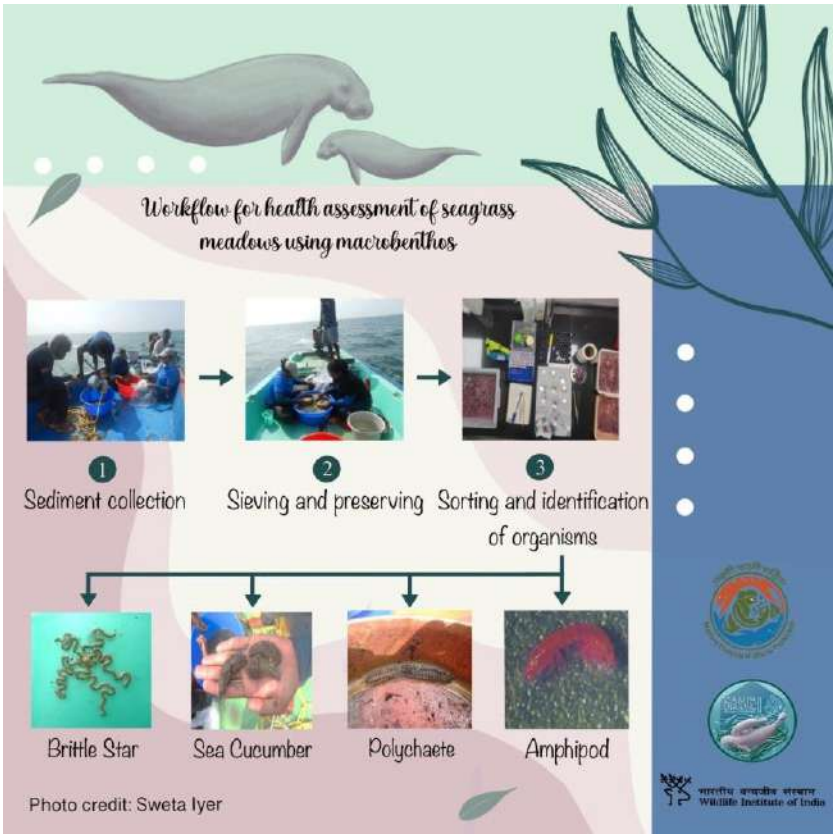


Figure 122. World Dugong Day post Day 12

22nd May 2022: International Biodiversity Day

Figure 123. World Dugong Day post Day 14

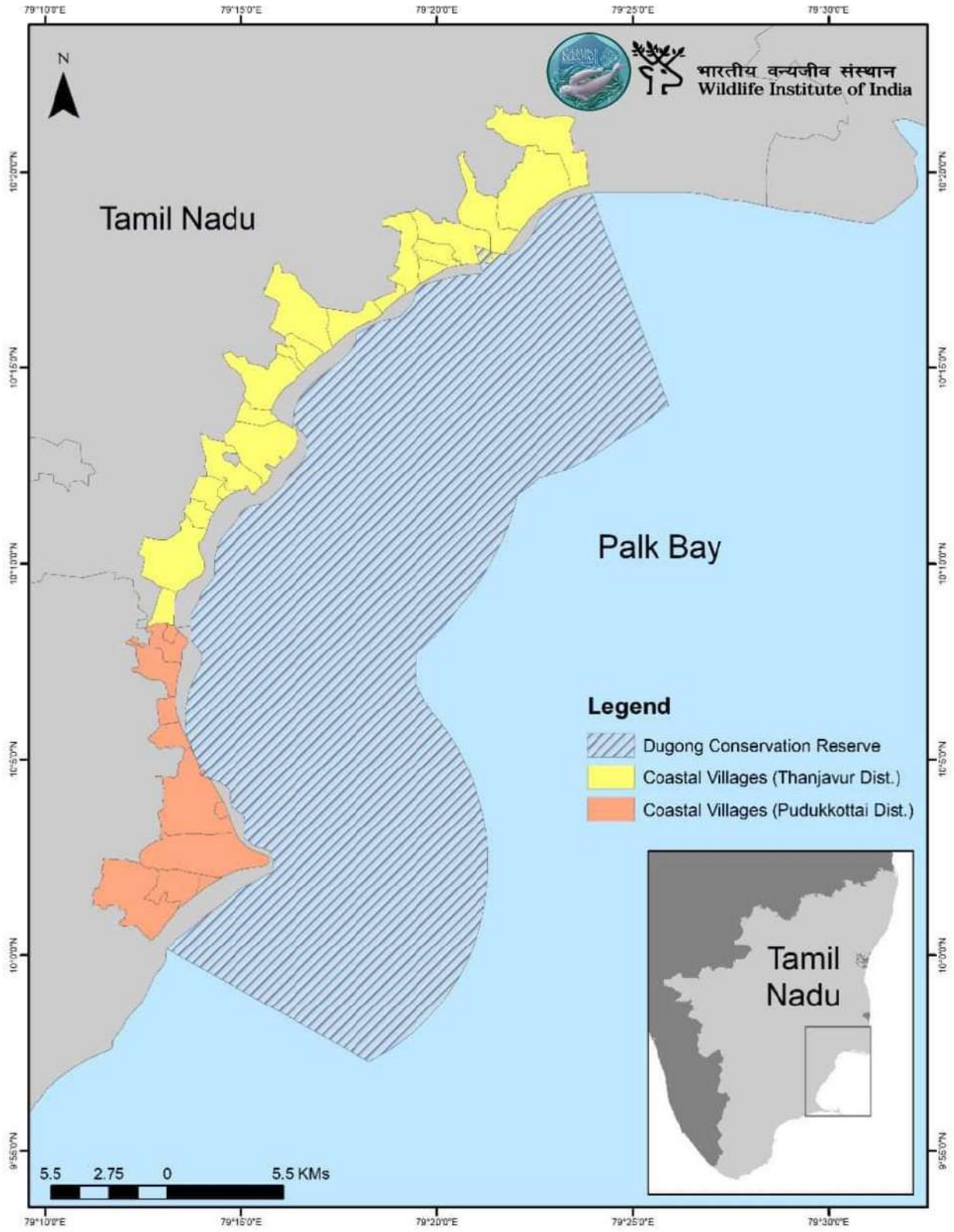


Figure 124. Map highlighting the Dugong conservation reserve in Tamil Nadu

Figure 125. Biodiversity associated with seagrass beds

23rd May 2022: We organised a drone training programme successfully with Gujarat forest department marine National park range today to continue the double celebration of international biodiversity day the upcoming World Dugong Day. Sagar briefed the attendees who had already been trained virtually, and they refreshed their understanding of drone operation before beginning the survey. We informed critical dugong areas where drone surveillance may begin in order to see live dugongs. All of the attendees' forest guards and officers were able to fly the provided drone with ease. ACF sir Mr Pratik Joshi expressed his appreciation for the session, adding, "Always willing to help for such knowledge exchange programme and would continue to do so with WII Dugong conservation team.

Figure 126. World Dugong Day post Day 15

23rd May 2022: We conducted awareness programs for the fisheries community in kattumavadi, Therukku Pudukudi and Keelakudiyiruppa. These villages are part of Dugong Conservation reserve. Small meetings gave a chance to interact with fisheries personally. We talked about Dugong, seagrasses, the Conservation reserve and their importance. Fisher also openly shared their concerns about fishing issues and their concern about fishing issues and the impact of the reserve. All fishers seemed quite positive about the decision to conservation reserve.

Figure 127. World Dugong Day post Day 15

23rd May, 2022: As part of Dugong Day events, we conducted a meeting for the Indian Coast Guard station at Mandapam. We spoke about Dugongs and their conservation, our project and the role ICG can play in recovering this species. We got assurance from the new Commanding Officer that his team is ready to work with us. We also disturbed posters, bookmarks, stickers and logbooks to all the officers. We are grateful to them for their support.

Figure 128. World Dugong Day post Day 15

23rd MAY 2022: World Turtle Day

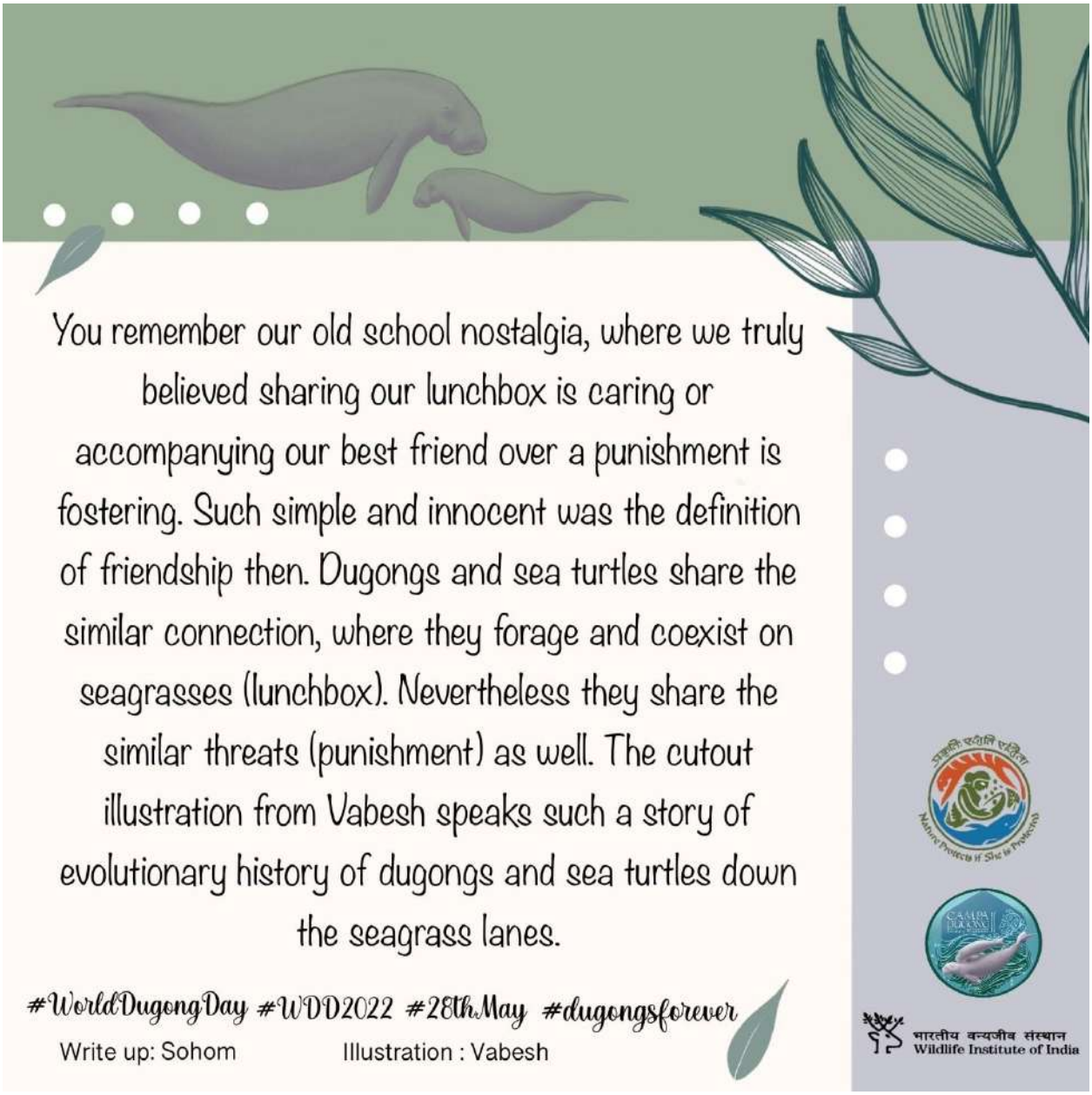


Figure 129. World Dugong Day post Day 15

Figure 130. World turtle day

24th May 2022: We conducted small fisher community meetings today in Manamelkudi Keelakudiyiruppa, Vadakku Pudukudi and Pongaram in Pudukkotai District. Dugong conservation reserve was the main theme for all awareness programs. Traditional fishers along with their kids were sensitized in these events.

Figure 131. World Dugong Day post Day 16

24th May 2022: On the onset of the final week to #WorldDugongDay, we salute the frontline warriors, who are striving to bring back the species on the verge of extinction, going against all odds!

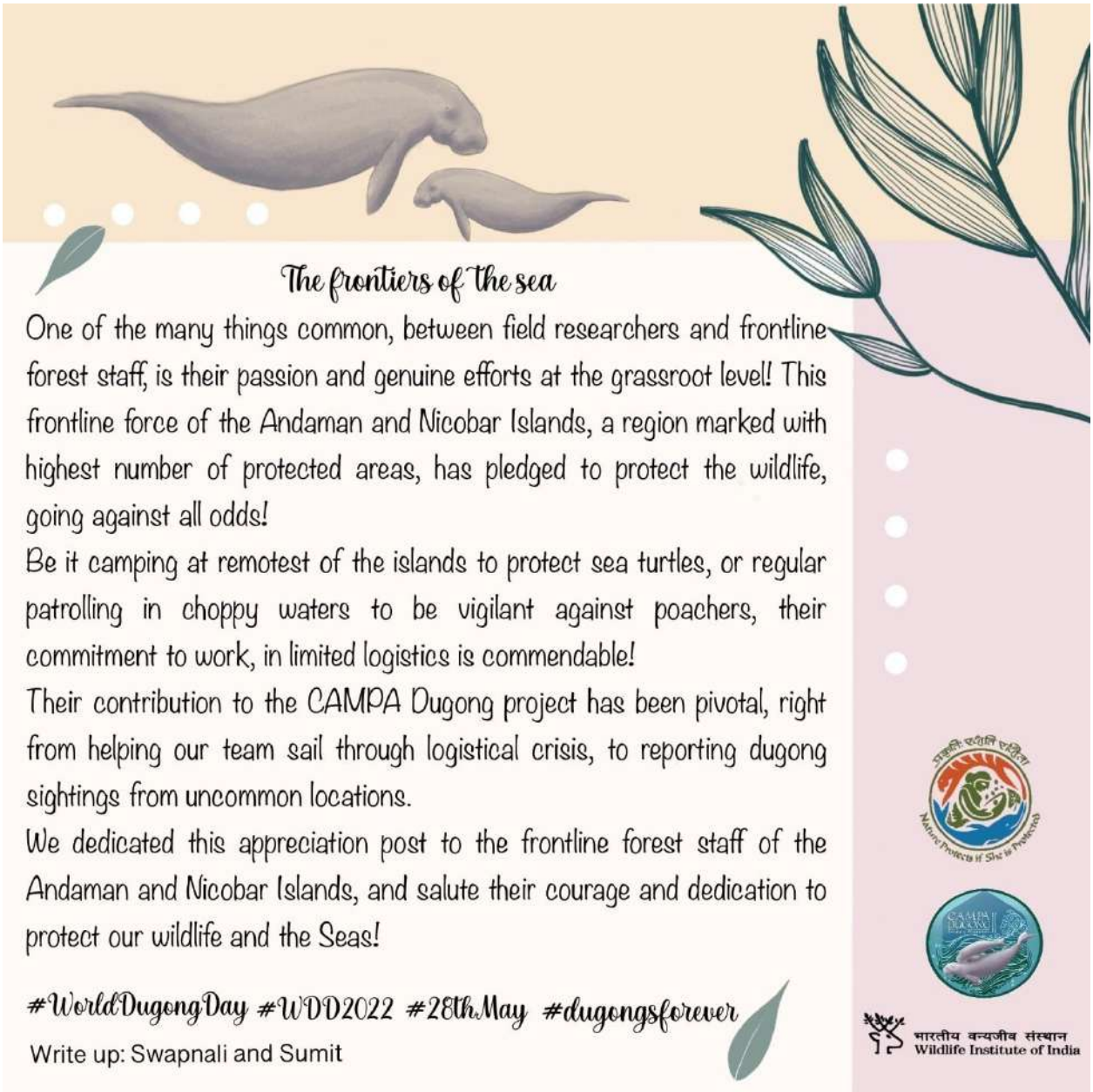


Figure 132. World Dugong Day post-Day 16

Figure 133. Appreciation post

27th May 2022: Meet the dugong heroes: Commdt Rishabh Saxena (Indian Coastguard)

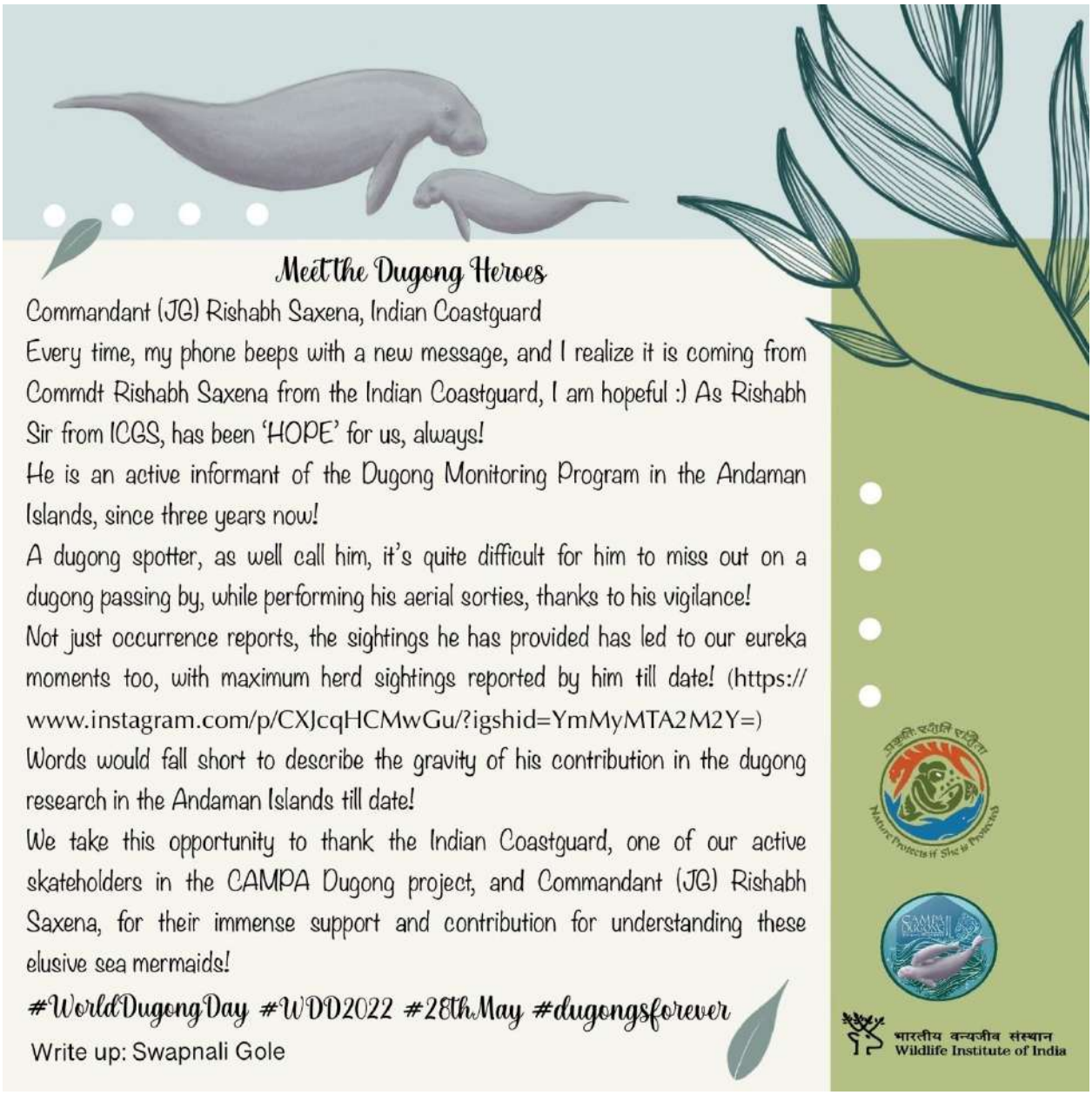


Figure 134. World Dugong Day post Day 19

27th May 2022: Webinar on Dugong Day

Figure 135. Webinar Flyer for World Dugong Day

27th May 2022: Meet the dugong heroes: Nvk (ACD) Karan Singh (Indian Coastgaurd)

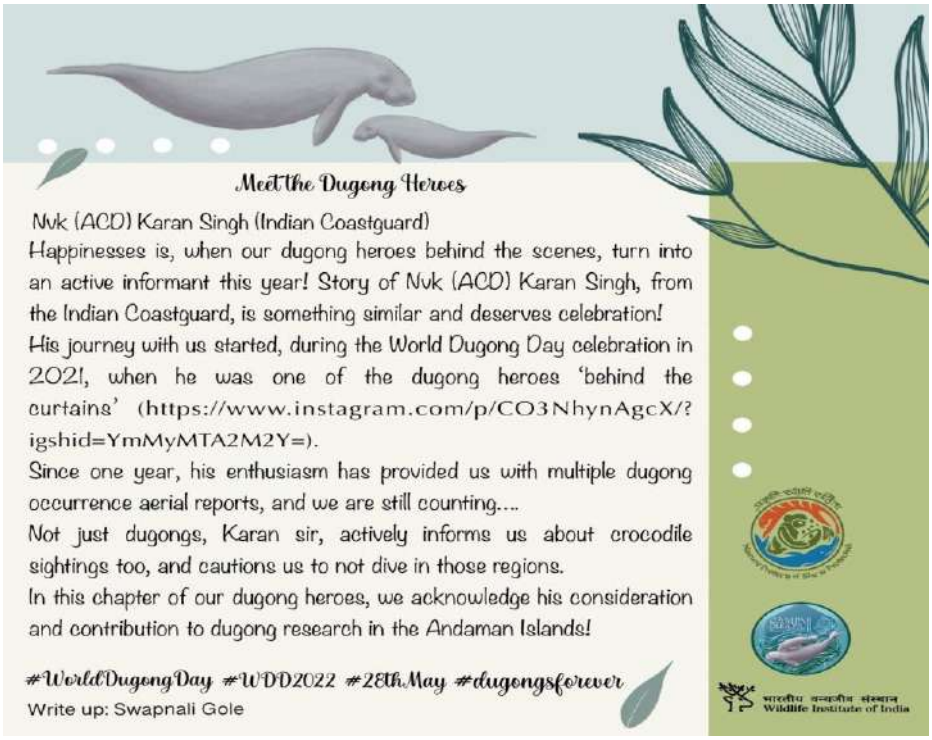


Figure 136. World Dugong Day post Day 19

28th May 2022: Happy World Dugong Day

Figure 137. World Dugong Day post

2.4. Other important celebrations

2.4.1. Webinar on Advances in marine conservation and research

The National Wildlife Week is celebrated from the 2nd to the 8th of October every year in India. This week aims at protecting and preserving India's flora and fauna. Wildlife Week was conceptualized in 1952 with a long-term goal to safeguard the lives of the endangered and threatened species of animals.

Figure 138. Wildlife Week poster for webinar on Advances in Marine Conservation & Research

India is a biological hotspot, which means, it is home to a large variety of animal and plant species. India's flora and fauna are highly diversified and constitute more than 7 percent of the world's biodiversity. It also incredibly accounts for 7.4 percent of the world's fauna. This highly biologically diversified country requires proper education and awareness to preserve this rich cover. Hence, wildlife week was conceptualized.

CAMPA-Ministry of Environment, Forest & Climate Change, Government of India, the Wildlife Institute of India, and ENVIS, MoEF& CC jointly organized an online webinar titled "Advances in Marine Conservation Research in India" at 10 AM to 4 PM on 1st October 2021. This webinar aimed to provide an overview of the latest tools and

techniques that are being used in marine conservation research projects at WII. The webinar was held online on YouTube, and it can be accessed at the following weblink;

https://tinyurl.com/rj3dfj8v; a total of 675 people viewed this event.

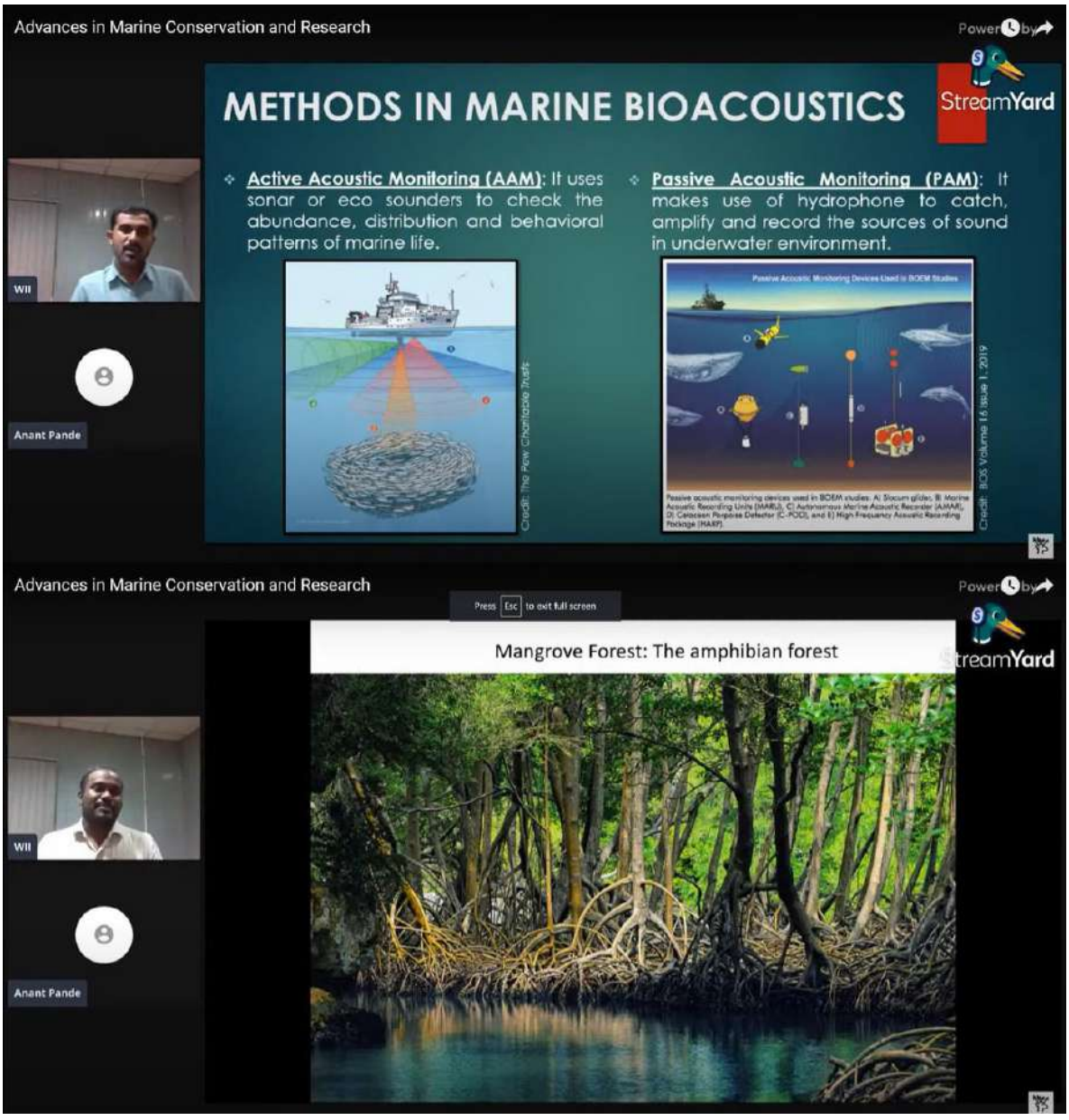


Figure 139. Glimpse of wildlife week webinar

2.4.2. Celebration of International Seagrass Day

Healthy seagrass =healthy planet. World Seagrass Day is celebrated annually on 1st March to raise awareness about seagrass and its important functions in the marine ecosystem. The seagrasses are grass-like plants that live close to the sea. They are the only flowering plant to grow in the marine environment. There are more than 60 seagrass species in the world. They act as the best carbon sink and provide food for marine life.

Figure 140. World seagrass day

2.4.3. Celebration of World Wildlife Day (WWD)

World Wildlife Day (WWD) is an opportunity to celebrate the many beautiful and varied forms of wild fauna and flora and raise awareness of their conservation's many benefits. At the same time, the Day reminds us of the urgent need to step up the fight against wildlife crime and human-induced reduction of species, which have wide-ranging economic, environmental and social impacts

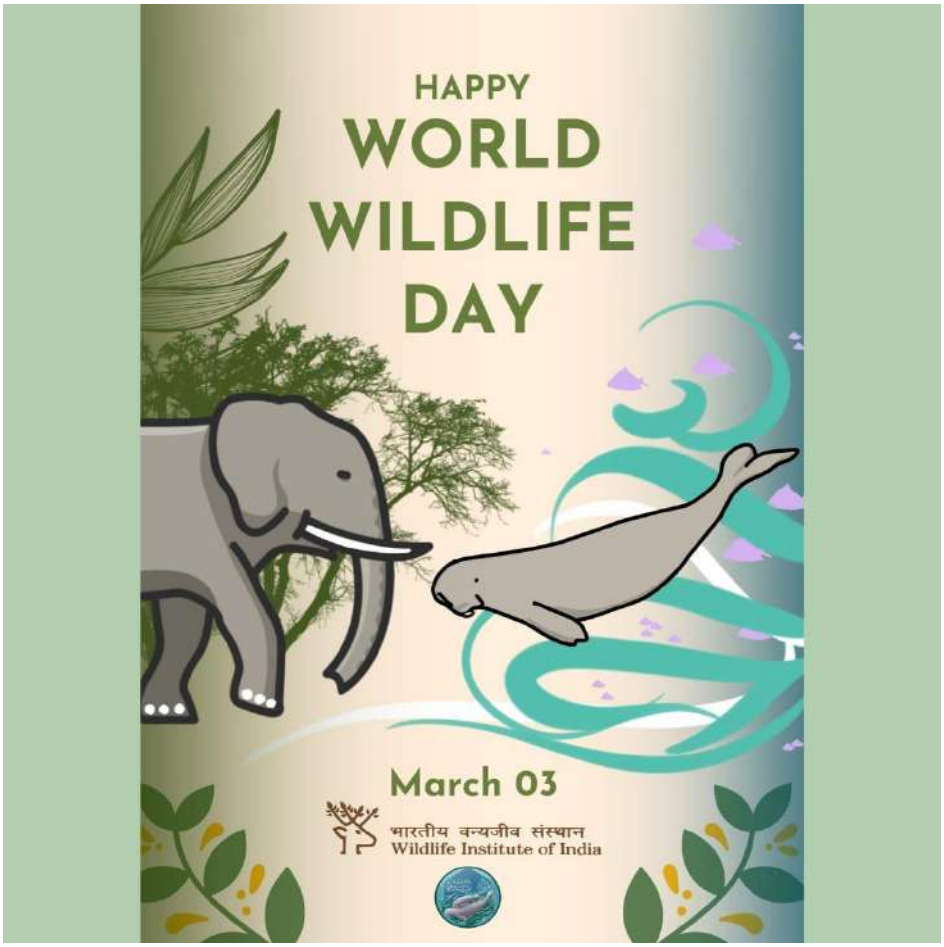


Figure 141. World Wildlife Day post

2.5. Stranding workshop on Marine Mammals 2021-2022

The Wildlife Institute of India organized a marine mammal stranding workshop in collaboration with the Ministry of Environment, Forest and Climate Change, Government of India, Central Zoo Authority, ICAR CMFRI, and the Forest Department Rameswaram, Tamil Nadu, on 17th to 19th October 2022. The workshop was an attempt to help strand networks and the forest department aid in quick response to both alive as well as dead marine mammal strandings, sample collection, and necropsy protocols.

Figure 142. Marine mammals stranding workshop at Rameswaram

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Annexure. I. Acknowledgement list

Field Assistants; Uzair Kureshi, Satya Swaroop Nanda, Ajay Kumar, Junus Babbar, Tanmay Gokhale, Ajith Kumar, Praveen R., Sreyasa Raj, Mayur Fulmali, Priyambada Routray, Saw Tapori, Esha Gokhale, Ashish Gokhale, Tanmay Gokhale,
Mayur Fulmali, Rajat Pande

Volunteers; Maksud Chhatra, Amisha Nakhwa, Shipra Singh, Fatema Hirkani, Maithili Sawant, Shraddha Pillai, Charushree Santosh, Sneha Baraiya, Mansi Dave, Sanjana Shetty, Leonard Fernandes, Aryan Patel, Atharva Togattiwar, Nachiket Ghag, Xavier D'souza, Shalini Prajapati, Anjali Thevar, Ishani Banerjee, Rajib Saha, Sagnik Datta, Taslima Ahmed Hazarika, Darshita Patel, Zahra Makda, Jenisha Shiyani, Joel D. John, Srigayatridevi Velukumar Nadar, Nitya Bankupalli, Alex Justin

District Forest Officers; Smt. Prabha, District Forest Officer, Pudukkottai District, Thiru. Akhil Thampi, District Forest Officer, Thanjavur District, Thiru. Abhishek Tomar, District Forest Officer, Thoothukudi District, Thiru. M. Ilayaraja, District Forest Officer, Kanyakumari District, Sh. A. K. Paul, DFO Territorial-South Andaman, Sh. Ayyub Hasan, DFO, Nicobar Division, Sh. K. G. Rassogi, DFO, Swaraj Dweep, Sh. Siva Sakthi, DFO-Diglipur Territorial Division

Range Forest Officers; Shri. M.P. Bela, RFO, Devbhumi Dwarka Gujarat Forest Department, Shri Sunil Kanjariya, RFO, Poshitra Forest Division Gujarat Forest Department, Shri. Yadvendra Jadeja, RFO, Jodiya range, Jamnagar, Gujarat Forest Department, Smt. Megala Murugesan, Range Forest Officer, Pudukottai, Thiru. Prathap, Range Forest Officer, Ramanathapuram, Thiru. Mahendran, Range Forest Officer, Ramanathapuram, Smt. Gowsikka, Range Forest Officer, Ramanathapuram, Smt. Thilagavathi, Range Forest Officer Ramanathapuram, Thiru. Jino Range, Forest Officer, Ramanathapuram, Thiru. Saravanan, Range Forest Officer, Ramanathapuram, Thiru. Rajshekar, Range Forest Officer, Ramanathapuram, Thiru. Ragu, Range Forest Officer, Ramanathapuram, Thiru. Senthil Kumar, Range Forest Officer, Ramanathapuram, Thiru. Balamurgan, Range Forest Officer, Ramanathapuram, Thiru. Kumar, Range Forest Officer, Thanjavur District,

Coastal Security Group; Smt. Muthu Kannu, Inspector of Police, Coastal Security Group, Pattukottai, Thanjavur, Thiru. Rajkumar, Sub-Inspector of Police, Coastal Security Group, Pattukottai, Thanjavur

Assistant Conservator of Forest; Sh. Abdul Aziz, ACF-Nicobar Division

Veterinary Officer; Dr. Sam Varghese, Forest Department, ANI

Deputy Range Officer; Sh. Mondal, Nancowry Division

Forest Rangers; Sh. Shadab Ali, Forest Ranger-Katchal, Sh. Pramod Singh, Forest Ranger-Great Nicobar, Sh. Erula Rajan, Forest Ranger- MGMNP and Lohabarrak Wildlife Division, Sh. Jagdish Kumar Rao, Forest Ranger, Wimberlygunj, Sh. Bipul Chandra Roy, Forest *Ranger-*Aerial Bay, Diglipur

Forester; Sh. Mohammad Hussain, Forester, MGMNP, Sh. Priyesh Pandey, Forester, Diglipur

Forest Guard; Shri Santosh Dey, Forest Guard- Diglipur

*DRM-Forest Depart*ment; Sh. Ibrahim and crew, DRM-Kamorta Forest Department, Amarjit Pal, Boat Master-Diglipur Forest Department, Debashish, DRM-Diglipur Forest Department, Sushanta Baroi, DRM-Diglipur Forest Department

Annexure. II. Media reports and coverage

૧૬ નવેમ્બર નાં દિવસે CAMPA ડુગોંગ પ્રોજેક્ટમાં કાર્યરત ભારતીય વન્યજીવ સંસ્થાના(WII) સંશોધકો શિવાની પટેલ અને પ્રાચી હટકર ઓખાની કેન્દ્રીય વિદ્યાલય ખાતે ધોરણ ૯ અને ૧૦ નાં ૬૦ વિદ્યાર્થીઓને તેમજ શિક્ષકોને "દરિયાઈ ગાય (ડુગોંગ)" વિશે જાગૃત કરાયા. તેઓને કચ્છના અખાત માં જોવા મળતી અન્ય દરિયાઈ જીવસૃષ્ટિ વિશે પણ માહિતગાર કર્યા હતાં. તમામ વિદ્યાર્થીઓને અને શિક્ષકોને "મારો મિત્ર ડુગોંગ (દરિયાઈ ગાય)" નું પુસ્તક પણ વિતરણ કરવામાં આવ્યું હતું. તેમજ બધાં વિદ્યાર્થીઓ અને શિક્ષકોએ દરિયાઈ ગાય ને બચાવવાનું અને આપણા દરિયાકિનારે કચરો ન ફેંકવાનો સંકલ્પ પણ કર્યો હતો.

ઓખા ખાતે CAMPA ડુગોંગ પ્રોજેક્ટ માં કાર્યરત ભારતીય વન્યજીવ સંસ્થાના (WII) સંશોધકો દ્વારા ઓખા કેન્દ્રીય વિદ્યાલયમાં ધોરણ ૯ અને ૧૦ વિદ્યાર્થીઓને દરિયાઈ ગાય વિશે માહિતી આપી જાગૃત કરવામાં આવેલ

તારીખ ૧૬ નવેમ્બર નાં દિવસે CAMPA ડુગોંગ પ્રોજેક્ટમાં કાર્યરત ભારતીય વન્યજીવ સંસ્થાના(WII) સંશોધકો શિવાની પટેલ અને પ્રાચી હટકર ઓખાની કેન્દ્રીય વિદ્યાલય ખાતે ધોરણ ૯ અને ૧૦ નાં ૬૦ વિદ્યાર્થીઓને તેમજ શિક્ષકોને "દરિયાઈ ગાય (ડુગોંગ)" વિશે જાગૃત કરવામાં આવ્યા અને તેઓને કચ્છના અખાત માં જોવા મળતી અન્ય દરિયાઈ જીવસૃષ્ટિ વિશે પણ માહિતગાર કર્યા હતાં. તમામ વિદ્યાર્થીઓને અને શિક્ષકોને "મારો મિત્ર ડુગોંગ (દરિયાઈ ગાય)" નું પુસ્તક પણ વિતરણ કરવામાં આવ્યું હતું. તેમજ બધાં વિદ્યાર્થીઓ અને શિક્ષકોએ દરિયાઈ ગાય ને બચાવવાનું અને આપણા દરિયાકિનારે કચરો ન ફેંકવાનો સંકલ્પ પણ કર્યો હતો.

First survey to count dolphin off Gujarat coast begins near Dwarka

Nimesh.Khakhariya
@timesgroup.com

Rajkot: In a first, the forest department has initiated a detailed survey of dolphins to chalk out strategies for the conservation and management of this protected species.

The survey started near the temple town Dwarka and it would be extended to other areas of the Arabian Sea where frequent sightings of dolphins are reported by the locals and fishermen.

Dolphins are spotted in the sea from Okha to Navlakhi in the Gulf of Kutch. The survey is being conducted in an area sprawling approximately 850 sq km. Officials said this baseline survey will provide a rough estimate of the number of dolphins in the areas of frequent sightings, availability of sufficient prey base, etc.

Dolphins are spotted in sea between Okha and Navlakhi

Pratik Joshi, range forest officer, Marine National Park (MNP) said, "Dolphin is a keystone species, which helps understand the entire ecosystem of marine biodiversity. There are many aquatic creatures that prey on dolphins and vice versa. This survey will also give us an idea of the existence of other species in the sea." Joshi added, "To date, no scientific survey was conducted regarding dolphin numbers, barring a couple of them conducted by individuals. This is the first time a systematic scientific survey has been undertaken." The survey is being conducted using 'line transect sampling method,' which is a simple way of estimating numbers of a large chunk of wild creatures in which binoculars and some basic equipment are sufficient. A total of 10 teams are engaged in this survey in which the MNP is a nodal agency.

Other agencies who have joined this exercise are the Jamnagar forest division, Dwarka social forestry division, Zoological Survey of India, Wildlife Institute of India, Wildlife Trust of India, and the Central Fisheries Research Institute, Veraval. Forest officials said a team comprises three to four people with one team leader, two observers and one technical expert.

Fishermen who save marine mammals in Gulf of Mannar to get rewards

TIMES NEWS NETWORK

Ramanathapuram: Wildlife officials in the Gulf of Mannar Marine National Park (GMMNP) are planning to introduce rewards for fishermen who save marine mammals. The decision comes after local fishermen saved two dugongs and two dolphins recently after they were accidentally caught on their nets.

Gulf of Mannar Marine National Park, forming the core area of an even more extensive Gulf of Mannar Marine Biosphere Reserve, sprawls over an area of 560 square kilometers and the first area to be declared as a marine national park in South East Asia.

The marine national park has around 117 species of corals, fishes, sea horses, dolphins, sharks, porpoises, sea cows, sea turtles and even whales. However, the region, one of the important fishing grounds of the local community, threatens marine habitat. Wildlife officials said it has necessitated that a proper consensus and a line of control be reached between the conflicting priorities.

BACK TO NATURE: Fishermen releasing a dugong into the sea

Of late, the fisher folk play a very active role to safeguard the marine mammals and they have started considering them as their kith and kin, which motivates them to release the marine mammals back into the sea if they are accidentally caught in their fishing gear, say officials. CAMPA (Compensatory Afforestation Management and Planning Authority) Dugong Recovery Project of Wildlife Institute of India along with the forest department have been incentivizing such eco-friendly efforts along the Gulf of Mannar coast for some time, said the officials.

As the efforts are yielding results, they are being appreciated by forest secretary Supriya Sahu and Ramanathapuram wildlife warden Bakan Jagdish Sudhakar said wildlife ranger Jino Blessil. "In addition to it, our department has undertaken intense vigil along the coast, especially in the regions where shore-netting is practised," the officer said.

Shore-netting is one of the ancient fishing techniques where an entire fishing hamlet draws a massive fishing net dropped in the sea in a semi-circle format to the shore. The dolphins are attracted to these shore-nets since they can get easy prey if they follow these nets. And in the process, the dolphins get accidentally caught in shore-nets and drown to death. On November 16, two dolphins were caught in the shore-net at Seelameenpadu in Ramanathapuram district. Fishermen Nagoor Kani and Ahmad Jallaludeen took all the efforts to release these mammals back into the sea. On Saturday, a dugong was caught in the shore net at Nariippaiyur in Ramanathapuram district. Fishermen Manikandan and Yoseppu organised the release of the dugong into the sea, according to the forest department.

"But the marine mammals, when caught in the shore-nets, damage the fishing gear resulting in the loss of fish. So, the department is planning to come out with a reward system for the fishermen who save the marine mammals," added Blessil.

Conserving Marine Ecosystem Bioengineers, the 'Seagrass': A need of our future

By Prachi Hatkar

Dugong Dugon

Image courtesy : With Thanks from Internet for Social Awareness

Seagrass are underwater angiosperms (flower bearing plants). Unlike Seaweed or Algae they bear roots, stems leaves, fruits and flowers like terrestrial plants. Seagrasses grow in salty and brackish waters around the world, typically along gently sloping, protected coastlines. Since they depend on light for photosynthesis, they are most commonly found in shallow depths where light levels are high. Seagrasses are often called ecosystem engineers because they modify their environments to create unique habitats. Seagrass meadows globally are under pressure with worldwide loss and degradation, but there is a growing recognition of the global importance of seagrass ecosystem services, particularly as a major carbon sink and as fisheries habitat. Even though seagrasses occupy only 0.1% of the ocean floor, they sequester up to 11% of the organic carbon buried in the ocean.

Seagrasses absorb 83 million tonnes of carbon from the atmosphere annually. One acre of seagrass can sequester 740 pounds of carbon per annum.

Seagrasses can capture carbon from the atmosphere up to 35 times faster than tropical rainforests. They also play a vital role in oxygen production and absorption of carbon dioxide and acts as a purifier in aquatic ecology.

About one square meter of seagrass can generate 10 litre of oxygen every

Workshop on marine mammal stranding

EXPRESS NEWS SERVICE
@ Rameswaram

THE Wildlife Institute of India has organised the first ever 'marine mammal stranding response workshop' in the State in Rameswaram, and the three-day event was inaugurated on Monday.

The CAMPA Dugong team of the Wildlife Institute of India, Dehradun, will conduct the capacity-building workshop in collaboration with the Central Marine Fisheries Research Institute (CMFRI), Tamil Nadu State Forest Department and the Central Zoo Authority (CZA) for the forest department personnel deployed along India's coastline from Monday to Wednesday. The CAMPA- Dugong recovery programme funded the workshop under the Ministry of Environment Forest and Climate Change (MoEFCC).

The workshop aims to help State agencies to review capabilities and research activities to conserve marine mammals | EXPRESS

Tamil Nadu Principal Chief Conservator of Forests Shekhar Kumar Niraj inaugurated the workshop and said the programme had provided scientists, protected area resource managers, and veterinarian experts of the coastal states, a common platform to discuss current research and monitoring programmes on marine mammals and identify priority information requirements for stranding events.

The three-day workshop would witness various technical sessions, practical demonstration classes and discussions on possible interventions for marine mammal stranding. Emphasis will be given to developing a standard protocol for stranded marine mammals that are easy to follow. At the same time, the detailed step-by-step analysis will help frontline responders and researchers alike. The workshop aims to help State agencies to review capabilities and research activities to conserve marine mammals.

On the first day of the special workshop, scientists from Pondicherry university, OMCAR foundation and Wildlife Institute of India conducted sessions about marine biodiversity and conservation, the Dugong recovery programme, introduction to common marine mammals of the country, the threats they face, and Marine Mammal Stranding Response - Experience from Palk Bay. Practical and field visit sessions will be taken up on the second and third days of the workshop.

तरुण भारत
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कच्छच्या आखातातून समुद्री गाईची नोंद

» उमंग काळे «

मुंबई, दि. १२ : कच्छच्या आखातामधून प्रथमच दुर्मीळ समुद्री गाईचे (डुगॉंग) छायाचित्र टिपण्यात संशोधकांना यश मिळाले आहे. भारतीय वन्यजीव संस्थानच्या (डब्ल्यूआयआय) संशोधकांनी 'एरियल ड्रोन'च्या माध्यमातून समुद्री गाईचे छायाचित्र टिपले. गुजरातच्या सागरी परिसंस्थेत हाताच्या बोटावर मोजण्याइतके दुर्मीळ समुद्री गाईचे वास्तव्य राहिले आहे. त्यामुळे त्यांच्या संवर्धनासाठी गुजरात वनविभाग आणि 'डब्ल्यूआयआय'कडून अभ्यास सुरू आहे.

'डुगॉंग' हे किनारी भागची परिसंस्थेत मूलभूत भूमिका बजावतात. भारतीय किनारपट्टीवर अंदमान आणि निकोबार बेट, तामिळनाडू (मन्नार आणि पाल्क बेचे आखात) आणि गुजरात (कच्छचे आखात) या तीन ठिकाणी 'डुगॉंग'चा अधिवास आढळतो. मच्छीमारांच्या माहितीनुसार, या भागात 'डुगॉंग'चे अस्तित्व होते. परंतु, याआधी गुजरातच्या किनाऱ्यावरून जीवंत 'डुगॉंग'चे छायाचित्रित पुरावे मिळाले नव्हते. त्यासाठी 'डब्ल्यूआयआय'च्या संशोधकांकडून या प्राण्याच्या संवर्धनासाठी एक अभ्यास प्रारंभ सुरू होता.

वर्षभरापासून 'डब्ल्यूआयआय'कडून यासंबंधीचा अभ्यास सुरू आहे. मात्र, सध्या 'लिटिकल डुगॉंग मॅपिंग' कार्यक्रमाचा एक भाग म्हणून 'डब्ल्यूआयआय'चे डॉ. जे. ए. जॉन्सन आणि पुदुचेरी विद्यापीठातील प्राध्यापक डॉ. के. शिवकुमार यांच्या मार्गदर्शनाखील संशोधक समीहा पठाण, सागर राजपूरकर, शिवानी पटेल, प्राची हटकर, जेम्स किशन आणि उझैर कुरेशी हे 'डुगॉंग'वर संशोधनाचे काम करत होते. या कामासाठी 'एरियल ड्रोन'चा वापर करून 'डुगॉंग'च्या अस्तित्वाचा पुरावा नोंदवण्याचे काम सुरू होते. हे काम संशोधक सागर राजपूरकर यांच्या माध्यमातून सुरू होते. अखेरीस राजपूरकर यांना कच्छच्या आखातामधून जीवंत 'डुगॉंग'चे छायाचित्र टिपण्यात यश मिळाले आहे. महत्त्वाचे म्हणजे कच्छच्या आखातामधून नोंदवलेला हा जीवंत 'डुगॉंग'चा पहिला छायाचित्रित पुरावा आहे.

डुगॉंगविषयी...

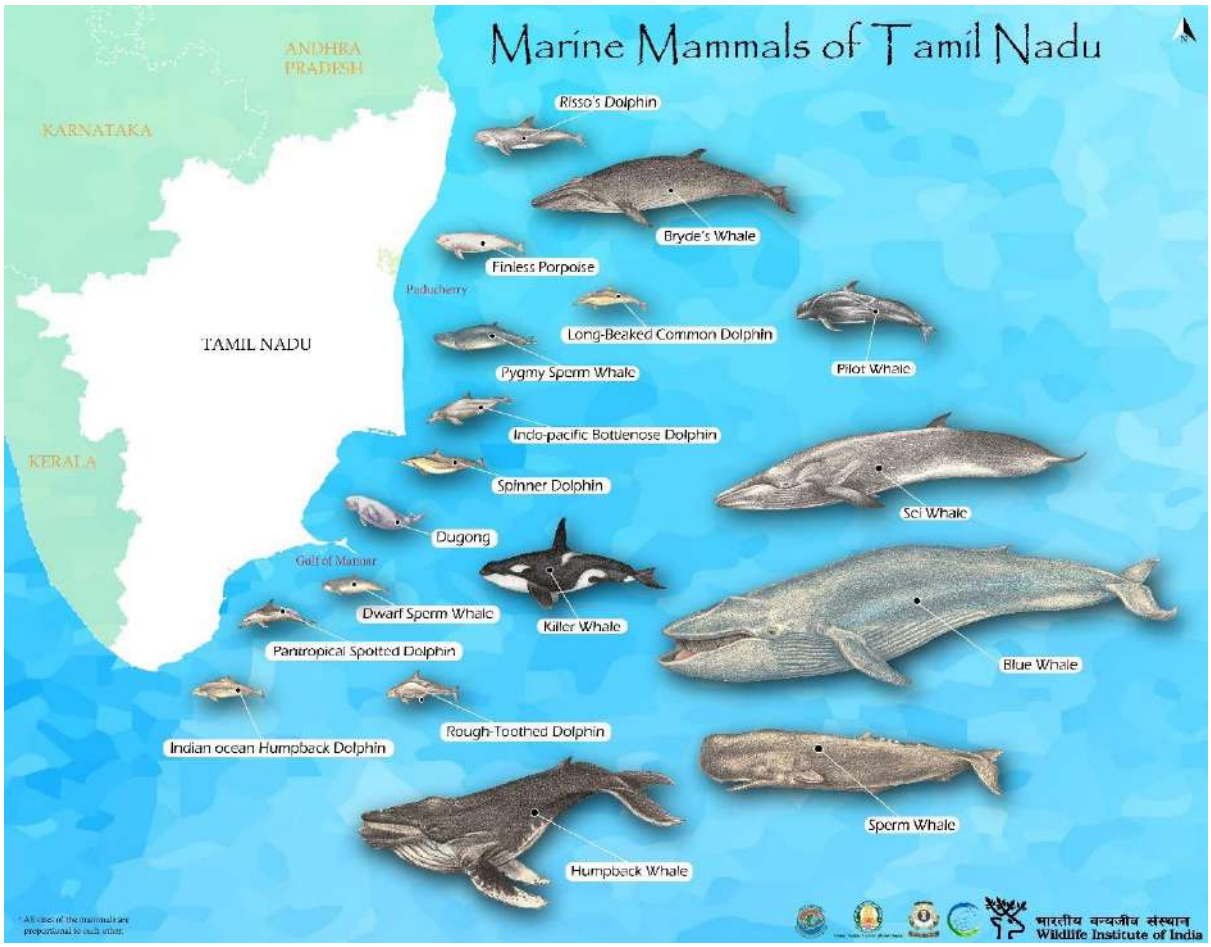
डुगॉंग ही सिरेनिया समुद्री गाईच्या अस्तित्वात असलेल्या फक्त चार प्रजातींपैकी एक आहे. हा एकमेव तृणभक्षी सस्तन प्राणी आहे, जो केवळ समुद्रातील गवताळ अधिवासावर अवलंबून आहे. वाढत्या मासेमारीमुळे आणि इतर किनारी विकासकामांमुळे भारतातील समुद्रातील गवताळ अधिवासाचा ऱ्हास झाला आहे. यामुळे डुगॉंगचे अस्तित्व संकटात सापडले आहे. मात्र, १९७२च्या 'वन्यजीव संरक्षण कायद्या'अंतर्गत हा सागरी सस्तन प्राणी प्रथम श्रेणीत संरक्षित आहे. तसेच हा प्राणी 'कन्व्हेन्शन ऑन इंटरनॅशनल ट्रेड इन एनडेंजर्ड स्पिसीज ऑफ वाईल्ड फौना ॲण्ड फ्लोरा' (सायटिस) अंतर्गतही संरक्षित आहे.

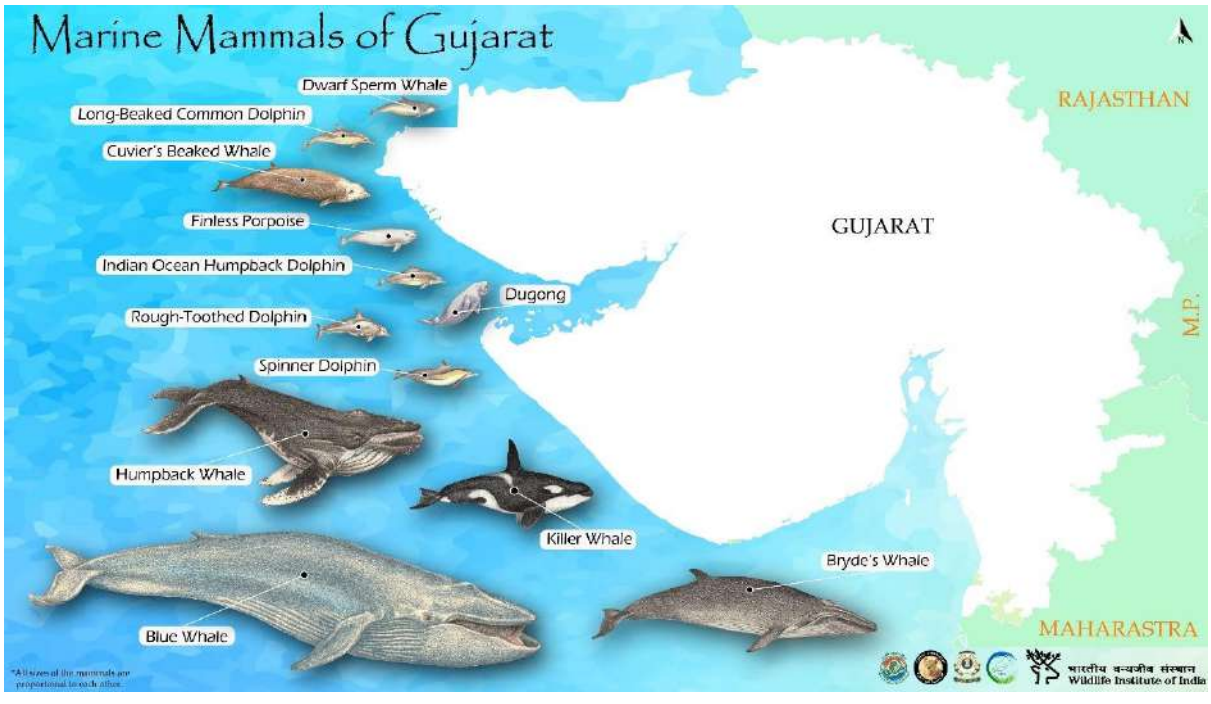
छायाचित्रामुळे डुगॉंगच्या संरक्षणासाठी प्रोत्साहन

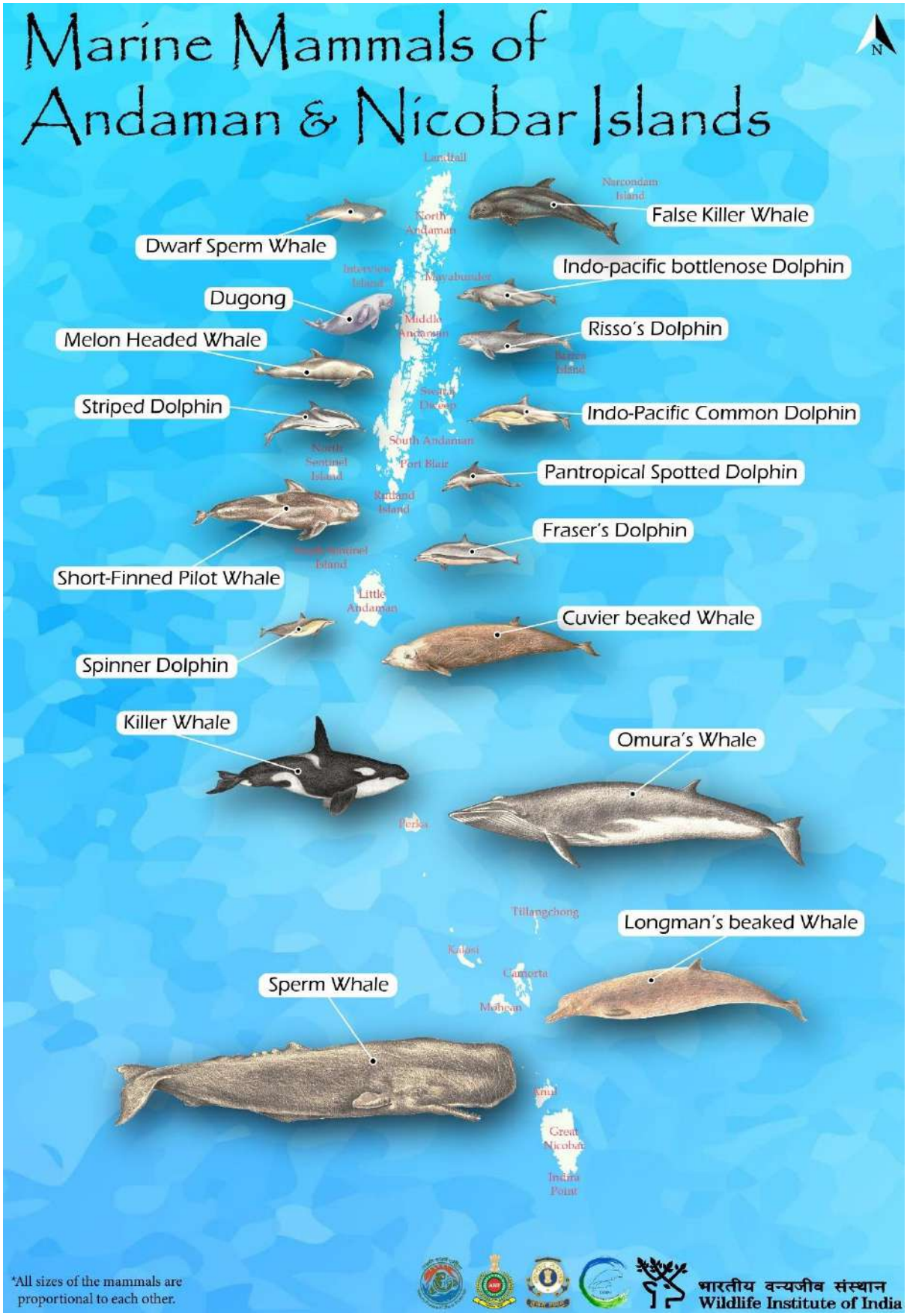
"अंदाज आणि अटकाळ पुरावे असूनही 'ड्रोन'च्या माध्यमातून टिपलेले छायाचित्र हे कच्छच्या आखातातील डुगॉंगच्या अस्तित्वाची पुष्टी करतात. ही एक यशस्वी कामगिरी आहे. ज्यामुळे सागरी राष्ट्रीय उद्यानाच्या प्रशासनाला कच्छच्या आखातातील डुगॉंगच्या अधिवासाचे संरक्षण करण्यासाठी अधिक प्रोत्साहन मिळेल.

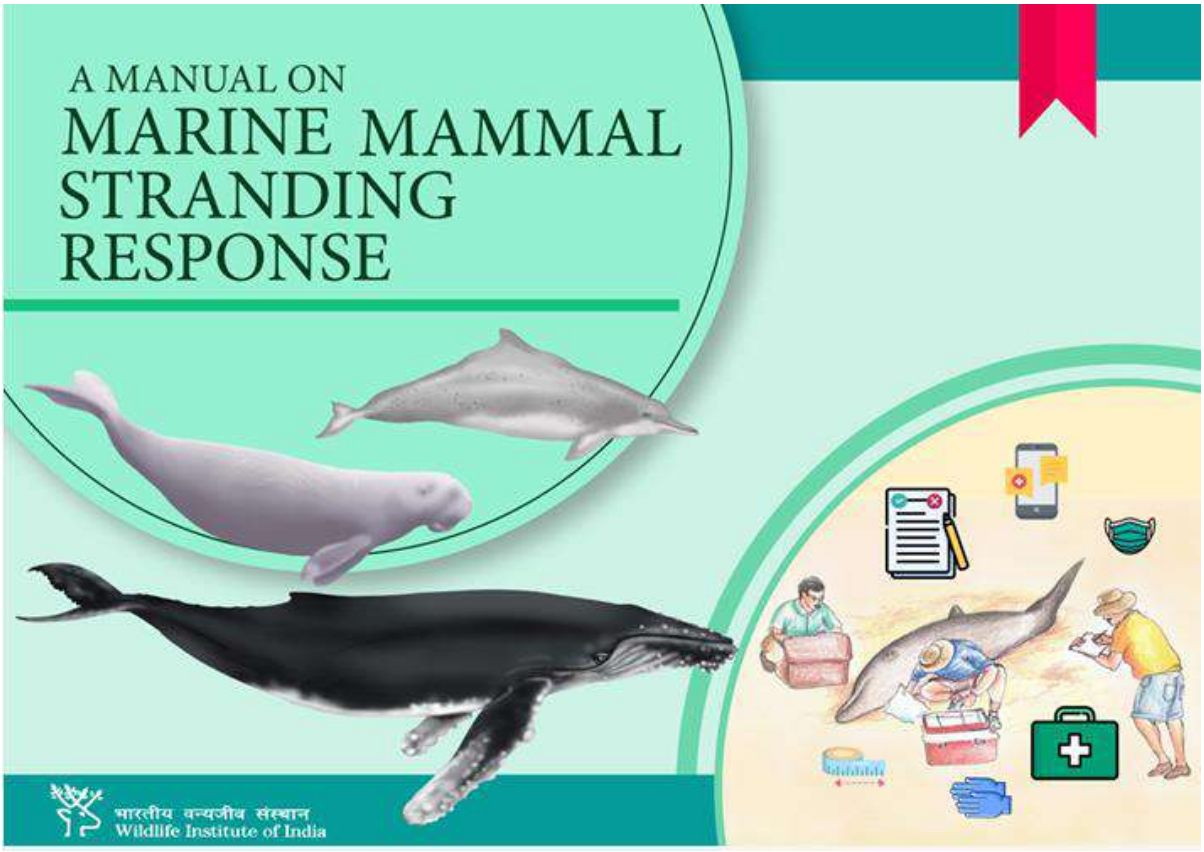
-सेंथिल कुमारन, उपसंरक्षक, मरिन नॅशनल पार्क, जामनगर

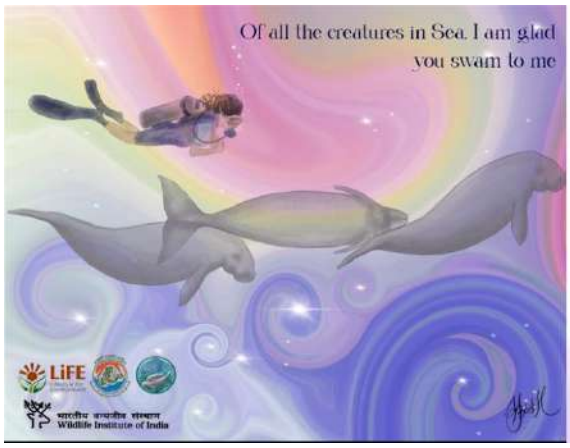
Annexure. III. Outreach material and publications



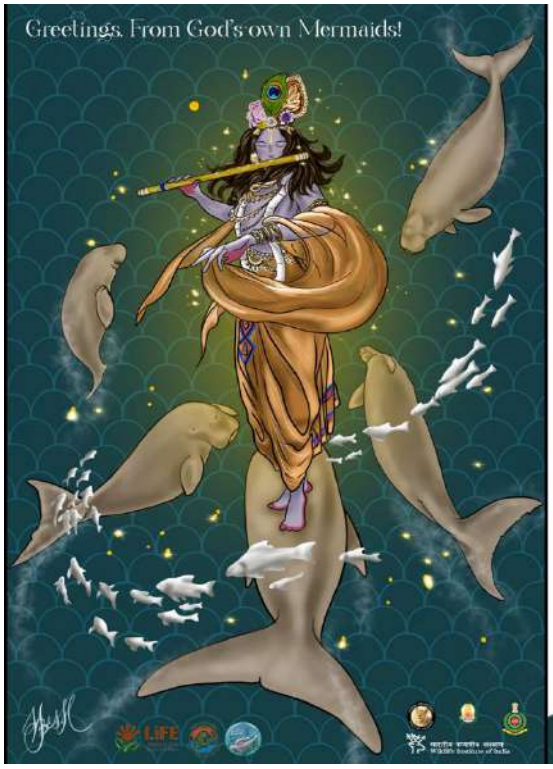



Marine Mammals of
Andaman & Nicobar Islands
N
Landfall
Narcondam Island
North Andaman
False Killer Whale
Dwarf Sperm Whale
Interview Island
Mayabunder
Indo-pacific bottlenose Dolphin
Dugong
Middle Andaman
Risso's Dolphin
Melon Headed Whale
Baratang Island
Striped Dolphin
Swaraj Dweep
Indo-Pacific Common Dolphin
South Andaman
North Sentinel Island
Port Blair
Pantropical Spotted Dolphin
Rutland Island
Fraser's Dolphin
South Sentinel Island
Short-Finned Pilot Whale
Little Andaman
Cuvier beaked Whale
Spinner Dolphin
Killer Whale
Omura's Whale
Perka
Tillangchong
Longman's beaked Whale
Kalpsi
Camorta
Sperm Whale
Mohean
Katchal
Great Nicobar
Indira Point
*All sizes of the mammals are proportional to each other.
भारतीय वन्यजीव संस्थान
Wildlife Institute of India





Dugong, also known as sea cows, is a MARINE MAMMAL that inspired the stories of the Mermaids!
Close relatives: MANATEES, ELEPHANTS, and HYRAXES.
DIET: Aquatic plant called SEAGRASSES (not sea-algae)! These gentle giants eat approximately 30kg of seagrass a day!
DISTRIBUTION: ~40 countries in Indo-Pacific tropical and subtropical waters. In INDIA, dugongs are found in the GULF OF MANNAR & PALK BAY(Tamil Nadu), GULF OF KUTCH (Gujarat), and the ANDAMAN & NICOBAR ISLANDS!
THREATS to dugongs include unregulated boat speed, accidental net entanglement, illegal hunting/ poaching, and habitat loss!



Beyond ecology, dugongs hold mythological importance, preserved as narratives in the ancient epic MAHABHARATA!
As the holy city of DWARKA sank into the Arabian Sea right after lord Krishna's death he ensured that his dearest cows would not suffer the wrath of the sea! The sea devoured every inhabitants as Dwarka sank, but not the cows! As Krishna's cows were transformed into Sea cows, today known as dugongs

Journal of Threatened Taxa | www.threatenedtaxa.org | 26 January 2023 | 15(1): 22494–22500
ISSN 0974-7907 (Online) | ISSN 0974-7893 (Print)
https://doi.org/10.11609/jott.8163.15.1.22494-22500
#8163 | Received 28 August 2022 | Final received 20 October 2022 | Finally accepted 09 January 2023
COMMUNICATION
OPEN ACCESS

Flowering and fruiting of Tape Seagrass *Enhalus acoroides* (L.f.) Royle from the Andaman Islands: observations from inflorescence buds to dehiscent fruits

Swapnali Gole [1], Sivakumar Kuppusamy [2], Himansu Das [3] & Jeyaraj Antony Johnson [4]

[1] CAMPA_Dugong Project, Wildlife Institute of India, Chandrabani, Dehradun, Uttarakhand 248001, India.
[2] Department of Ecology and Environmental Sciences, School of Life Sciences, Pondicherry University, R.V. Nagar, Kalapet, Puducherry 605014, India.
[3] Unit Head - Marine Threatened Species and Habitats, Terrestrial and Marine Biodiversity, Environment Agency Abu Dhabi, UAE.
[4] Department of Habitat Ecology Wildlife Institute of India, Chandrabani, Dehradun, Uttarakhand 248001, India.
[1] gole.swapnali@gmail.com, [2] ksivakumarwii@gmail.com, [3] hsdas@ead.gov.ae, [4] jaj@wii.gov.in (corresponding author)

Abstract: Seagrass phenophases are crucial in understanding their reproductive biology but are seldom documented. We studied flowering and fruiting phenophases of *Enhalus acoroides* from a mixed-species intertidal seagrass meadow in Ritchie's archipelago, Andaman Islands, India. The estimated mean densities of pistillate and staminate flowers were 16.0 ± 12.0/ m² and 12.7 ± 7.3/ m², respectively. We observed the bloom of free-floating male flowers (961.7 ± 360.4/ m²) during the spring low tides (at mean sea surface temperature ~30°C). Seagrass cover, shoot density, and canopy height of *E. acoroides*, along with flowering densities, showed a zonal variation within the sampled meadow. We report the first-time observations of several phenophases of *E. acoroides*, such as female inflorescence buds, male inflorescence, a bloom of released male flowers, pollination, and fertilized flowers from the Indian waters. We also report the prevailing threats to seagrass meadows, such as meadow scarring done by boat anchorage in the Andaman Islands.

Keywords: Mass bloom, meadow scarring, mixed-seagrass meadow, Swaraj Dweep.

Aquatic Mammals 2023, *49*(1), 53-61, DOI 10.1578/AM.49.1.2023.53

Herd Size Dynamics and Observations on the Natural History of Dugongs (*Dugong dugon*) in the Andaman Islands, India

Swapnali Gole,[1] Sumit Prajapati,[1] Nehru Prabakaran,[1]
Jeyaraj Antony Johnson,[1*] and Kuppusamy Sivakumar[2]

[1]*Wildlife Institute of India, Dehradun, India*
**E-mail: jaj@wii.gov.in*
[2]*Department of Ecology, School of Life Sciences, Pondicherry University, Puducherry, India*

Abstract

In the last four decades, dugong (*Dugong dugon*) aggregations have been rarely reported from the geographically isolated, vast seascape of the Andaman Islands, India. The Indian Ocean tsunami of 2004, hunting, coastal development, and habitat loss are the major causes of this change in the social system of dugongs in the Andaman Islands. Our long-term monitoring study (2017 to 2022) reveals a changing trend in aggregating behaviour of dugongs. In an inclusive, collaborative effort, we engaged multiple stakeholders using two approaches: (1) creating a spatially spread citizen science network targeting sea-faring agencies—the fishers, forest department, SCUBA divers, and defence bodies (Indian Navy and Indian Coast Guard); and (2) conducting standardized questionnaire surveys (UNEP/CMS) with fishers. Our approach yielded reports of 63 herd sightings of dugongs from the Andaman archipelago. The fishers reported 73.01% of the sightings, followed by the defence bodies (20.63%), forest department (3.18%), and SCUBA divers (3.18%) like the Andaman and Nicobar Islands. Moreover, such an approach would be critical for sensitizing the local stakeholders regarding the conservation and management of large marine mammals such as dugongs.

Key Words: sirenians, dugongs, *Dugong dugon*, citizen science, anecdotal, seagrasses, bycatch, aquatic mammals

Introduction

Dugongs (*Dugong dugon*, Müller) are an elusive marine mammal species with a wide distribution range in Indo-Pacific tropical waters, spanning 39 countries (Marsh et al., 2011). Global decline in dugong populations, mostly due to bycatch, boat collision, hunting (indigenous/illegal), and habitat loss (Marsh et al., 2011; Hines, 2012), demands strong national/transnational legislative measures for conserving the remnant dugong population across its distribution range. In India, dugongs receive the highest legal protection under Schedule-I of the Indian Wildlife (Protection) Act of 1972, which pro-

Understanding dietary differences in Indian dugongs through opportunistic gut sampling of stranded individuals

Sumit Prajapati[1], Chinmaya Ghanekar[1], Sameeha Pathan[1], Rukmini Shekar[1], K. Madhu Magesh[1], Swapnali Gole[1], Srabani Bose[1], Sweta Iyer[1], Anant Pande[1,2], Kuppusamy Sivakumar[1,3] and Jeyaraj Antony Johnson[1,*]

[1]Wildlife Institute of India, Chandrabani, Dehradun 248 001, India
[2]Marine Programme, Wildlife Conservation Society – India, Bengaluru 560 097, India
[3]Department of Ecology and Environmental Sciences, School of Life Sciences, Pondicherry University, Puducherry 605 014, India

We analysed gut samples of stranded dugongs from Tamil Nadu and Gujarat, India, to understand their dietary preferences. We quantified seagrass fragments from the gut as leaf, stem and rhizome, and identified leaf fragments up to genera level by their morphological features and epidermal cell characteristics using an inverted microscope. The overall abundance of aboveground fragments (leaf, stem) was higher in all samples, which may suggest the dugongs use a cropping mechanism to forage. The ingested seagrass generic diversity was higher in Tamil Nadu ($n = 5$) dugong individuals than those in Gujarat ($n = 2$). A total of five genera were recorded from all samples, viz. *Halophila* spp., *Halodule* spp., *Cymodocea* spp., *Enhalus* sp. and *Syringodium* spp. In Tamil Nadu, *Cymodocea* spp. (46.24%) was the most dominant, followed by *Halophila* spp. (26.49%), *Syringodium* spp. (14.83%) and *Halodule* spp. (12.16%),

the same. The availability of seagrass is one of the limiting factors for dugong distribution. Thus, understanding dugong foraging patterns is crucial for mapping their critical habitats. Dugongs use two major feeding techniques, viz. cropping and excavation of seagrass, depending on species morphology and substratum[7–9]. So far, dugong foraging preferences are known through direct observations of feeding or by analysis of stomach contents[10–13].

Indian dugong populations are at risk due to various threats, with an estimated population of fewer than 300 individuals left in the wild[14,15]. Recent studies across isolated pockets of their distribution along the Indian coastline (Gulf of Kutch in Gujarat, Gulf of Mannar and Palk Bay in Tamil Nadu, and Andaman and Nicobar Islands) have helped generate crucial ecological data on their distribution, habitats, genetic diversity, connectivity and threats[6,15–17]. Limited studies exist on dugong feeding biology from India[13,18], given the difficulty of observing them in the wild. Thus, stranded dugongs provide a critical opportunity to understand their dietary composition through gut sampling. In this study, we utilize the gut contents collected from stranded dugongs to understand the differences in their foraging pattern within the study sites. This study helps fill the research gap on dugong feeding behaviour from the Indian

Annexure. IV. Awareness and outreach activities conducted

List of awareness and outreach activities conducted at Gujarat.

1. Webinar on Dugong conservation India- Bharatiya Vidya Bhavan college

Date: 24th August 2021

Venue: Mumbai

Webinar on "Conservation of Dugongs and their habitats in India" in collaboration with **Bharatiya Vidya Bhavan college** of 45 participants were registered, and e-certificates were given to those participants on 24th August 2021.

2. Webinar on CAMPA–Recovery of Dugongs and their habitats in India

Date: 7th September 2021

Venue: Mumbai

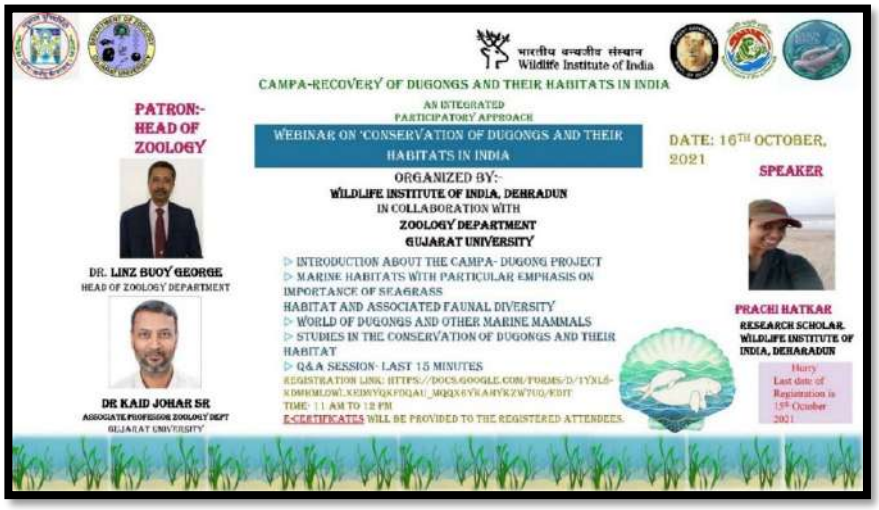
Webinar on "Conservation of Dugongs and their habitats in India" collaboration with Zoology Department, Thakur College of Science and Commerce TCSC Mumbai. A total of 129 participants were registered and e-certificates were given to those participants on 7th September 2021.

3. Awareness program on the Conservation of Dugongs and their Habitats in India

Date: 05th October 2021

Venue: Vidyasagar college of Jamnagar We expanded the Awareness program in the Gulf of Kutch with Vidyasagar college of Jamnagar. Total of 120 college students pursuing graduation and doctoral degree attended the program.

4. Webinar on the Conservation of Dugongs and Their Habitats in the Gulf of Kutch



Date: 16th October 2021

Venue: Gujarat Webinar on "Conservation of Dugongs and their habitats in Gulf of Kutch" collaboration with Zoology Department, Gujrat University. A total of 113 participants were registered, and e-certificates were given to those participants on 16th October 2021.

5. Webinar on the Conservation of Dugongs and Their Habitats in the Gulf of Kutch

Date: 24th October 2021

Venue: Gujarat

Webinar on "Conservation of Dugongs and Their Habitats in Gulf of Kutch" A total of 185 participants were registered. This conservation outreach webinar served to sensitize people on the conservation and protection of marine life, especially the Dugongs and their habitat along Gujarat's coast. To inculcate an aptitude for care for marine life among students as they play a key role in taking forward the message of conservation, the webinar was conducted to share knowledge with students and citizens of Gujarat on 24th October 2021. It was attended by almost 185 participants. Mr. Yashesh Shah, CEO of Secure Nature, and Mrs. Niki Shah, founder of Opus Oceanic Research Laboratory, led the webinar. The dugong recovery project of WII was represented by Ms. Shivani Patel, who described the project's activities and outcome, which were the result of collaborative efforts between governments, NGOs, different stakeholders, and fishing communities.

6. Minutes of meeting with the RFO Mr. Bela of Dwarka range

Date: 23rd November 2021

We discussed future activities with the Dwarka range forest officer, Bela sir. Furthermore,

we discussed what we could do to make the Paga reef Marine Protected Area less crowded through responsible tourism. The outcome was the creation of a community awareness program for dolphin watching near those camping areas to reduce plastic waste and assist in proper waste management practices.

7. Wall painting for the awareness of the local people of Okha port

Date: 26th November 2021

Venue: Okha

The mural was painted to raise awareness of Marine Life conservation among the residents of Okha on 26th November 2021.

8. Awareness program with Elysium marine camp resort

Date: 25th December 2021

Venue: Bet Dwarka

We conducted an awareness event for tourists at Elysium marine campsite in Bet Dwarka on Christmas evening on 25th December 2021 with the help of media personnel Miss Hir Rawal and the camp owner Mr. Bhagirath, where a total of 62 individuals learned about dugongs and their habitats in the Gulf of Kutch. Tourists and campground employees were taught not to use single-use plastic products and were given cloth bags and glass cups to use instead. The children were given storybooks. Tourists pledged not to throw any plastic items in the ocean to save the marine biodiversity around them.

9. Webinar on Conservation of Dugongs & Their Habitats in India

Date: 11th February 2022

Venue: Rajkot

Webinar on "Conservation of Dugongs and their habitats in Gulf of Kutch" collaboration with **Department of Bioscience, Saurashtra**

University. A total of 107 participants were registered and e-certificates were given to those participants on 11th February 2022.

10. Dugong scholarship and Awareness program at Beyt primary school

Date: 21st February 2022

Venue: Shree Kanya beyt Primary School

We held an awareness and scholarship program for 6th to 8th-grade students at Shree Kanya beyt Primary School on 21.02.2022. We also distributed comic books and awareness posters. We educated 80 students about marine life, dugongs, and seagrass habitat, as well as their roles in ecosystems, threats, and conservation initiatives. A scholarship exam was conducted, and 10 students were selected as Dugong ambassadors.

11. Webinar on Conservation of Dugongs & Their Habitats in the Gulf of Kutch, Gujarat

Date: 23rd February 2022

Venue: Ahemdabad

Webinar on "Conservation of Dugongs and their habitats in Gulf of Kutch" collaboration with Department of Zoology, ST. Xavier's College,

(Autonomous) Ahmedabad, A total of 135 participants were registered and e-certificates were given to those participants on 23rd February 2022.

12. Webinar on Marine protected areas in India organized by Nature's Eye

Date: 13th March 2022

Venue: Dehradun

A total of 38 individuals participated in this virtual awareness webinar.

13. Virtual Conference presentation at INTERNATIONAL INDIAN OCEAN SCIENCE CONFERENCE (IIOSC)

Date: 23rd February 2022

Venue: Okha

14. Minutes of Meeting with DCF, MNP, Gujarat

On March 21, 2022, a detailed meeting with DCF Sir Senthil Kumaran at Jamnagar, Gujarat was conducted. He was informed about the research so far as well as the ongoing work. There was a discussion about Dugong's record and how to use this drone to increase monitoring in areas where dugongs are frequently seen. A DJI Mavic Pro 2 drone was handed over to the DCF to be used for training/survey purposes from his office.

15. Awareness and scholarship program at Beyt Kanya Shala

With the coming world dugong day on 28 May, we have begun a celebration series from today onwards in Gujarat. An awareness program has been organized for Bet Girl school. A total of 56 girls from 6th to 8th grade were educated about dugongs and other marine life sighted in the Gulf of Kutch, as well as the threats to biodiversity. They were responding enthusiastically about the marine life they had seen around their island. They also spread the word not to dump plastic on the beach and to conserve dugongs, as they say in the video, "દરિયાઈ ગાય બચાવો."

16. Awareness and scholarship program at Shri Rupen Bandar Primary School

The team held an awareness session for Shri Rupen Bandar Primary School on 27 April 2022. One of the volunteers Ami Joshi gave a presentation about the importance of Dugongs and the seagrass ecosystem. In addition, as part of the CAMPA-Dugong scholarship initiative, ten fishermen students from Rupen Bandar who excelled in their exams were chosen as "Dugong ambassadors" and would get a scholarship. The Gujarat team will engage in exciting activities with various stakeholders in the coming days. Around 40 students attended the program.

17. World Dugong Day celebration in Okha Town, Gujarat dated 28TH May 2022

An awareness rally, sand art competition, Poster and Drawing display, and citizen science approaches were successfully conducted in Okha, Gujarat, as a final event of the World Dugong Day celebration. This event drew a large number of youngsters and adults. To win the sand art competition, the kids' team created sand dugongs. Both teams showed remarkable creativity in their sand artworks, so we declared them both champions and awarded them with sustainable glass mugs and books as prizes. All citizens in this program have pledged to protect marine life and dugongs in Gujarat.

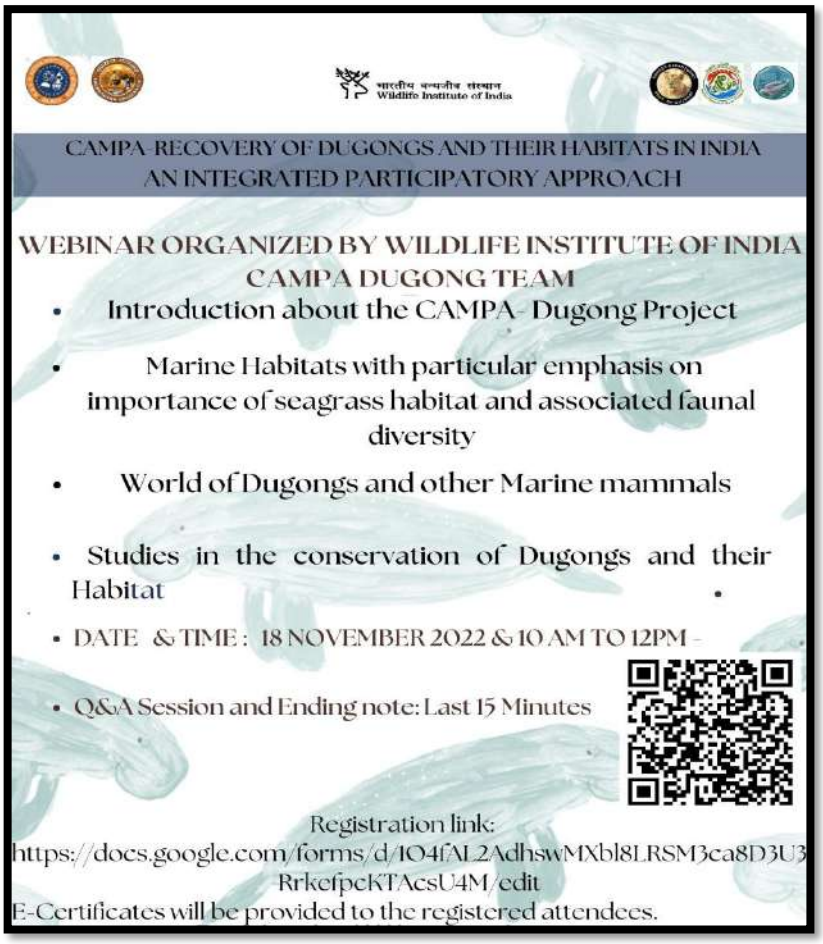
18. Outreach program for 9th & 10th standard students at Kendriya Vidyalaya, Okha Town, Gujarat

An outreach program for 9TH and 10TH standard students was organized at Kendriya Vidyalaya, Okha. The session was attended by a total of 60 students. The students were sensitized to important marine habitats such as the seagrass meadows and coral reefs along with dugongs and another marine megafauna. Dugong-related goodies (Comic books, stickers, and

bookmarks) were gifted to the students. The students regularly do beach clean-up activities and will participate with us in our future beach clean-up program. They also pledged to save dugongs.

19. Webinar on Dugong conservation India on 18th November 2022

The webinar on "Conservation of Dugongs and their habitats in India" was conducted in collaboration with H. & H.B. Kotak institute of Science, Rajkot. A total of 48 participants were registered and e-certificates were given to those participants on 18th November 2022.



20. Outreach and awareness program at R.K. Bandar

We organized another community interaction on the 5th December 2022 program as part of the Indian coast guard's event today at R.K Bandar with fisheries officers for 70 fishermen from various coastal districts along Gujarat's coastline. We gave them logbooks to record any sightings they come across while fishing, as well as reusable glass cups, to help educate them not to use or throw plastic items into the ocean. The fishermen were also informed about the

region's marine megafauna and the importance of seagrass habitat. Members of the Okha Sagar Putra Boat Association and fishermen identified the marine mammals of the region and were eager to share sighting records in the future.

21. Webinar on Conservation of Dugongs in India

The webinar on "Conservation of Dugongs and their habitats in India" was conducted in collaboration with Think Wildlife Foundation. The talk encompassed their behavior, threats to the species, and the restoration of their seagrass habitat. A total of 125 participants had registered for the webinar.

22. Awareness program at fisheries department, Okha

We held an awareness program for the fisheries department on 11th January 2023 in Okha, where we thoroughly discussed with fisheries officers Sir Kamlesh Karena and AD Makwana the number of fishing boats operating from various fishing ports in the GoK region. They also decided to raise awareness about Dugongs and seagrass habitats through their community interaction program with fishermen. We distributed log books and other outreach materials to them.

23. National Conference on Environment and Biodiversity (NCEB-2022)

National Conference presentation on Review of stranding records of megaherbivore the Dugong (Dugong dugon) in the Gulf of Kutch, Gujarat, India- An implication to the conservation of marine mammals in Gujarat in National Conference on Environment and Biodiversity (NCEB-2022) held on 27 and 28 January 2023 organized in collaboration with Academy of Environmental Biology, Lucknow, Bio Vision Charitable Trust, Maharashtra & National Institute of Wind Energy, Chennai Department.

List of awareness and outreach activities at Tamil Nadu

1. World Dugong Day at Palk Bay on 28th May 2021

We successfully conducted an exhibition on World Dugong Day at Palk Bay in an exhibitive manner; we presented a visual treat to students to imbibe the importance of marine life and conservation, and the role of scuba diving in accomplishing the same. As their eyes sparkled while getting a live demo of using scuba gear and underwater surveys, looking at colourful awareness materials, and a friendly dugong mascot welcoming all aboard, they were also attracted to the vibrating array of fishes and corals presented to them by the forest department. Our science express reached a big hit, sensitizing around 30000 kids and local masses.

2. Coastal Clean-Up Day Celebrations on 2nd October 2021

The team was involved in an awareness and coastal & underwater clean-up event conducted by Alagappa

University. We helped mainly in carrying out the underwater clean-up, assisting scholars and students in the same.

3. World Fisheries day awareness program at Thiruvarur, on 21st November 2021

The WII team member gave a talk at the World Fisheries Day Awareness Programme for the fisher community at a community meeting in Jambuvanodai, Thiruvarur District. The event was conducted by the TN Fisheries Department, along with the TN Coastal Security Group. Even the Forest department was part of the event. A coastal clean-up event followed the community meeting.

4. Felicitation for 5 Dugong Rescuers

Date: 23rd December 2021

5 dugong rescuers were felicitated with a sum of Rs. 10,000/- and honoured by the Honourable Minister of Forests of Tamil Nadu, in the presence of District Collector of Thanjavur District, 11 Members of the Legislative Assembly, 2 Members of the Parliament, Principal Chief Conservator of Forests of Tamil Nadu, Chief Conservator of 34 Forests of Trichy Circle, Thanjavur District Forest Officer, Fishermen Society Head of Nagapattinam District.

5. Awareness program for school students at Thondi on 10th January 2022

We successfully conducted a dugong awareness program for the kids in a fishing village near Thondi on 10th January 2022. We explained dugong, their importance, and the necessity to save dugongs and the marine environment.

6. Tamil Nadu Synchronized Bird Census-Phase I from 27th to 29th January 2022

The Wildlife Institute of India team and ten volunteers from Alagappa University participated first ever synchronized bird census conducted by Tamil Nadu Forest Department. 5 areas were surveyed; Nearly 20000 birds of about 80 species were sighted and recorded. Several bird experts joined the survey.

7. Dugong conservation, sea turtle walk, and marine life awareness program on 4th and 5th February 2022

Tamil Nadu forest department along with the Wildlife Institute of India CAMPA Dugong team organized two events on the 4th and 5th of February 2022, consisting of a sea turtle awareness walk from Pariyathalai to Manapan and Dugong conservation and Marine life awareness program followed by the coastal cleanup program. Around 80 college and school students participated in

the program. The events were attended by honorary Chief guest Dr. K. Senthil Raj, IAS, (District collector, Tuticorin), Mr. V. Saravanan, IAS (Deputy collecter), Dr. S. Kannabiran, DRO Mr. S. Jeyakumar, SP, Mr. Tomar DFO, Tuticorin and around 50 departments of government officials.

8. Tamil Nadu Synchronized Bird Census-Phase II on 12th – 13th February 2022

The wildlife institute of India team participated in the second phase of the first-ever synchronized bird census conducted by the Tamil Nadu Forest Department. 5 areas were surveyed, and several bird experts were part of it as well.

9. Meeting with Thanjavur District Forest Officer regarding Palk Bay Dugong conservation reserve

Date: 4th March 2022

The Wildlife Institute of India team met with Mr. Akhil Thampi IFS, DFO, Thanjavur district, to discuss the preparation of a detailed project report and budget split for the sanctioned Rs. 25 lakhs for preparation of the DPR. We also listed out all necessary activities that need to be carried out in order to prepare the DPR. Mr. Anbu, OMCAR Foundation, and forest officials were present during the meeting.

10. Reimagined Sustainable Livelihoods post COVID-19 in Gulf of Mannar World Marine Biosphere Reserve – UNESCO Phase 1 Workshop on 5th to 11th March 2022

A video literacy workshop for 14 participants from the local fisher community was conducted by Surabhi Foundation as Phase 1 of the project. The Wildlife Institute of India team gave a talk on underwater photography and videography in the workshop. The participants made videos in 2 days (the last 2 days of the 6-day workshop) where they received field training in shooting and editing videos. The videos were then judged and the best three were awarded certificates. All videos were chosen to be published on Newsreel Asia.

11. World Forest Day Celebrations on 21st March 2022

The Wildlife Institute of India team was invited by the Ramanathapuram Forest Range Officer to give a talk to school children of Karangkadu village to mark World Forest Day. WII team member gave a talk on the importance of coastal habitats- mangroves and seagrass, and on the issue of littering.

12. Underwater biodiversity awareness and Beach Cleanup for National Stand-up Paddle athletes in Partnership with Quest Asia Water sports academy

Date: 27th April 2022

In light of Dugong Day, on 27th April we conducted underwater biodiversity awareness and Beach Cleanup for National Stand-up Paddle athletes in Partnership with Quest Asia Water sports academy, Ocean Ambassadors, Yolo kayak, Gopro, Tamil Nadu tourism and JKR group at Kurusadai Island. All participants travelled to island by a stand-up paddle making the event eco-friendlier.

13. Awareness workshop for underwater biodiversity and its monitoring with cameras for water babies' program of Quest Asia water sports academy

Date: 30th April 2022

On 30th April, we conducted workshop for underwater biodiversity and its monitoring with cameras for water babies' program of Quest Asia water sports academy and Ocean Ambassadors NGO.

Water babies are school kids of local fisher folk who are trained for different water sports. Wildlife Warden Mr. Jagdish Bakan attended the workshop to encourage the kids.

14. Conducting awareness programs for fisher community

Date: 23rd to 25th May 2022

We arranged an awareness program and 2 small fisher community meetings in different places. Dugong Conservation reserve was the main theme for all awareness programs. We have thanked the local fisher community for their efforts yet again and encouraged them to keep up the good work at Rajamadam where many dugongs have been released before.

15. Underwater and Beach Cleanup programs and awareness rally

Date: 27th May 2022

We conducted underwater and Beach Cleanup programs at kodimunnai, Manamelkudi today. Forty school kids rallied to the Cleanup site with dugong banners along with DFO & RFO, Pudukkottai district, Fisheries inspector Manamelkudi, Ecotourism village head, Manamelkudi, team Temple Adventures, Pondicherry and local volunteers.

We collected 10 gunny bags of trash nearby watchtosnorkelingwer in Kodimunnai. The trash was handed over to local Panchayat for further disposal. School kids were encouraged to learn various techniques like diving and snorkelling. Small tree plantation drive was also conducted after the clean-up.

16. Dugong Day celebration on 28th May 2022

We were invited to Dugong Day by the OMCAR Foundation at their Palk Bay centre.

A painting competition-themed 'life underwater' for village kids was arranged. Kids from ages 9 to 15 participated. We gifted stickers and t-shirts to the winners of the competition. The OMCAR foundation on the same occasion gave a scholarship distribution for fisher widow's kids.

A village meeting at Somanathanpattinam was arranged in joint efforts with Forest Department, OMCAR Foundation, and our team. OMCAR Foundation distributed solar lights to the fisher community. We have been wholeheartedly welcomed by the villagers.

17. Dugong awareness rally on 28th May 2022

The Wildlife Institute of India, Tamil Nadu team conducted an awareness program at Thondi. First, we conducted a meeting in the presence of Mr. Jagdish Sudhakar Bakan, WLW and DFO, Ramanathapuram, and Dr. E. Kathavarayan, DD, Fisheries,

Ramanathapuram. During this meeting, the dugong app was released. Following this, the awareness rally was flagged off. On the way, an awareness board (near the Thondi harbour) erected by the Thondi team was unveiled by our chief guests in the presence of fishermen and school students who participated in the rally. The rally then continued and students distributed pamphlets to fishermen and other shops.

18. The village meeting at Somanathanpattinam on 28th May 2022

A village meeting at Somanathanpattinam was arranged in joint efforts with the forest department, OMCAR FOUNDATION, and our team. Villagers are sensitized to important habitats like seagrass and mangroves along with dugongs and another marine megafauna. OMCAR FOUNDATION distributed solar lights to the fisher community. We have been wholeheartedly welcomed by the villagers. They promised to work with us for the conservation reserve and pledged to marine life conservation.

19. World Environment Day Activity

Date: 5th June 2022

An awareness event was organized by the CAMPA-Dugong project team at Arichalmunai where a sand sculpture depicting a dugong surrounded by other marine fauna, such as turtle, sea cucumber, starfish, crab and shrimp was made by the CAMPA-Dugong project team along with volunteers from Alagappa University.

The CAMPA-Dugong project team at TN, students from Alagappa University, volunteers from the fisher community of Dhanushkodi along with around 80 members of the Indian Coast Guard, Coastal Security Group and Revenue Department, Pondicherry, formed a human chain signifying the quote “Only One Earth”

20. Opening ceremony of Kodimunnai Ecotourism in Dugong conservation reserve area

Date: 1st July 2022

On 1st July, The WII team was invited as a guest for the opening ceremony of the Kodimunai ecotourism centre which is part of Dugong conservation reserve area.

21.Visit to quest academy with Pudukkottai Range Forest Officer for ecotourism center

Date: 6th July 2022

On 6th July, the WII team along with RFO, Pudukkottai district, visited Quest Asia water sports academy at Pirapanvalasai to discuss about the planning for water sport activities at the Kodimunai ecotourism center.

22. Dugong Conservation workshop at OMCAR Foundation

Date: 15th September 2022

Place: Velivayal

15th September, WII team was a part of the Dugong Conservation Workshop at OMCAR foundation. The team co-hosted the workshop. It consisted of video message from Dr. J. A. Johnson followed by presentations and interactive sessions with all 60 students from Alagappa University, Annamalai University, Bharatidasan University and Adirampattinam College.

23. School visits for Scholarship students

Date: 8- 29th September 2022

Venue: Thanjavur, Pudukudi, and Ramanathapuram districts

The WII Team visited 57 Schools of all the 3 districts- Thanjavur, Pudukudi, and Ramanathapuram for updating the details of the scholarship students. Our team had a meeting with all the headmasters regarding the project and the scholarship program. Dugong comic book was given to every school to add in the school's library.

24. Awareness workshop for marine biodiversity and its monitoring for Thangachimadam School children Organized by Quest Asia water sports academy

Date: 12th September 2022

Place: Pirapanvalasai

On 12th September, we visited Quest Asia water sports academy at Pirapanvalasai where we were invited to conducted workshop for school kids were me explained about marine biodiversity and habitats around the area. We also briefed them about Dugong, seagrasses, its Habitats and gave dugong souvenirs to the school Head Master.

25. Meeting with DFO, Mr. Abhishek Tomar IFS

Date: 26th September 2022

Venue: Thoothukudi

We had a meeting with Mr. Abhishek Tomar IFS, Thoothukudi, for updating CAMPA-Dugong project activities and role of different stage holders in the upcoming events

26. Meeting with stakeholders

Date: 4th October 2022

Venue: Kumbakonam

Chinmaya Ghanekar, representing WII Team along with Dr. Balaji V from OMCAR foundation, Mr. Thampi, DFO Thanjavur and Mr. Sathish, CCF Trichy circle had a meeting with Supriya Sahu, IAS, Principal Secretary to Government, Department of Environment, Climate Change and Forests and N. Muruganandam, IAS, Principal Secretary, Industries, GoT. WII and OMCAR team presented the Conservation importance of Dugong Conservation reserve through our studies. A need for dugong conservation centre, identifying

tourism potential as alternative livelihood was discussed. We also emphasized importance of our research work.

27. Attending Green Committee Meeting with the collector

Date: 17th November 2022

Venue: Ramnathpuram

Ms. Chinmaya representing the WII Team attended the Green Committee meeting with the District collector Mr. Johny Varghese, I.A.S. Ramnathapuram.

28. Meeting with the Wildlife Warden, Ramnad

Date: 30th November 2022

Place: Ramnathpuram

The WII Team had a meeting the Wildlife Warden Jagdish Bakan, I.F.S., Ramnathapuram for updating the project works and discussing the upcoming events.

29. Felicitation Ceremony for the Dugong Rescuers

Date: 10th January 2023

Place: Manora

A felicitation ceremony was held at Manora for Manthiripattinam Dugong rescuers. In order to honor and felicitate these 11 fishermen, the Wildlife Institute of India team awarded these fishermen with a cash prize of Rs. 10,000 along with a certificate, medal and a Dugong Rescuer souvenir kit. Forest department gave Rs 25,000 as compensation for net damage and Rs. 5000 to each fisher. OMCAR foundation also honoured the fishermen with Rs. 10,000 as a prize. The Divisional Forest Officer, Thanjavur, I.F.S. Akhil Thampi, Assistant Director Fisheries, Thanjavur Mr. M. Sivakumar, Dr. Nehru Prabakaran, Scientist-C, Wildlife Institute of India, Dr V. Balaji, Omcar Foundation, P. Gangeswari Inspector Fisheries, Mallipattinam graced the occasion and honoured the fishermen.

30. Felicitation Ceremony for the Dugong Rescuers

Date: 2nd February 2023

Place: Thangachimadam

Three Dugongs trapped in the net were rescued and released safely by the joint efforts of fishers at Mookaiyur, and Naripaiyur, Ramnad District, Thoothukudi Wildlife Range. Celebrating World Wetland Day, 19 Fisher's efforts have been recognized and complimented by the government today at Thangachimadam Government Higher Secondary School, Tamil Nadu. The WII CAMPA Dugong Recovery program, along with the Chief guest, Mr. Jagdish Sudhakar Bakan, IFS, Wildlife Warden, District Forest Officer, Ramanathapuram district, Miss. Gayathri Usman, Kadal Osai FM, and Range Forest officers from Tuticorin and Madapam range have awarded these fishermen's each team a cash prize of Rs. 10,000 each, a certificate, a medal, and a Dugong souvenir.

31. Dugong conservation awareness Programs

Date: 4th,5th and 7th March 2023

Venue: Kalpar, Kuthukal Valasai, and Natarajapuram village

Three days (4th, 6th, and 7th of March 2023) dugong conservation awareness preparatory program was organized by the Tamil Nadu Forest Department, Ramnathapuram District, along with the Wildlife Institute of India and Karunya Educational and Economic rural development trust NGO.

The program was organized in 3 villages, Kalpar village, Kuthukal Valasai village, and Natarajapuram village. A total of 231 Fisher community attended this program. With the presence of Mr. Jagdish Sudhakar Bakan, IFS, Wildlife Warden, District Forest Officer, Ramanathapuram district, the event was inaugurated and hosted by Prathap M, FRO Erwadi zone & Gowsikka S, FRO, Mandapam zone, followed by an introductory presentation about Dugongs, its habitats and conservation by Ms. Sweta Iyer, Wildlife Institute of India followed by a talk on alternate livelihood by Mrs. Kamala, Karunya NGO. Thilagavathi M, FRO, Keelakarai zone, and E Balamurugan FRO, Marine Elite Force, ended the event with an interactive discussion with the fisher community and a vote of thanks. This event is an effort to spread awareness among people, which includes fisher communities, Self-help groups, and local peoples, about the dugong and seagrass ecosystem, its existence, benefits, threats, and the need to conserve Dugong and seagrass habitats. And the efforts put forth for Dugong conservation by the forest department and Wildlife Institute of India.

32. Inter-Departmental coordination meeting on the purpose and outline of the Dugong conservation and awareness by the Tamil Nadu Forest Department

Date: 14th March 2023

Venue: Manamelkudi

Inter-Departmental coordination meeting on the purpose and outline of the Dugong conservation and awareness was organized by the Tamil Nadu Forest Department, Pudukkottai District, and Aranthangi Range along with the Omcar Foundation, Wildlife Institute of India, and Fisheries Department. The program was organized in the Vasantham Hall, Manamelkudi. A total of 50 Fishers attended this program. This meeting aims to extend Dugong awareness among the people. To explain to them the importance of the dugong and seagrass ecosystem, its existence, benefits, threats, and the need to conserve Dugong and seagrass habitats. And the efforts put forth for Dugong conservation by the forest department, OMCAR foundation, and Wildlife Institute of India.

Annexure. V. Dugong ambassadors list

Table 17. Dugong Ambassadors of Gujarat

SN	Photo	Name	Standard	School name
1		Subhaniya Rizvan Subhaniya	8th	Shree Beyt Kumar School
2		Subhaniya Mohammad Asif Abdul Karim Rijvan Subhaniya	6th	Shree Beyt Kumar School
3		Mohammadimtiyaj Ismaail Babar	8th	Shree Beyt Kumar School
4		Shehnaj Taleb Subhaniya	7th	Shree Beyt Kanya School
5		Shabnam Shabir Subhaniya	7th	Shree Beyt Kanya School
6		Riyaz Kasam Sibhaniya	7 th	Shree Beyt Kumar School

SN	Photo	Name	Standard	School name
7		Kajbanu Ismail Babar	6 th	Shree Beyt Kanya School
8		Mahamadsmir Satar Subhaniya	6 th	Shree Beyt Kumar School
9		Aman Musa Channa	8 th	Nagar Palika Sanchalit Okha High School
10		Varishabanu Sanghar Osmangani	6 th	Shree Beyt Kanya School
11		Mahmadramjan Mamad Thaim	6 th	Shree Beyt Kumar School
12		Rihan Ishak Palani	8 th	Shree Beyt Kumar School
13		Osmangani Akbar Thaim	7 th	Nagar palika Sanchalit Okha High School
14		Sejinabanu Satar Nagiya	6 th	Shree Kanya School

SN	Photo	Name	Standard	School name
15		Mohammad Vasim Bashir	6 th	Balapur school
16		Sherbanu satar shekh	6 th	Shree Aarambhada Kanya shala
17		Ismail Satar Shekh	6 th	Shree Aarambhada prathmik shala
18		Shakur Shahanawaz Modi	6	Balapur kumar school govt
19		Tanijim Hamid Betara	6 th	Surajkaradi Taluka School
20		Najmin Rajak Thaim	7 th	Prathmik Shala no.1 Bhunga
21		Adreman Hanif Channa	7 th	Shree Aarambhada prathmik shala
22		Hasina Hasan Chaanna	6 th	V.A. English medium school Okha

SN	Photo	Name	Standard	School name
23		Faran Thaim	6 th	Shree Beyt Kumar School
24		Rakib Shabbir Thaim	7 th	Shree Beyt Kumar School
25		Mohammad Anas Thaim	9 th	Shree Beyt Kumar School
26		Mohammad Juned Ayub Thaim	9 th	Shree Beyt Kumar School
27		Rehanaben Anvar Kundliya	7 th	Shree Aarambhada Kanya shala
28		Samir Rashidbhai Sanghar	8 th	Shree Aarambhada prathmik shala
29		Saniya Rashidbhai Sanghar	6 th	Shree Aarambhada Kanya shala

SN	Photo	Name	Standard	School name
30		Ashraf Salim Sanghar	8 th	Shree Aarambhada prathmik shala
31		Yasin Salimbhai Sanghar	7 th	Shree Aarambhada prathmik shala
32		Shivaji Malabhai Chauhan	8 th	Shree Aarambhada prathmik shala
33		Numan Ahemadraza Junusbhai	7 th	Shree Aarambhada prathmik shala
34		Sofiya Kasambhai Kunadiya	6 th	Shree Aarambhada Kanya shala
35		Aishabanu Thaim	10 th	Nagar palika Sanchalit Okha High School
36		Najhir Basir Bolim	8 th	Shree Beyt Kumar School
37		Memuna Hasan Angariya	8 th	Shree Beyt Kanya School

SN	Photo	Name	Standard	School name
38		Sabana Ajij Gameti	7 th	Shree Beyt Kanya School
39		Saynabanu Satar Subhaniya	6 th	Shree Kanya School
40		Husena Abdulajij Subhaniya	7 th	Shree Beyt Kumar School
41		Makasud Yunusbhai Chhatra	12 th	Kendriya Vidyalaya Dwarka
42		Shayrabanu Ashgar Palani	7 th	Shree Beyt Kanya School
43		Mohammad Ashif Abdul Karim Subhaniya	6 th	Shree Beyt Kumar School
44		Subhaniya Rizavan Satar	8 th	Shree Beyt Kumar School
45		Sumbhaniya Jubedabanu	11 th	Model School Dwarka
46		Sodha Faruk	9 th	Mithapur High School, Mithapur

SN	Photo	Name	Standard	School name
47		Sumbhaniya Rajma	12 th	Model School Dwarka
48		Ashraf Salim Sanghar	8 th	Shree Aarambhada prathmik shala
49		Sumbhaniya Irfan	9 th	Model School Dwarka
50		Soni Subhashbhai Vaghela	6 th	Kasturba Gandhi Balika Vidhyalay
51		Nandani Vijaybhai Chauhan	9 th	Shree Government High School Vasai
52		Mitesh Merubhai Vaghela	10 th	Shree Government High School Vasai
53		Kiran vijaybhai Chauhan	9 th	Shree Government High School Vasai
54		Mayur Merubhai Vaghela	10 th	Mithapur High School, Mithapur

SN	Photo	Name	Standard	School name
55		Aakash Vijaybhai Chauhan	10 th	Mithapur High School, Mithapur
56		Aashiyabanu Satarbhai Kureshi	11 th	Mithapur High School, Mithapur
57		Siften Satarbhai Kureshi	8 th	Mithapur High School, Mithapur
58		Asha Rameshbhai Chauhan	7 th	Shri Bhimrana Primary School
59		Rakesh Jasmat Vaghela	6 th	Shri Bhimrana Primary School
60		Roshni Ramji Chauhan	7 th	Shri Bhimrana Primary School
61		Prakash Ramji Chauhan	6 th	Shri Bhimrana Primary School
62		Atul Meru Vaghela	7 th	Mithapur High School, Mithapur
63		Ritu Govabhai Vaghela	6 th	Shri Bhimrana Primary School

SN	Photo	Name	Standard	School name
64		Mital Markhibhai Chauhan	9 th	Mithapur High School, Mithapur
65		Mayuri Markhibhai Chauhan	8 th	Mithapur High School
66		Nishaben Mangabhai Chauhan	6 th	Shri Surajkaradi Kanya Shala
67		Amit Vijaybhai Vaghela	7 th	Shri Saraswati Shishumandir
68		Mukesh Jitubhai Vaghela	7 th	Shri Bhimrana Primary School
69		Akash Dilubhai Vaghela	7 th	Shri Bhimrana Primary School
70		Asgar Angariya	9 th	Shri Swaminarayan Highschool

SN	Photo	Name	Standard	School name
71		Rasid Sadik Bharucha	7 th	Shree Rupen Prathmic Shala
72		Sunefa Hanif Bharucha	7 th	Shree Rupen Prathmic Shala
73		Mohin Farid Kharai	7 th	Shree Rupen Prathmic Shala
74		Sugra Javid Kharai	7 th	Shree Rupen Prathmic Shala
75		Suhana Yasin Isbani	7 th	Shree Rupen Prathmic Shala
76		Jarina Osaman Kharai	7 th	Shree Rupen Prathmic Shala
77		Farhan Farudbhai Thaiyam	7 th	Shree Rupen bunder Prathmic Shala

SN	Photo	Name	Standard	School name
78		Nafishabanu Ishabhai Pateliya	7 th	Shree Rupen Prathmic Shala
79		Enalbanu Isubbhai Ishbani	7 th	Shree Rupen Prathmic Shala
80		Sadiya Gafar Thaim	7 th	Shree Rupen Prathmic Shala
81		Priyaben Vijaybhai Parmar	7 th	Shree Varvala Shala
82		Manjibhai Vasantbhai Parmar	6 th	Shree Varvala Prathmic Shala
83		Sana Thakarbhai Vaghela	6	Shree Varvala Prathmic Shala
84		Bijal Bhikubhai Vaghela	6 th	Shree Varvala Prathmic Shala

SN	Photo	Name	Standard	School name
85		Bhikha Bhikhubhai Parmar	6 th	Shree Varvala Prathmic Shala
86		Mitesh hodar	6 th	Shree Varvala Prathmic Shala
87		Alsifa Salim Bhadela	8 th	Shree Varvala Prathmic Shala
88		Mahejabi Mamad Sodha	7 th	Shree Varvala Prathmic Shala
89		Rambai kanabhai Chauhan	7 th	Shree Varvala Prathmic Shala
90		Hemaben vashram Chauhan	7 th	Shree Varvala Prathmic Shala
91		Kiran Vaghela	7 th	Shree Varvala Prathmic Shala

SN	Photo	Name	Standard	School name
92		Varsha Vijay Parmar	7 th	Shree Varvala Prathmic Shala
93		Sumribai Parmar	8 th	Shree Varvala Prathmic Shala
94		Karan Kanhabhai Chauhan	8 th	Shree Varvala Prathmic Shala
95		Dharmesh Vaghela	8 th	Shree Varvala Prathmic Shala

Table 18. List of Dugong ambassadors from Tamil Nadu

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
1		M.Ajees	Male	9th	Govt. High School, Chozhaganpettai
2		A.Syedsaifulhuq	Male	11th	GovtHr Sec School SP Pattinum
3		M.Santhiya	Female	9th	Govt High School Vattanam
4		P.Rathika	Female	9th	Govt High School Vattanam
5		K.Abitha	Female	11th	Govt Girls Hr Sec School Thondi
6		G.Praveena	Female	11th	Govt Girls Hr Sec School Thondi
7		R.Thirisha	Female	11th	Govt Girls Hr Sec School Thondi
8		T.Kuppuselvi	Female	11th	Govt Girls Hr Sec School Thondi
9		R.Ragul	Male	9th	SM Boys Hr Sec School Thondi
10		Rathiskaviyakarman.k	Male	9th	SM Boys Hr Sec School Thondi

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
11		B.Mahisri	Female	9th	Govt High School Nambuthalai
12		M.Jeevitha	Female	9th	Amala Annai Hr Sec School Karankadu
13		K.Prasitha	Female	9th	Amala Annai Hr Sec School Karankadu
14		V.Visitha	Female	11th	Amala Annai Hr Sec School Karankadu
15		M.Dharshini	Female	11th	Amala Annai Hr Sec School Karankadu
16		K.Kalaiyarasan	Male	9th	Govt Hr Sec School Uppor
17		S.Sadhashni	Female	9th	Govt Hr Sec School Thiruppalaikudi
18		T.Kanimozhil	Female	9th	Govt High School, Sambai
19		A.Mohammadselva haji	Male	9th	Govt Hr Sec School, Devipattinam
20		R.Indhuja	Female	9th	Govt Hr Sec School, Devipattinam
21		K.Kanakamani	Female	9th	Mohamedia Hr Sec School, Chittarkottai

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
22		B.Mugesh	Male	11th	Mohamedia Hr Sec School, Chittarkottai
23		B.Silosan	Male	9th	Govt High School, Palanivalasai
24		G.Gobika	Female	9th	Arabi Oliyullah High School, Puduvalasai
25		K.Gowtham	Male	11th	Govt Boys Hr Sec School, Panaikulam
26		M.Eswaran	Male	11th	Govt Boys Hr Sec School, Panaikulam
27		S.Akalya	Female	11th	Govt Girls Hr Sec School, Panaikulam
28		R.Sharmila	Female	11th	Govt Girls Hr Sec School, Panaikulam
29		N.Sathya	Female	11th	Govt Hr Sec School, Uchipulli
30		R.Rajesh	Male	11th	Govt Hr Sec School, Alagankulam
31		N.Saravanavisva	Male	11th	Govt Hr Sec School, Irumeni
32		M.Yuvasri	Female	11th	Govt Hr Sec School, Irumeni
33		M.Yazhni	Female	11th	Govt Hr Sec School, Irumeni

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
34		L.Hemalatha	Female	9th	Govt Hr Sec School, Vedalai
35		G.Vaishali	Female	9th	Govt Hr Sec School, Vedalai
36		S.Pranesh	Male	9th	Govt Hr Sec School, Vedalai
37		N.Nasrinnasarkhan	Female	9th	Govt Girls Hr Sec School, Mandapam
38		Araahdilfar A.	Female	11th	Govt Girls Hr Sec School, Mandapam
39		S.Mohamedsulaika	Female	11th	Govt Girls Hr Sec School, Mandapam
40		N.Sabiyaamamal	Female	11th	Govt Girls Hr Sec School, Mandapam
41		M.Thilal Aiswarya	Female	11th	Govt Girls Hr Sec School, Mandapam
42		A.Pradeepkumar	Male	9th	Govt Hr Sec School, Mandapam Camp
43		S.Mukilan	Male	9th	Govt Hr Sec School, Mandapam Camp
44		M.Muhaideenvasirkhan	Male	11th	Govt Hr Sec School, Mandapam Camp
45		K.Mohamedajitha	Female	11th	Govt Hr Sec School, Pamban

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
46		V.Vatsanebic	Male	11th	Govt Hr Sec School, Pamban
47		J.Eprodicthibin	Male	9th	Punitha Yagapar Hr Sec School, Thangachimadam
48		P.Asma	Female	11th	Punitha Yagapar Hr Sec School, Thangachimadam
49		S.Anushka	Female	11th	Punitha Yagapar Hr Sec School, Thangachimadam
50		J.Rikkacathrine	Female	11th	Punitha Yagapar Hr Sec School, Thangachimadam
51		K.Ashcojerinda	Female	11th	Punitha Yagapar Hr Sec School, Thangachimadam
52		Logatharshini	Female	9th	Govt Hr Sec School, Thangachimadam
53		V.Iniya	Female	11th	Govt Hr Sec School, Thangachimadam
54		M.Umayasnega	Female	11th	Govt Hr Sec School, Thangachimadam

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
55		S.Rahulganth	Male	11th	Govt Hr Sec School, Rameswaram
56		K.Arockiyajenose	Male	11th	Govt Hr Sec School, Rameswaram
57		K.Mavitha	Female	9th	Govt High School, Karaiyur
58		C.Soundharya	Female	9th	Govt High School, Karaiyur
59		A.Shalini	Female	9th	Girls Govt Hr sec School, Pudumadam
60		S.Shamili	Female	9th	Girls Govt Hr sec School, Pudumadam
61		V.Deepika	Female	11th	Govt Hr Sec School, Pudumadam
62		R.Jerinsilmiya	Female	11th	Govt Hr Sec School, Pudumadam
63		P.Manoj	Male	9th	Govt High School, Thamaraikulam
64		N.Dineshkumar	Male	9th	Govt High School, Thamaraikulam

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
65		A.Ashirafargish	Female	11th	Govt Hr Sec School, Periyapattinum
66		V.Naveenadevi	Female	11th	Govt Hr Sec School, Periyapattinum
67		J.Inul Baseela	Female	11th	Govt Hr Sec School, Periyapattinum
68		M.Rifa	Female	11th	Govt Hr Sec School, Periyapattinum
69		S.Musammila	Female	11th	Govt Hr Sec School, Periyapattinum
70		N.Kaviya	Female	9th	Govt High School, Kalimankundu
71		P.Abinaya	Female	11th	Govt Hr Sec School, Thinaikulam
72		B.Abitha	Female	11th	Govt Hr Sec School, Thinaikulam
73		P.Kavitha	Female	11th	Govt Hr Sec School, Thinaikulam

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
74		A.Abrosebegam	Female	11th	Govt Hr Sec School, Thinaikulam
75		N.Saniya	Female	11th	Govt Hr Sec School, Thirupullani
76		M.Pravinkumar	Male	11th	Govt Hr Sec School, Thirupullani
77		M.Mohamed al badran	Male	11th	Makhdoomia Hr Sec School, Kilakarai
78		M.Mohamed al badru	Male	11th	Makhdoomia Hr Sec School, Kilakarai
79		S.Mathan	Male	9th	Islamiah High School, Kilakarai
80		P.Abirami	Female	9th	Hameedia Girls Hr Sec School, Kilakarai
81		M.Yogeswari	Female	11th	Hameedia Girls Hr Sec School, Kilakarai
82		R.Kokila	Female	11th	Hameedia Girls Hr Sec School, Kilakarai

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
83		M.Bhuvaneshwaran	Male	9th	Hameedia Hr Sec School, Kilakarai
84		M.Vikram	Male	11th	Hameedia Hr Sec School, Kilakarai
85		V.Mugesh	Male	9th	Govt Hr Sec School, Erwadi
86		A.Ramya	Female	9th	Govt Hr Sec School, Erwadi
87		K.Vikram	Male	11th	Govt Hr Sec School, Erwadi
88		B.Jayabharathi	Female	11th	Govt Hr Sec School, Erwadi
89		S.Jasmin	Female	9th	Govt High School, Valinokkam
		M.Mohameduwaish	Male	9th	Govt Hr Sec School, T.Mariyur
91		S.Barakathnisha	Female	9th	Govt Hr Sec School, T.Mariyur
92		P.Sneha	Female	11th	Govt Hr Sec School, T.Mariyur
93		N.Saratha	Female	11th	Govt Hr Sec School, T.Mariyur

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
94		B.Kirena	Female	9th	Govt Hr Sec School, Kannirajapuram
95		M.Mugesh	Male	11th	Govt Hr Sec School, Sayalkudi
96		M.Seenivasan	Male	11 th	Govt Hr Sec School, Katumavadi
97		K.Ranjith	Male	11 th	Govt Hr Sec School, Katumavadi
98		V.Lakshmi	Female	11 th	Govt Hr Sec School, Katumavadi
99		P.Anbazhagan	Male	11 th	Govt Boys Hr Sec School, Manamelkudi
100		B.Arikaran	Male	11 th	Govt Boys Hr Sec School, Manamelkudi
101		P.Pavithra	Female	11 th	Govt Girls Hr Sec School, Manamelkudi
102		K.Anusiya	Female	11 th	Govt Girls Hr Sec School, Manamelkudi

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
103		P.Pravina	Female	11th	Govt Girls Hr Sec School, Manamelkudi
104		A.Mahalakshmi	Female	11 th	Govt Girls Hr Sec School, Manamelkudi
105		D.Durkeshwari	Female	11 th	Govt Girls Hr Sec School, Manamelkudi
106		P.Ragini	Female	11 th	Govt Girls Hr Sec School, Manamelkudi
109		J.Seiyaduahmed	Male	9 th	Govt Hr Sec School, Kottaipattinam
110		S.Kanagayalini	Female	9 th	Govt High School, Jegathapattinum
111		R.Sabapathi	Male	9 th	Govt Hr Sec School, Gopalapattinum
112		K.Manikandan	Male	9 th	Govt Hr Sec School, Mimisal
113		M.Dharshini	Female	9 th	Govt Hr Sec School, Mimisal
114		G.Bhakkiyalakshmi	Female	9 th	Govt Hr Sec School, Mimisal

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
115		G.Subashri	Female	9 th	Govt Hr Sec School, Adirampattinum
116		G.Vishalini	Female	11 th	Govt Hr Sec School, Adirampattinum
117		N.Sandhya	Female	11 th	Govt Hr Sec School, Adirampattinum
118		V.Vinothini	Female	9 th	Govt Hr Sec School, Adirampattinum
119		M.Virakumar	Male	9 th	Govt Hr Sec School, Rajamadam
120		N.Thulasika	Female	9 th	Govt Hr Sec School, Rajamadam
121		S.Pragadeeshwaran	Male	9 th	Govt Hr Sec School, Rajamadam
122		S.Sowndarya	Female	11 th	Govt Hr Sec School, Rajamadam
123		E.Aruljesika	Female	11 th	Govt Hr Sec School, Rajamadam

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
124		P.Lourdu	Female	11 th	Govt Hr Sec School, Rajamadam
125		A.Azrinaseema	Female	9 th	Govt Hr Sec School, Mallipattinam
126		N.Afraabhanu	Female	9 th	Govt Hr Sec School, Mallipattinam
127		T.Asira Barvin	Female	9 th	Govt Hr Sec School, Mallipattinam
128		R.Santosh	Male	9 th	Govt High School, Sethubavachathram
129		P.Akilesh	Male	9 th	Govt High School, Sethubavachathram
130		A.Anushka	Female	9 th	Govt High School, Sethubavachathram
131		E.Rabis Bhanu	Female	9 th	Govt High School, Sethubavachathram
132		E.Sakilahmed	Male	9 th	Govt High School, Sethubavachathram
133		J.Boomathi	Female	9 th	Govt High School, Pudutheru
134		M.Bhuvaneshwari	Female	9 th	Govt High School, Pudutheru

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
135		J.Maria joseph niranjan	Male	11th	Govt Hr Sec School, Vembar
136		J.Sijone	Male	9th	St.Louis Hr Sec School, Keezhavaippar
137		J.Kishore	Male	11th	St.Louis Hr Sec School, Keezhavaippar
138		M.Kaviarasi	Female	11th	St.Louis Hr Sec School, Keezhavaippar
139		V.Athisha	Female	11th	St.Louis Hr Sec School, Keezhavaippar
140		A.Refrin	Male	11th	St.Louis Hr Sec School, Keezhavaippar
141		M.Mariajeeva	Male	11th	St.Louis Hr Sec School, Keezhavaippar
142		S.Mariselvan	Male	9th	Govt Hr Sec School, Tharavaikulam
143		V.Muniraj	Male	11th	Govt Hr Sec School, Tharavaikulam

SN.	Photo	NAME	GENDER	STANDARD	SCHOOL NAME
144		A.Antonyvinciba	Female	11th	Govt Hr Sec School, Tharavaikulam

Table 19: Dugong Ambassadors of Andaman Nicobar Island

SN	Photo	Name	Gender	Standard	School
1		Snigdha Sikder	Female	11th	Govt. Sr. Sec School Havelock-3
2		Seema Chowdhury	Female	12th	Govt. Sr. Sec School Havelock-3
3		G. Shiva	Male	12th	Govt. Sr. Sec School Havelock-3
4		Abhijeet Mazumder	Male	12th	Govt. Sr. Sec School Havelock-3
5		M. Neha	Female	First year graduation	Govt. Sr. Sec School Havelock-3
6		Abhay Halder	Male	11th	Govt. Sr. Sec School Havelock-3
7		Chanchal Sarkar	Male	12th	Govt. Sr. Sec School Havelock-3
8		Rohit Sammaddar	Male	12th	Govt. Sr. Sec School Havelock-3

SN	Photo	Name	Gender	Standard	School
9		Ashit Halder	Male	12th	Govt. Sr. Sec School Havelock-3
10		Rohit Mondal	Male	12th	Govt. Sr. Sec School Havelock-3
11		Ranjeet Mondal	Male	12th	Govt. Sr. Sec School Havelock-3
12		Payal Bala	Female	12th	Govt. Sr. Sec School Havelock-3
13		Tanushree Mondal	Female	12th	Govt. Sr. Sec School Havelock-3
14		Srishti Gharami	Female	12th	Govt. Sr. Sec School Havelock-3
15		Nibedita Mondal	Female	11th	Govt. Sr. Sec School Havelock-3
16		Sunita Roy	Female	10th	Govt. Sr. Sec School Havelock-3
17		Deepti Mondal	Female	12th	Govt. Sr. Sec School Havelock-3

SN	Photo	Name	Gender	Standard	School
18		Rupsha Biswas	Female	First year graduation	Govt. Sr. Sec School Havelock-3
19		Shilpi Bala	Female	First year graduation	Govt. Sr. Sec School Havelock-3
20		Priyanka Biswas	Female	12th	Govt. Sr. Sec School Havelock-3
21		Smriti Mondal	Female	11th	Govt. Sr. Sec School Havelock-3
22		R. Priya	Female	12th	Govt. Sr. Sec School Neil Island
23		Rekha Roy	Female	11th	Govt. Sr. Sec School Neil Island
24		Pinky Podder	Female	11th	Govt. Sr. Sec School Neil Island
25		Sumit Das	Male	10th	Govt. Sr. Sec School Neil Island
26		Rohit Kumar Das	Male	10th	Govt. Sr. Sec School Neil Island

SN	Photo	Name	Gender	Standard	School
27		Abinash Mondal	Male	10th	Govt. Sr. Sec School Neil Island
28		Vishnu Bairagi	Male	12th	Govt. Sr. Sec School Neil Island
29		Kajal Roy	Female	12th	Govt. Sr. Sec School Neil Island
30		Prasanta Roy	Male	11th	Govt. Sr. Sec School Neil Island
31		Rajesh Shill	Male	First Year graduation	Govt. Sr. Sec School Neil Island
32		Samaresh Gain	Male	12th	Govt. Sr. Sec School Neil Island
33		Sushmita Das	Female	12th	Govt. Sr. Sec School Neil Island
34		Nitish Biswas	Male	First Year graduation	Govt. Sr. Sec School Neil Island
35		Pritish Biswas	Male	First Year graduation	Govt. Sr. Sec School Neil Island

SN	Photo	Name	Gender	Standard	School
36		Avay Das	Male	11th	Govt. Sr. Sec School Neil Island
37		Baishaki Das	Female	9th	Govt. Middle School Neil Island
38		Sadhana Das	Female	10th	Govt. Middle School Neil Island
39		Dev Kumar Biswas	Male	12th	Govt. Middle School Neil Island
40		Rajdeep Ghose	Male	9th	Govt middle school Guptapara
41		Sangita Das	Female	12th	Govt middle school Guptapara
42		Tapan Biswas	Male	12th	Govt middle school Guptapara
43		Rani Roy	Female	12th	Govt middle school Guptapara

SN	Photo	Name	Gender	Standard	School
44		Sudeep Mondal	Male	10th	Govt middle school Guptapara
45		Nisha Roy	Female	12th	Govt middle school Guptapara
46		Ajay Biswas	Male	11th	Govt middle school Guptapara
47		Pasanjit Mondal	Male	12th	Govt middle school Guptapara
48		Bijoy Sutradhar	Male	12th	Govt middle school Guptapara
49		Sakshi Das	Female	12th	Govt middle school Guptapara
50		Beuty Biswas	Female	9th	Govt Middle School Wandoor
51		Tarun Mondal	Male	11th	Govt Middle School Wandoor
52		Subankar Sardar	Male	11th	Govt Middle School Wandoor

SN	Photo	Name	Gender	Standard	School
53		Uday Bairagi	Male	10th	Govt Middle School Wandoor
54		Mitali Mondal	Female	11th	Govt Middle School Wandoor
55		Sania Adhikari	Female	11th	Govt Middle School Wandoor
56		Manas Biswas	Male	12th	Govt Middle School Wandoor
57		Sumit Mondal	Male	12th	Govt Middle School Wandoor
58		Madhari Mondal	Female	12th	Govt Middle School Wandoor
59		Aysha Toppo	Female	8th	Government Senior Sec. school Rangachang
60		T. Zaira Banu	Female	8th	Government Senior Sec. school Rangachang
61		Manju	Female	8th	Government Senior Sec. school Rangachang

SN	Photo	Name	Gender	Standard	School
62		Priyanka Tirkey	Female	8th	Government Senior Sec. school Rangachang
63		T. Rukshar Begum	Female	11th	Government Senior Sec. school Rangachang
64		M. Jaya Praveen	Female	11th	Government Senior Sec. school Rangachang
65		Avishek Minj	Male	11th	Government Senior Sec. school Rangachang
66		J. Omakshi	Female	11th	Government Senior Sec school Bambooflat.
67		K. Kavita	Female	11th	Government Senior Sec school Bambooflat
68		P. Dharma Rao	Male	11th	Government Senior Sec school Bambooflat
69		K. Madhav Rao	Male	11th	Government Senior Sec school Bambooflat
70		A. Kalpana	Female	11th	Government Senior Sec school Bambooflat

SN	Photo	Name	Gender	Standard	School
71		V. Banuwathi	Female	11th	Government Senior Sec school Bambooflat
72		B. Kalavathi	Female	11th	Government Senior Sec school Bambooflat
73		L. Kurma Rao	Male	11th	Government Senior Sec school Bambooflat
74		J. Swathi	Female	12th	Government Senior Sec school Bambooflat
75		M. Shana Bibi	Female	12th	Government Senior Sec school Bambooflat
76		N. Kumari	Female	11th	Government Senior Sec school Bambooflat
77		P. Lachaiya	Male	11th	Government Senior Sec school Bambooflat
78		P. Uha	Female	12th	Government Senior Sec school Bambooflat
79		J. Kavitha	Female	12th	Government Senior Sec school Bambooflat

SN	Photo	Name	Gender	Standard	School
80		Mahesh Dass	Male	12th	Government Senior Sec school Bambooflat

Annexure. IV. Budget details for the financial year 2021-2023

Table 20. Budget details for 2021 -2022

RECOVERY OF DUGONGS AND THEIR HABITATS IN INDIA AN INTEGRATED PARTICIPATORY APPROACH			
RECEIPT & PAYMENT			
FOR THE PERIOD OF 01 APRIL 2021 TO 31 MARCH 2022			
RECEIPT	**AMOUNT (In Rs.)**	**PAYMENT**	**AMOUNT (In Rs.)**
Opening Balance	19787504.32	Manpower Engagement	8169126.00
Advance for Expenses	1859410.00	Capacity Building & Awareness	171345.00
Bank Interest	351315.00	Research Monitoring Species and Habitat	7972653.39
Grant Received	38840000.00	Participatory Management	970000.00
		Marine Mammal Rescue and Rehab.	406976.00
		Consumables	356481.00
		Advance for Expenses	751055.00
		Total Expenditure	**18797636.39**
		Balance as on 31.03.2022 A/c No. 55294	**42040592.93**
Grand Total	**60838229.32**	**Grand Total**	**60838229.32**

Table 21. Budget details for 2022 -2023

RECOVERY OF DUGONGS AND THEIR HABITATS IN INDIA AN INTEGRATED PARTICIPATORY APPROACH			
RECEIPT & PAYMENT			
FOR THE PERIOD OF 01 APRIL 2022 TO 31 MARCH 2023			
RECEIPT	**AMOUNT (In Rs.)**	**PAYMENT**	**AMOUNT (In Rs.)**
Opening Balance	4,20,40,592.93	Manpower Engagement	57,92,243.00
Advance for Expenses	7,51,055.00	Capacity Building & Awareness	7,47,840.00
Bank Interest	9,10,689.00	Research Monitoring Species and Habitate	1,16,38,507.00
Grant Received	-	Participatory Management	-
		Marine Mammal Rescue and Rehab	9,92,556.00
		Interest return to Ministry	1,04,36,830.00
		Advance for Expenses	9,26,635.00
		Total Expenditure	**3,05,34,611.00**
		Balance as on 31.03.2023 A/C No. 55294	**1,31,67,725.93**
Grand Total	**4,37,02,336.93**	**Grand Total**	**4,37,02,336.93**

Tamil Nadu Forest Department

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Contact:
Director
Wildlife Institute of India
Dehradun- 248001
Uttarakhand State
Email: dwii@wii.gov.in

Dr. J. A. Johnson
Scientists-F & Principal Investigator
Wildlife Institute of India
Dehradun- 248001
Uttarakhand State
Email: jaj@wii.gov.in