MARINE MAMMAL PROTECTED AREAS TASK FORCE

IUCN SSC WCPA

DRAFT

Working to Implement Conservation Actions in Important Marine Mammal Areas (IMMAs) of the Andaman Islands, India

12th – 20th November 2018

Contents

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Cover photo: Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) by Mahi Mankeshwar. This page, false killer whale (*Pseudorca crassidens*) by Mahi Mankeshwar.

Executive Summary

A team of four international experts assembled by the IUCN Marine Mammal Protected Areas Task Force (www.marinemammalhabitat.org) visited the Andaman Islands in November 2018 to work with a local coordinating group comprised of seven Indian biologists. The goal of the visit was to support the implementation of conservation and management considerations for an Important Marine Mammal Area (IMMA) for dugongs and 15 species of cetaceans in the Southern Andamans, and two Areas of Interest (AoI) for dugongs, one in the North Andamans, and the other in the Nicobar Islands. All areas were proposed during the 'North East Indian Ocean and South East Asian Seas' IMMA expert workshop held in Kota Kinabalu, Malaysia in March 2018 and went through the peer review process.

The Kota Kinabalu Workshop was the second of five workshops organised to identify IMMAs in Pacific and Indian Ocean regions of the Southern Hemisphere. The project includes an implementation component, following the first three of the regional workshops. For the North East Indian Ocean and South East Asian Seas Region, the Andaman and Nicobar Archipelago was considered to have a favourable marine conservation climate by virtue of the relatively pristine conservation status of its marine environment, the commitment to conservation by the concerned authorities, and the presence on site of a very committed group of marine mammal conservation scientists.

This report describes the efforts conducted in the Andamans, leading to a set of management recommendations developed during the team's visit to the area. The work included an analysis of threats to marine mammals in the Southern Andamans IMMA, engagement with stakeholders at local, national and international levels to discuss conservation tools and management plans, and the selection of conservation tools and support to the development of plans for the management of the IMMA.

It was determined that the two marine mammal taxa inhabiting Andaman waters (i.e., cetaceans and the dugong, a sirenian) have different conservation challenges and will require different management approaches. This dual approach was discussed and agreed with the various stakeholders encountered during the visit.

This report includes a narrative of the visit, with details of the places visited and the people providing input and discussion during the visit, followed by a set of management recommendations that could be a starting point to inform the shaping of future marine mammal conservation policies in the Andaman and Nicobar Islands.

The team determined that implementing conservation action within IMMAs could never be achieved from outside the Andamans or top down within the Andamans, whether by members of the Task Force or by international conservation groups or other outside entities. Instead, the success of IMMAs depends upon full engagement by all stakeholders at the local community level, as well as researchers, government and NGOs. The recommendations included here provide the baseline for the development of targeted scientific, management and policy measures to be coordinated by a local entity.

Priority actions include: (1) addressing the endangered dugongs' situation by regulating speedboats and jet skis in their habitat, considering the sustainability of traditional direct takes, monitoring bycatch in fisheries, and conserving seagrass meadows in good health; and (2) increasing management and conservation effectiveness throughout the IMMA by establishing a local consultative group tasked to recommend best practices, raise awareness and promote further research and monitoring. Medium- and lower priority actions envisaged include addressing cetacean bycatch in fisheries, habitat loss and disturbance from unplanned tourism expansion and unregulated wildlife watching as well as assessing the noxious effects of plastic, sewage, oil and chemicals, and noise pollution, and marine mammal mortality caused by vessel collisions.

Since recommendations have different priority levels, efforts should be made to address the highest priority recommendations first. However, these priorities need to be periodically reviewed, and in the light of new information may need to be reassessed.

Background

The IUCN Joint SSC/WCPA Marine Mammal Protected Areas Task Force is a working group of international marine mammal experts who have developed a classification scheme for identifying Important Marine Mammal Areas (IMMAs) in various parts of the world. IMMAs are discrete portions of habitat, important to one or more marine mammal species, which have the potential to be delineated and managed for conservation. Therefore, in their quality of evidence-based scientific product, IMMAs are purely biocentric. They are NOT marine protected areas (MPAs) and have no legal basis. They may, however, indicate sites where MPAs could be considered, and they will help support a marine spatial planning (MSP) process with a robust contribution from science.

A global IMMA network for the conservation of the world's aquatic mammals and other marine biodiversity, identified through internationally agreed criteria, functions as a repository of sites important for the maintenance of marine biodiversity. IMMAs also provide a basis for future monitoring of these highly visible species against climate change. As such, the IMMA Programme, managed by the Marine Mammal Protected Areas Task Force, provide effective support to the building of institutional capacity at the international and national levels to make substantial contributions to global marine conservation.

IMMAs effectively harness marine mammal properties of flagship and umbrella species, and are effective indicators of pelagic biodiversity and the health of ecosystems. More specifically, IMMAs support the Convention on Biological Diversity's (CBD) portfolio of ecologically or biologically significant areas (EBSA) descriptions as a basis for promoting environmental protection and developing management plans for specific areas of the world ocean. IMMAs also contribute to the delineation of Key Biodiversity Areas (KBAs) based on the IUCN Standard, and can support the designation of management provisions such as particularly sensitive sea areas (PSSAs) by the International Maritime Organisation (IMO).

In 2017 the Conference of Parties to the Convention on Migratory Species (CMS), by adopting Resolution 12.13, acknowledged the IMMA criteria and process, requested Parties and invited Range States to identify specific areas where the identification of IMMAs could be beneficial, and invited the CBD, the IMO and IUCN to consider IMMAs as useful contributions for the determination of EBSAs, PSSAs and KBAs. Following a protocol-based set of selection criteria that takes into account factors such as species diversity, distribution, population sizes, life cycle activities and certain other special attributes, IMMAs are selected with the intention of assisting decision makers and managers in expert-led prioritization of conservation efforts (MMPATF 2016).

Recently the Task Force focused on the North East Indian Ocean region for identifying potential IMMAs. The North East Indian Ocean and South East Asian Seas IMMA Workshop was the second of five workshops organised to identify IMMAs in the Southern Hemisphere. These five workshops, being held between 2017 and 2021, are part of the framework of the GOBI/IKI Project funded by the Government of Germany. The project includes an implementation component, following each of the first three regional workshops — Pacific Islands (2017), North East Indian Ocean and South East Asian Seas (2018), and Western Indian Ocean and Arabian Seas (2019). At each workshop, stakeholders are engaged to discuss the implementation of pilot management activities based on one or more IMMAs and, in some cases, AoI identified in these regions.

Dr. Dipani Sutaria, Mahi Mankeshwar, Dr. K. Sivakumar and Dr. Elrika D'Souza nominated a portion of the waters adjacent to the Andaman islands as a candidate IMMA at the IMMA workshop held in Kota Kinabalu (Sabah, Malaysia) in March 2018 based on the results of ongoing marine mammal research studies (Fig. 1). Previous and ongoing research (D'Souza et al 2013, 2015; Mankeshwar and Sutaria 2018; Sivakumar and Nair 2013) showed that the waters of the Andaman Islands are a critical habitat for marine mammals protected under Schedule 1 of the Indian Wildlife Protection Act (1972). The area is rich in marine mammal diversity with at least 16 species recorded (Mankeshwar and Sutaria 2018), including dugongs, Omura's whales, Fraser's dolphins, killer whales and sperm whales.

The Andaman and Nicobar archipelago comprises an extensive chain of tectonically active islands in the Andaman Sea. With 325 islands and a total coastline of 1962 km, the archipelago in the eastern Indian Ocean separates the Bay of Bengal from the Andaman Sea. The Andaman-Nicobar ridge forms the western boundary of the Andaman basin, which is delimited to the east by the Malay Peninsula, and Burma and

Sumatra lie to the north and south of it respectively. This basin is characterized by a complex system of rift valleys and associated volcanic seamounts; the sea floor is characterized by an insular shelf, steep drop-offs, productive sea mounts and trenches reaching depths of 4400 m. The habitats provided by the Andaman Sea with its sea grass meadows, mangrove forests and various depth gradients in the open sea makes it a favourable area for marine mammals. The biogeographic location of the archipelago in the Andaman Sea also makes it likely that it lies at the edge of geographic ranges of certain species while other species might overlap in sub-populations.

Given that the Andaman waters are a diversity hotspot for marine mammals, the IMMA status can provide the impetus to build a long-term conservation programme for the area along with giving the region international ecological recognition. The IMMA-led conservation programme would create a niche for a more aware and knowledge-based development agenda in the future. The capital city of Port Blair within the study area has the highest human population on the islands and is the most active with respect to fishing activities, inter-island ferry traffic and tourism. The main conservation issues in the area are centred on unmanaged tourism, bycatch in fishing gears, limited data on species distribution, population abundance and movement patterns, and lastly the knowledge gap amongst the various stakeholders with regard to the whales and dolphins of these waters.

The island-based tourism industry, mainly dive tourism and water-sports, has seen an unprecedented growth in recent years, and has in turn led to high demand from the ancillary industries of inter-island ferry-services and fisheries. These sea-based industries are known to negatively impact marine mammal populations in other parts of the world where growth has gone unchecked (Constantine 1999; Hoyt 2012, 2018a; Lusseau et al. 2009; Ilangakoon 2012). If the way tourism is carried out is addressed and managed, then there is the chance to avoid the mistakes made in other regions and it will pave the way for responsible whale/dolphin and other marine tourism (Hoyt 2012, 2018b).

Considering this scenario, and by invitation from the Wildlife Institute of India, the co-chairs of the IUCN SSC/WCPA Marine Mammal Protected Areas Task Force Erich Hoyt and Giuseppe Notarbartolo di Sciara, along with Tundi Agardy and Jon Day, undertook a six-day consultation programme, to introduce administrators and island-based stakeholders to the IMMA process and address the current conservation issues of tourism and capacity building via presentations, dialogue and mapping tools. Protecting IMMAs with the help of local communities is the main aim of this process.

One purpose of the consultation visit was to reinforce the selection of IMMA and AoI in the Andamans and Nicobars region. During the North East Indian Ocean and South East Asian Seas IMMA Regional Workshop, an IMMA was identified in the southern Andamans for dugongs and 15 cetacean species (Fig. 1 and 2) while the two AoI at the north end of the Andamans and in the Nicobar Islands were identified for dugongs. The IMMA and two AoI were selected to receive implementation recommendations for management and conservation measures. It was envisioned that the work in the Andamans could serve as a case study to examine how IMMAs could be used to foster marine mammal conservation in the wider region.

This report describes the efforts conducted in the Andamans, leading to a set of management recommendations developed during the team's visit to the area. The work includes an analysis of threats to marine mammals in the selected pilot area (Activity VI.4 of the GOBI-IKI Project), engagement with stakeholders at local, national and international levels to discuss conservation tools and management plans (Activity VI.5), and the selection of conservation tools and support to the development of management plans for the selected area (Activity VI.6).

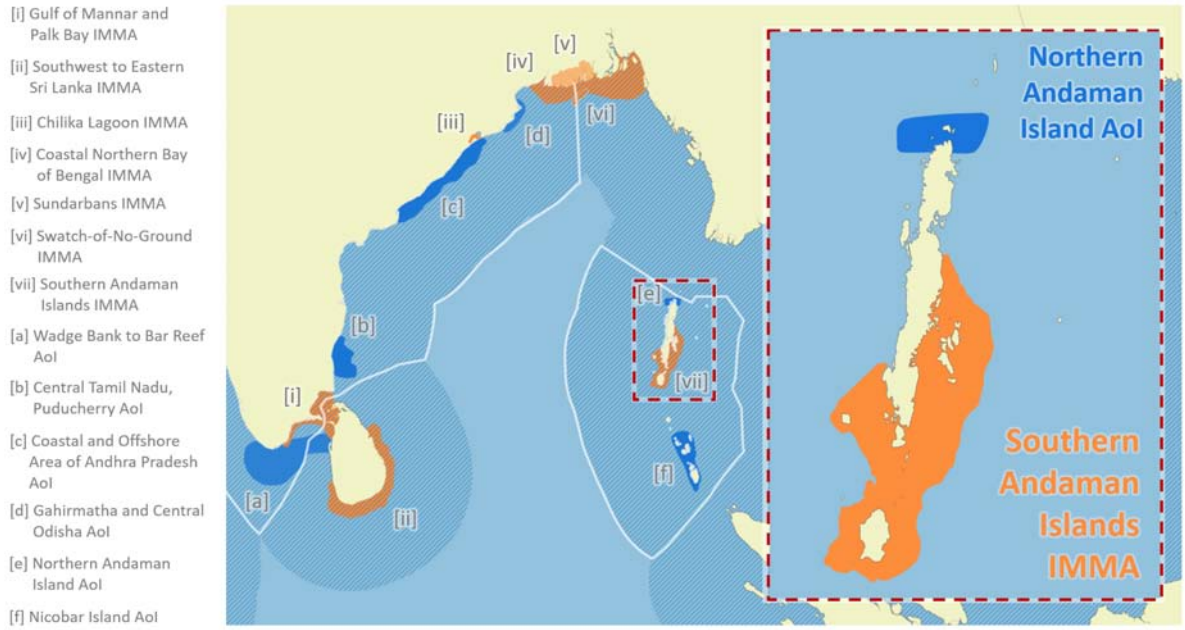

Fig. 1 IMMAs and AoI identified in the Bay of Bengal and Andaman Sea.

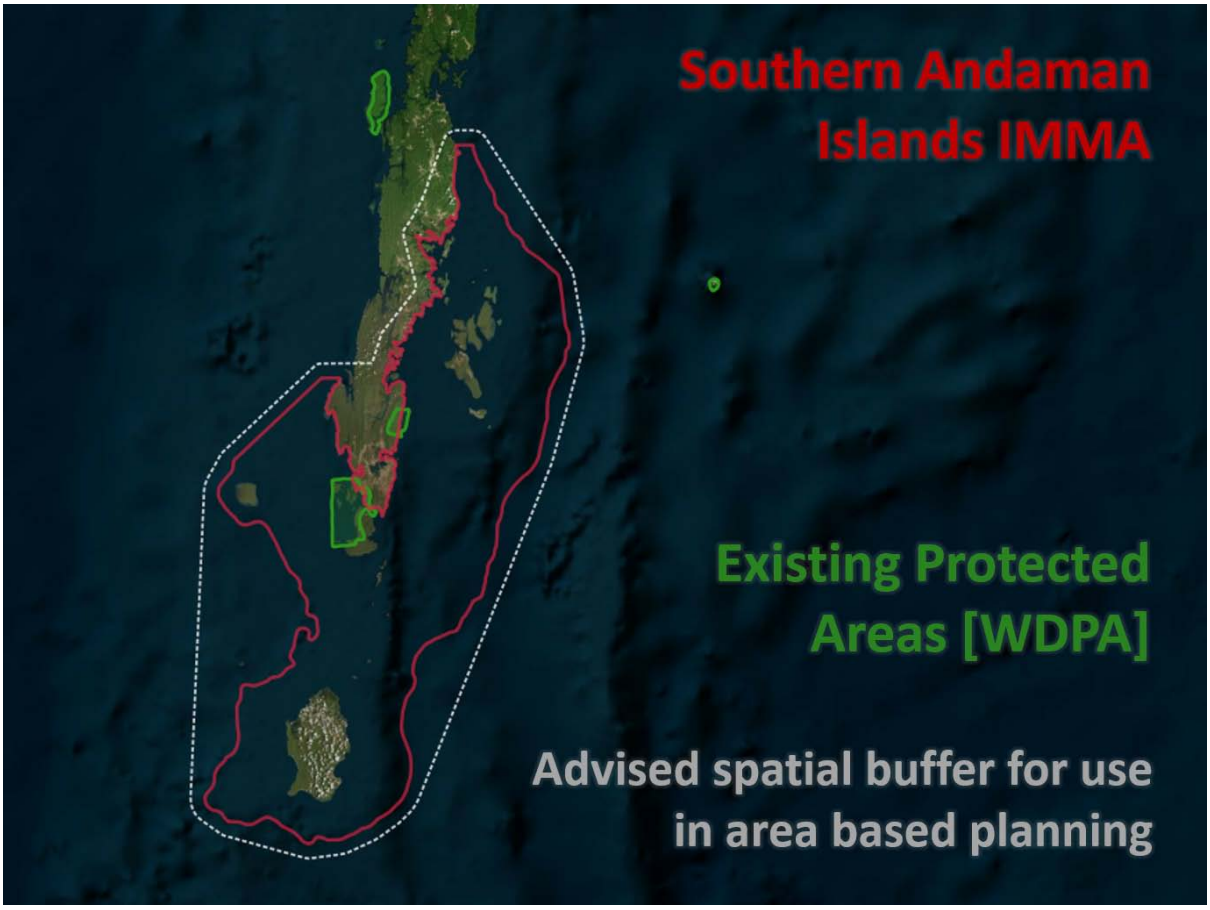

Fig. 2 The Southern Andamans IMMA and existing marine protected areas and advised spatial buffer for use in area-based planning

The visit ascertained that the waters of the Andamans host an important diversity of marine mammal species, which are not currently the subject of the attention that their ecological, cultural and economic values merit. Marine mammals in the Andamans belong to two separate orders – sirenians with one species, the dugong, *Dugong dugon*, and cetaceans with 15 species (see Appendix 1). Dugongs are confined to the shallow waters around the islands, whereas cetaceans occupy nearshore and offshore areas.

This ecological difference between the two taxa also results in differences in their threat levels and in their current and potential importance for the local human communities.

The dugong in the Andamans has a small, isolated population, only 15 individuals based on D'Souza et al. (2015). Although three mother-calf pairs have been seen, experts would consider such low estimates unsustainable in the long or even short run and urgent efforts must be undertaken to increase protection to give the population the chance to recover.

By contrast, cetaceans are not known to be affected by specific threats, and have never been the subject of special attention in Andaman tradition and culture. However, their predictable presence in the islands' waters and remarkable species diversity indicate that in the Andamans there is a promising, untapped whale watching potential for which regulations need to be in place before an industry starts to develop and threatens to grow out of control.

Thus, the two marine mammal taxa inhabiting the Andaman waters have different conservation challenges and will require different management approaches. This dual approach was discussed and agreed with the various stakeholders encountered during the visit.

This report includes a narrative of the visit, with details of the places visited and the people providing input and discussion during the visit, followed by a set of management recommendations that could be a starting point to inform the shaping of future marine mammal conservation policies in the Andaman Islands.

Personnel involved in the visit

Task Force international group:

Co-chairs, IUCN Marine Mammal Protected Areas Task Force

Mr. Erich Hoyt - research fellow, Whale and Dolphin Conservation
Dr. Giuseppe Notarbartolo di Sciara - founder and honorary president, Tethys Research Institute

Management advisors

Dr. Tundi Agardy - Sound Seas, USA and IUCN Marine Mammal Protected Areas Task Force
Mr. Jon Day – James Cook University, Townsville, Australia; formerly a director of the Great Barrier Reef Marine Park Authority

IMMA local coordinating group:

Dr. Dipani Sutaria – Independent Ecologist, Senior Research Fellow at James Cook University and IUCN Marine Mammal Protected Areas Task Force
Dr. K. Sivakumar – Wildlife Institute of India
Ms. Swapnali Gole – Wildlife Institute of India
Ms. Mahi Mankeshwar – Independent researcher
Mr. Evan Nazareth – Research assistant
Ms. Aashi Parikh – Research assistant
Dr. Elrika D'Souza – Nature Conservation Foundation

Spotlighting the New Southern Andaman Islands IMMA

Important Marine Mammal Areas (IMMAs) are described as "discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation". They are an advisory, expert-based classification applied to the world's oceans, coastal waters and shorelines, and relevant inland water bodies. Areas awarded IMMA status are globally significant and may thus merit area-based protection and/or monitoring for marine mammals. The recently awarded Southern Andaman Islands IMMA is unique in the world in the diversity of marine mammals present and the range of development in the IMMA, which includes areas on the spectrum from urbanized to pristine.

The Southern Andaman Islands IMMA comprises an area that provides known habitat for the dugong and 15 cetacean species. The extent of the IMMA is determined by verified marine mammal sighting data. Additional AoI have been identified in other parts of the archipelago. Yet since other parts of the Andaman and Nicobar Islands (ANI) have not been studied systematically, it is understood that there may be more areas within the archipelago that could eventually be conferred IMMA status. Also new species may be discovered that would add to the area's diversity. For this reason, additional research and monitoring is warranted.

The Southern Andaman Islands IMMA is outstanding from a marine mammal point of view. However, the IMMA also comprises areas that support other flagship species: four species of sea turtles, whale sharks, numerous shark and ray species, and bird species. The IMMA also includes a wide array of habitat types - coral reefs, mangroves, seagrasses, estuaries, sea mounts, and pelagic upwelling areas. There are notable marine protected areas (MPAs) in the IMMA, as well as shipping lanes, fishing sites and ports, tourism recreation areas, and mixed-use areas.

Current protection of marine habitat and species through MPAs is laudatory but limited, with the two MPAs in the IMMA representing a small percentage of the marine waters of the archipelago under MPA status. MPAs are overseen by the Department of Environment and Forests Andaman and Nicobar Islands (hereafter A&N Forest Department). The remaining areas fall under the jurisdiction of the Coast Guard, which is charged with monitoring and surveillance as well as enforcement of maritime regulations. Despite the fact that there are many government agencies involved in various aspects of marine use, there is limited capacity for in-water management with no one agency to coordinate, and no agency tasked expressly with managing impacts on marine mammals. Marine mammal expertise exists within some government agencies (notably Wildlife Institute of India) as well as among the non-governmental organizations (NGOs). These marine mammalogists and the dive operators who are regularly here can assist with monitoring and management, but need to do so in a coordinated way.

The Government of India has commitments and obligations under many international conventions pertaining to marine mammal conservation (e.g., CMS, CBD, CITES). There are as yet opportunities to translate these commitments into national legislation or guidelines. Given the management limitations that exist in some regards, a huge opportunity exists for Andaman and Nicobar Islands to address marine mammal and wider environmental issues in a strategic way to become a global example of IMMA best practices. In terms of international recognition, the Nicobar Islands comprise the Great Nicobar Biosphere Reserve, is part of the UNESCO MAB Programme and the World Network of Biosphere Reserves.

Marine mammals in the Southern Andaman Islands IMMA face a range of existing and prospective threats. Current threats to marine mammal species include fisheries interactions and, in some cases, direct take, coastal development and related impacts on critical habitat, and pollution with both habitat and marine mammal health effects (see 'Pressures' in Table 1). Emerging threats to marine mammals include tourism expansion with both direct and indirect impacts on resident marine mammal populations, the potential move from underexploited to overexploited fisheries, and climate change. Against this backdrop of pressures is the reality that capacity for managing impacts is constrained by the lack of an overseeing agency to promote integrated and holistic management.

There is a clear need for expanded marine mammal surveys and research into the vulnerabilities of this extraordinary IMMA. Marine mammal studies could be scaled up to be geographically more comprehensive. In addition, there is scope to utilize citizen science and agency-augmented research, and share currently inaccessible data, such as that collected by the Coast Guard and Navy. Clear demand exists

for systematic information on marine mammals, including requests from Coast Guard for marine mammal data to feed into oil spill contingency planning, and requests from dive operators for marine mammal information that helps them avoid impacting sensitive species and habitats. Since parts of Andaman and Nicobar Islands are under-surveyed and thus poorly understood with regards to marine mammal distribution, status, and prospects, embarking on an expanded research agenda is highly recommended. The Andaman and Nicobar Islands have an important and unique opportunity to use the awarding of IMMA status to further understanding of marine mammals and provide the information necessary to allow India to play a leadership role in the conservation of these species and the sustainable use of these spectacular and ecologically rich islands.

Narrative of the visit and meetings

12th November 2018

Arrival in Port Blair, Andamans of IMMA international group, lodging at Mansha Regency Hotel

13th November 2018

Location: Department of Environment and Forests

Attendees: Dipani Sutaria, Mahi Mankeshwar, Swapnali Gole

DISCUSSION REGARDING MARINE MAMMAL RESEARCH AND THE STAKEHOLDER MEETING TO BE HELD ON 16TH NOVEMBER

- Presented the Acting Principal Chief Conservator of Forests (A-PCCF) Bhandari and ACF Anthony Paul with a Guide to the Marine Mammals of India
- Reported on first dedicated cetacean research study in South Andaman using multiple methods
- Ferry-based surveys covered more than 1782 km and 141 hrs of survey effort with 7 cetacean species identified.
- Dedicated vessel based surveys covered more than 623 km and 70 hrs of survey effort with 9 cetacean species identified.
- Discussed the issue of Visa type misunderstanding and requested that all international experts be included in the program on November 16th.
- The Acting Principal Chief Conservator of Forests (A-PCCF) suggested that the visa documents of the experts be sent to the Superintendent of Police (SP) for verification.

14th November 2018

Meeting of Andaman Nicobar Environment Team (ANET)

Attendees: IMMA International Group, Dipani Sutaria, Mahi Mankeshwar, Aashi Parikh, Evan Nazareth

- Base manager Adith Swaminathan gave us a tour of ANET property.
- Visited the mangrove mudflat area. Had lunch and interacted with researchers present at the base.
- Visited the Mahatma Gandhi Marine National Park (MGMNP) interpretation centre and the jetty in Wandoor from where ferries and glass bottom boats to Jolly Buoy and Redskin Islands operate.
- Visited the Lohabarrack beach.

14th November 2018

Location: Department of Environment and Forests, Visa Meeting

Swapnali Gole met with the APCCF to follow-up on his previous day's request for getting the Visas verified. The APCCF forwarded the letters from the Ministry of Home Affairs (MHA) and Wildlife Institute of India (WII) to the Superintendent of Police (SP).

15th November 2018

Location: Meeting with the Director, Information Publicity and Tourism, Port Blair

Attendees: IMMA International Group, Dipani Sutaria, Mahi Mankeshwar, Swapnali Gole.

- Erich Hoyt and Giuseppe Notarbartolo di Sciara presented the IMMA concept, process and potential to the Director of Tourism.
- Jon Day talked about his work at the Great Barrier Reef and tourism in Australia.

- The Director was already aware of the IUCN since he came from a zoological background and has a degree in medical sciences.
- The Director told the experts team about Ross Island, praising the aesthetics of the light and sound show and how the story was close to Indians' hearts.
- Dipani Sutaria gave a 'Marine Mammals of India' poster to the Director and it was suggested that Mahi Mankeshwar would update the Director monthly on cetacean research.

15th November 2018

Location: Meeting with the Indian Coast Guard Command Office, Port Blair

Attendees: IMMA International Group, Dipani Sutaria, Mahi Mankeshwar, Swapnali Gole

Dipani Sutaria, Mahi Mankeshwar and Swapnali Gole met with Commander Operations Ashish Mehrotra at the Coast Guard Headquarters in Port Blair where he was presented with the 'Marine Mammals of India' poster.

- He was given a brief introduction to the IMMA process by Dipani Sutaria and was invited to attend the consultation meeting on November 16th.
- He was open to the idea of the Taskforce and IMMA and was keen to know if there was a map of bio-sensitive areas in the region where regulations on vessel speeds and certain other activities could be put into place. He requested to be provided with maps highlighting these areas of importance.
- He was also inclined to know more about species that were protected under Schedule I of the Indian Wildlife Act and that were found on the islands in order to be able to regulate illegal fishing activities.
- He asked questions about the different species on the poster we presented to him. And told us about a whale skeleton he had observed near Cinque during his routine helicopter surveys.
- He suggested that training for species ID and how to collect information from Coast Guard vessels be carried out so that they can provide information towards the participant monitoring network.

15th November 2018

Meetings with officials with regards to the Visa process

- As a follow-up, Dipani Sutaria, Swapnali Gole and Mahi Mankeshwar visited the Superintendent of Police's office to learn about the progress of the verification of the visas where they learnt that the papers were with the Deputy Superintendent of Police (CID).
- They went to meet the Deputy at the CID office where he told them that the letter that was forwarded to the Police mentioned that the experts required verification in order to attend a conference on the 16th. We clarified to him that it was not a conference but only a three-hour long consultation meeting.
- They visited the forest department and met with the Principal Chief Conservator of Forests, Andaman and Nicobar Islands (PCCF, ANI) Tarun Coomar, who called the Deputy General Police of Port Blair and explained the issue. Tarun Coomar suggested there would be no problems.
- They met with the Superintendent of Police CID Mr Yadav, who was empathetic and said he would try to find a way, but eventually the Forest Department Protocol would have the final call on whether to use his recommendations or not.
- They returned to the Forest Department but the A-PCCF had left office for the day.
- They returned home to prepare for the meeting on November 16th, still wondering if there would be a reprieve and the international guests would be allowed at the meeting. Meanwhile preparation was made so that Dipani Sutaria could present in place of the international team co-chairs.

16th November 2018

Location: A&N Forest Department

Stakeholder Consultation meeting to implement IMMA - South Andamans Islands

- The Stakeholder Consultation Meeting was held in Van Sadan, Port Blair, at the Headquarters of the Department of Environment and Forests.
- Minutes of the meeting are contained in full in Appendix 1 to the report.
- From the Task Force International Group, only Jon Day was allowed to attend the meeting, having entered India under a "Conference Visa". The other three members of the Group, having been recommended to enter India under a "Business Visa", were nevertheless denied access to the meeting for having entered India under a "Business Visa" that apparently did not make them eligible to attend an official meeting.
- The opening presentation about IMMAs was present by Dipani Sutaria. Throughout the meeting there was good engagement from attendees and progress toward a common understanding of various issues and problems related to conservation, tourism and the presence and conservation status of dugong and cetaceans.

17-19th November 2018

Travel from Port Blair to Neil Island, and back to Port Blair

- On 17th November the IMMA team (international and national) travelled to Neil Island to discuss the results of the meetings and start drafting a report of the visit. The team remained on Neil for two days, returning to Port Blair on the 19th.
- Further productive discussions were held in the final day before departure.

20 November 2018

Departure from Port Blair

- Having finished their task in the Andamans, the international team departed from Port Blair on the 20th November.

Recommendations

It is understood that implementing IMMAs can never be achieved from outside a country or an area whether by members of the Task Force or by international conservation groups or other outside entities.

The recommendations below emerged from the stakeholders' consultation meeting, refined and expanded through further discussions by the local IMMA coordination team and the international IMMA expert group. The first section elucidates the rationale according to various categories. The second section enumerates a proposed list of actions according to the same categories. Table 1 below is a first take on summarizing a priority list for implementation.

Rationale for Recommendations

Improving stakeholder engagement through the local consultative group

Taking advantage of the interest of various parties in maintaining the values of the Southern Andaman IMMA (building on the meeting of the 16th described here), a Local Consultative Group comprising interested stakeholders should be formed to meet periodically and to discuss the sustainable ongoing use of the area. This consultative group, obviously devoid of decision-making authority, would nevertheless keep the conversation alive. The group could also keep a finger on the pulse of the marine environment encompassed by the IMMA, feeding information to decision makers in order to allow them to make the best-informed decisions about marine use of the area.

Priority conservation action

Given the imminent threats to dugong and the vulnerable status of the marine mammal populations in the Andaman and Nicobar Islands, immediate conservation actions should be taken to protect the animals and their habitat. Better enforcement practices should be put in place to prevent non-indigenous hunting of dugong. Seagrass beds that have been mapped throughout the Andaman and Nicobar Islands should be protected from anchoring and the negative impacts of coastal development, such as siltation during dredging and construction operations. Care should be taken to avoid future land reclamation in seagrass areas.

Further research

Recognizing the likelihood that (a) significant marine mammal areas also occur in the Northern Andamans and Nicobar Islands, (b) the current IMMA description likely will need further research to solidify knowledge, further periodic surveys should be undertaken in these areas. Expansion of the permits granted by the Forest Department to undertake surveys and long-term monitoring should be sought to undertake this more comprehensive research. Liaise with other academic and research institutions and funders to maximize the potential for joint external funding and/or increased collaboration.

Data-sharing

Continue with the participatory monitoring program that has already been initiated, and expand the area and reach of the stakeholders (e.g., dive operators, fishers, game fishers, ferry operators) to allow the broader exchange of information between researchers and stakeholders throughout the Andaman and Nicobar Archipelago. For example, Coast Guard had requested sensitivity maps of key habitats (e.g., seagrass beds, mangroves, corals) for oil spill contingency planning. At the same time, the information on marine mammal sightings obtained by the Navy could periodically be provided to researchers. Dive operators and fishers could also provide information in the format useful for researchers.

Awareness-raising

Increased publicity for the IMMA and increased research in the two related AoI (Northern Andaman & Nicobar Islands) could be achieved through periodic media releases and fact sheets. The use of the existing website (marinemammals.in) should be promoted and all stakeholders should be encouraged to input appropriate data. Awareness of school children about marine mammals and the marine environment more generally should be enhanced, including through the building of capacity of teachers to educate children about marine mammals. To better understand pressures on marine mammals, stranding networks and fishing community outreach could increase understanding of marine mammals in Andaman and Nicobar Islands. Raising public awareness would increase reporting of marine mammal strandings. Continue training of forest staff and set up a program for local veterinarians to deal with strandings; this would increase data quality. Authorities and NGOs could work with key local fishers to promote awareness of fishing impacts on marine mammals and to develop appropriate best practices to minimize such impacts.

Sustainable tourism

Recognizing the likely expansion of tourism for the Andaman and Nicobar Islands, the Chamber of Commerce, Tourism Department, Forestry Department, and other key stakeholders could work together to ensure a range of tourism opportunities and promote tourism that will be ecologically sustainable and equitable. Local champions who are recognized in the community should be sought to promote the possibilities of sustainable tourism, providing a range of opportunities for tourists, diversifying the tourism portfolio and increasing livelihood opportunities while minimizing impacts to marine mammals and the broader marine ecosystem. Tourists should be sensitized through appropriate educational videos suitable for the government ferries, water sports, tourist guides, charter fishers and dive operators. Additionally, the Andaman and Nicobar Islands has an opportunity to develop exemplary whale watching, since the industry has not yet begun to any extent. Substantial guidance exists for how to plan such ecotourism in a way that marine mammals are not harmed and the values of the IMMA are not put at risk. Recognizing that international guidelines exist (e.g., CMS and IWC whale watching guidelines), the Andaman and Nicobar Islands could establish appropriate regulations (e.g., on the number and type of vessels) to promote sustainable whale-watching in the future.

Integrated planning and management

An integrated, comprehensive, and holistic plan for managing marine uses while promoting marine conservation could be developed that would secure Andaman and Nicobar Islands' status as a world leader in marine management. As part of such a plan, government authorities might consider delineating areas where high speed watercraft (e.g., jet skis and speed boats) should slow down to minimize impacts upon marine mammals. Recognizing the possible impacts of constructing nearshore coastal developments (e.g., dredging, dumping and infrastructure), such a plan could ensure best practice approaches are adopted (e.g., use of silt curtains and noise reduction). Recognizing the wide range of vessels operating in the Andaman and Nicobar Islands, best practice approaches for vessel operations (e.g., anchoring, ballast water, speed in sensitive areas) could be widely adopted. Recognizing the detrimental impacts of pollution upon marine mammals, planners could consider opportunities to work with local communities and Port Authorities to reduce all forms of pollution (e.g., plastic, sewage, oil and chemicals). Across all this planning of optimal management, interested parties (including the Local Consultative Group described above) should recognize the need for both top-down and bottom-up approaches to ensure sustainability of activities in the marine environment.

Proposed list of actions

Note: It is suggested that the consultative group periodically monitor this list of actions and potentially update it with new information. It is hoped that the consultative group will undertake completion of Table 1.

Improved stakeholder engagement

1. Form a Local Consultative Group (including members of the consultative group who participatet in the stakeholder consultation meeting in Port Blair on November 16th 2018) comprising interested stakeholders with a dedicated chair to meet periodically and to recommend best practices to maintain the values of the ANI.
2. Consider rotating meetings among the various institutions involved, to promote parity of engagement.

Priority conservation action

3. Take steps to protect the mapped seagrass beds with priority given to the ones used by dugongs (e.g., no anchoring, no fishing, etc.)
4. Limit the number and speed of all boats in dugong habitat areas.
5. Restrict access of jet skis in known dugong areas.

Further research

6. Undertake periodic surveys in areas beyond the IMMAs including the AoI, recognizing the likelihood that significant marine mammal areas also occur in the Northern Andamans and Nicobar Islands.
7. Strengthen the current knowledge of the biology on the marine mammals within the IMMA.
8. Increase the understanding of the threats to marine mammals from seismic surveys, naval exercises known to impact marine mammals, and fisheries, as well as traditional take of dugong.
9. Expand the permits granted by the Forest Department and involvement by the Coast Guard to support surveys and long-term monitoring.
10. Liaise with other academic and research institutions that are currently not collaborating to explore the potential for joint external funding and government of India funding sources.
11. Work to increase funding available for research and monitoring.

Data-sharing

12. Facilitate the increased exchange of information between researchers and stakeholders
13. Meet demand by users, for instance Coast Guard wanting sensitivity maps of key habitats (e.g., seagrass beds, mangroves, corals) for oil spill contingency planning.
14. Facilitate the flow of information from those on the water to those working to maintain the IMMA, for example setting up an official channel for the Navy collecting information on sightings and periodically providing it to researchers.
15. Encourage users such as fishers, game fishers, ferry staff and dive operators to report sightings in the format useful for researchers.
16. Consider existing apps and app developers and find or develop an appropriate app for citizen science reporting of marine mammal sightings.

Awareness-raising

17. Promote the existing website (marinemammals.in) and encourage all stakeholders to input appropriate data.
18. Increase publicity for the IMMA and the two related AoI (Northern Andaman & Nicobar Islands) through periodic media releases and fact sheets.
19. Introduce aspects of marine biodiversity and research into the school syllabus, and encourage educators to 'bring children into the field' as a way to experience marine mammals and inspire their conservation.
20. Raise public awareness to report marine mammal strandings and continue training of forest staff.
21. Begin training of local vets to respond to strandings.
22. Work with key local fishers to promote awareness of fishing impacts on marine mammals (e.g., bycatch and depredation of marine mammals) and to develop appropriate practices to minimize such impacts.

Sustainable tourism

23. Work with the Chamber of Commerce, Tourism Department and other key stakeholders to ensure a range of tourism opportunities that minimize impacts, recognizing the likely expansion of tourism in the Andaman and Nicobar Islands.
24. Seek local champions who are recognized in the community to promote the possibilities of sustainable tourism, providing a range of opportunities for tourists.
25. Sensitize tourists through appropriate educational videos, suitable for the government ferries, water sports, tourist guides, charter fishers and dive operators.

Integrated planning and management

26. Consider delineating areas where high speed water craft (e.g., jet skis and speed boats) should slow down to minimize impacts on marine mammals.
27. Incorporate appropriate regulations for marine tourism, recognizing that international guidelines exist (e.g., CMS and IWC whale watching guidelines), and promote plans through partnerships with stakeholders.
28. Explore the wide range of certification schemes for possible application to the Andaman and Nicobar Islands (such as for dive operations and whale watching).
29. Ensure best practice approaches are adopted (e.g., silt curtains and noise reduction), recognizing the possible impacts of nearshore coastal developments (e.g., dredging, dumping and infrastructure).
30. Recognize the wide range of vessels operating in the Andaman and Nicobar Islands, and work to promote best practice approaches for vessel operations (e.g., anchoring, ballast water, speed in sensitive areas).
31. Explore opportunities to work with administrators and local communities, Port Authorities, etc. to reduce all forms of pollution (e.g., plastic, sewage, oil and chemicals, noise).
32. Improve fisheries management to address key concerns (e.g., fisheries interactions, bycatch, habitat degradation, and directed take) and incorporate into an integrated plan.
33. Develop an integrated plan for the IMMA and consider additional aspects if shown to be significant.
34. Promote both top-down and bottom-up approaches to ensure sustainability of activities in the marine environment.

Table 1. Implementation Summary Table (sorted in order of priority)

Note: This implementation table is designed so it can be sorted in different ways, e.g., in priority order, species order, or lead stakeholder order.

Species	Pressure	Sub-pressure	Issue	Priority	Lead stakeholders	Other stakeholders	Recommendations (numbers refer to recommendations listed above)
Dugong	maritime traffic	speedboats and jet skis	collision	high	ANFD DSS PMB ANCOC IP&T	Dive Clubs Local NGO	5, 26, 30
Dugong	fisheries	gillnets	bycatch	high	DF ANFD	Local NGO Schools	3, 8, 22, 32
Dugong	fisheries	traditional	legal direct takes	high	ANFD		8, 32
Dugong	coastal development		habitat loss and disturbance	high	ANFD DSS PMB ANCOC IP&T		13, 29, 31
Dugong	tourism	unplanned expansion	habitat loss and disturbance	high	ANFD IP&T ANCOC		13, 23, 29, 31
IMMA general	all		increase awareness	high	ANFD DIPT	Local NGO Dive Clubs Game Fishers Educational Institutes	18, 19, 20, 22, 24, 25, 34
IMMA general	all		need for coordination	high	ANFD IP&T ANCOC	Local NGO Dive Clubs Game Fishers Educational Institutes	1, 2, 34
IMMA general	all		further research	high	ANFD DF	Local NGO Dive Clubs Game Fishers Educational Institutes	6, 7, 9, 10, 11, 12, 14
Coastal odontocetes	fisheries	seine nets	bycatch	medium	ANFD DF	Fisher unions	8, 20,21, 22, 32

Coastal odontocetes	tourism	unplanned expansion	habitat loss and disturbance	medium	ANFD DSS PMB IP&T	Local NGO Dive Clubs Game Fishers Educational Institutes	13, 23, 27, 28, 29
Cetaceans	tourism	wildlife watching tours	disturbance	medium	ANFD DSS PMB ICG IP&T	Local NGO Dive Clubs Game Fishers Educational Institutes	27, 28, 33
Cetaceans	pollution			medium	ANFD ICG ANPCC		29, 31
IMMA general	all		citizen science	medium	ANFD DF ICG INS	Local NGO Dive Clubs Game Fishers Educational Institutes	15, 16, 17
Cetaceans	maritime traffic	high speed ferries (>14kt)	collision	medium	ANFD DF PMB DSS ICG INS		26, 30
Coastal odontocetes	fisheries	gillnets	interaction	medium	ANFD DF	Fisher unions	8, 20, 21, 22, 32
Pelagic odontocetes	fisheries	longlines	bycatch	medium	ANFD DF	Fisher unions	8, 22, 32
Dugong	maritime traffic	speedboats and jet skis	noise/disturbance	low	ANFD DSS PMB ANCOC IP&T	Local NGO Dive Clubs Game Fishers	4, 8, 29, 30, 31
Cetaceans	maritime traffic	high speed ferries (>14kt)	noise/disturbance	low	ANFD DF PMB DSS ICG IN		8, 29, 30, 31
Dugong	fisheries	trawl nets	habitat destruction	low	ANFD	Fisher unions	3, 32

					DF		
Pelagic odontocetes	fisheries		illegal direct takes	low	ANFD DF	Fisher unions	8, 32
Dugong	tourism	wildlife watching tours	disturbance	low	ANFD DSS PMB ICG IP&T	Local NGO Dive Clubs Game Fishers Educational Institutes	27, 28, 33

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Acronyms

A-PCCF	Acting Principal Chief Conservator of Forests
ACF	Additional Conservator of Forests
ANCOC	Andaman Nicobar Chamber of Commerce
ANET	Andaman Nicobar Environment Team
ANFD	Andaman and Nicobar Forest Department
ANI	Andaman and Nicobar Islands
ANPCC	Andaman Nicobar Pollution Control Committee
AoI	Area(s) of Interest
CBD	Convention on Biological Diversity
CCF	Chief Conservator of Forests
CID	Criminal Investigative Division of the Police
cIMMA	Candidate Important Marine Mammal Area
CMS	Convention on Migratory Species
DCF	Deputy Conservator of Forests
DF	Directorate of Fisheries
DSS	Directorate of Shipping Services
EBSA	Ecologically or Biologically Significant Area
GBRMP	Great Barrier Reef Marine Park
GOBI-IKI	Global Ocean Biodiversity Initiative's project supported by the International Climate Initiative
IBA	Important Bird and Biodiversity Area
ICG	The Indian Coast Guard
ICMMPA	International Conference on Marine Mammal Protected Areas
ICoMMPA	International Committee on Marine Mammal Protected Areas
IMMA	Important Marine Mammal Area
INS	The Indian Naval Service
IP&T	Information, Publicity and Tourism
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
MMPA	marine mammal protected area
MMPATF	Marine Mammal Protected Areas Task Force
MoEF-CC	Ministry of Environment, Forests and Climate Change
PCCF	Principal Chief Conservator of Forests
PMB	Port Management Board
SP	Superintendent of Police
WII	Wildlife Institute of India

Appendices

Appendix 1 – Minutes of the Stakeholder Consultation Meeting

Date: 16/11/2018
Time: 10:00-13:00
Location: Van Sadan, Port Blair, Andaman island
Facilitator: Swapnali Gole
Rapporteur: Aashi Parikh
Photographer and Videographer: Sohini Dudhat and Evan Nazareth

Participating Government agencies:

1) A-PCCF, ACF, DCF, CCF - Andaman and Nicobar Forest Department (A-PCCF Bhandari, ACF A.K Paul, DCF Amit Anand, DCF Naveen Kumar, CCF Diganta Gogoi
2) Mohammed Tahir- Directorate of Fisheries
3) Pravin Mohandas - Directorate of Shipping Services
4) Dr Tripathi - Chief - Port Management Board
5) Representatives from the Chamber of Commerce (Davis and Singh)
6) Directorate, Information Publicity and Tourism (did not attend the consultation. Met with the Director on November 14th)
7) The Indian Naval Service INS)
8) The Indian Coast Guard (ICG)

Scientific Community:

1) Swapnali Gole and Sohini Dudhat - Wildlife Institute of India
2) Dr Elrika D'Souza, Nature Conservation Foundation
3) Zoological Survey of India
4) Dr Vivek CP, Botanical Survey of India

Others:

1) Chetana Purushotham, Dive India - Scuba Shop
2) Mahima Jaini, Madhuri Ramesh and Adith S. Andaman Nicobar Environment Team
3) Darran Davis, AquaCreed – Game Fisher
4) Arun Singh, Ghummo Andaman

Welcome Note and Thanks from Swapnali Gole, WII.

Described the importance of the Andaman Islands, introduced the IUCN Marine Mammal Protected Areas Task Force to the participants - Jon Day, Giuseppe Notarbartolo di Sciara, Erich Hoyt and Tundi Agardy. After a round of introductions of 25 -27 participants at the meeting, the first presentation on IMMA was made.

10:15am IMMA presentation by Dipani Sutaria on behalf of the IUCN Marine Mammal Protected Areas Task Force

Key points:

- Andaman and Nicobar islands very important from the biodiversity perspective
- Why should marine mammals be studied and conserved
- The reasoning for mapping IMMAs globally and how the idea was formed.
- What are IMMAs - IMMAs are not MPAs. IMMAs are a spatial layer based on biocentric data and do not include any socio-economic data or political considerations, designed to inform conservation of marine mammals using various management strategies.
- In Andaman and Nicobar islands only one IMMA for dugongs and cetaceans; and two Areas of Interest (AoI) for Dugongs have been identified, apart from others in mainland India, Sri Lanka and Bangladesh.
- Availability of all the information and shapefiles of IMMAs and AoI online at marinemammalhabitat.org

- Research by Wildlife Institute of India, Nature Conservation Foundation, and Mahi Mankeshwar and Dipani Sutaria have led to the proposal of candidate Important Marine Mammal Area (cIMMA) and Areas of Interest, which, after peer review, have been given the status of Areas of Interest in north Andaman and Nicobar, and Important Marine Mammal Area to southern Andamans. With more supporting data, the two AoI could become IMMAs.

10:30am Presentation on cetaceans in the South Andamans by Mahi Mankeshwar

Mahi Mankeshwar is an independent researcher being advised by Dipani Sutaria. Mahi explained that no dedicated research had been carried out on the islands before 2016. Central Marine Fisheries Research Institute and Zoological Survey of India had documented strandings and carcasses washed ashore but no dedicated studies had been carried out.

- Acknowledged the contributions of various stakeholders present towards the study.
- Talked about the knowledge gap on cetaceans from the region.
- Explained the different methods used for data collection.
- Highlighted the role of the participatory monitoring network and Whatsapp as an important tool for data collection.
- Via an interactive species diversity map, distribution of each documented species was shown.
- Three species recorded through the stranding records maintained by the forest department were shown.
- Important areas within the IMMA were highlighted based on presence of cetaceans, vessel traffic and important bathymetric features.
- The results on survey effort, total number of interviews undertaken and the total number of species recorded were presented in a nutshell.
- Vessel traffic, sound pollution and fisheries interactions were listed as the prevalent threats to cetaceans in the IMMA.
- Cetacean research has been supported by Rufford Small Grants Foundation and Ravi Sankaran Foundation

Questions during Mankeshwar's talk:

INS Representative – You mention sound as a source of pollution, but what about oil spills and pollution from plastics?

Mankeshwar - Yes, there is, but we still don't know enough about it.

Sutaria - Yes the threat oil spills and solid waste is present. But as most of these species are pelagic and deep water species, and they communicate underwater, both bathymetric complexity and ambient sound are important considerations, and underwater noise is actually becoming a worldwide issue.

Bhandari, A-PCCF - Thank you for such wonderful efforts Mahi. My observation is this - I sincerely appreciate your efforts to put Andaman and Nicobar on the map, but you haven't included Nicobar (in your surveys and mapping), it gives the impression that they are not important, and it gives the impression that this kind of data is confined only to Andaman.

Mankeshwar – We are just beginning the work and there are logistical and financial constraints. We hope to cover the rest of Andamans and the Nicobars in the future.

Mr Singh, Ghummo Andaman and rep Chamber of Commerce - One more thing, it seems the surveys you have done are confined to south Andaman, Havelock and Neil, it has to extend to the northern channels, that has to be done. And another thing, you have been doing this for 2 years, and you've said that shipping traffic is increasing, but it has been for the last 20 years. What is the reason that we get so many species in this area despite all the threats and traffic? Is it because of lack of surveys in other areas?

Mankeshwar - It could be, we don't know yet.

Sutaria – Cetaceans are territorial, they display high site fidelity, so they are found in particular niches where they will feed or breed or reside all year, e.g., sperm whales are known to be present in areas of underwater canyons, and feed in deep water. So each species has its own habitat where it will strive to live even in the presence of growing threats. Some of these areas are also species rich as is South Andaman island, and there is a variety of space uses. But yes, at the moment we have not surveyed the entire region. The charm of the IMMA process is that it is flexible, the boundaries are fluid and can be changed. So new areas as they are found can be added.

Dr Tripathi, Chief Port Management Board - May I request you to go back to the bathymetry slide?

(slide located) I would request you to study the area outside of the ferry route. It will give a positive effect if you find that cetaceans are also using these other areas extensively. At the moment the data is confined to shipping routes, and data away from the route is not available. Also, if most of the cetaceans inhabit deeper waters, ship collision and noise

from vessels will not be a problem as suggested in the presentation other than in the ferry route. My request is if you can survey the other areas around this, then we can decide whether the route we are using is having a positive or negative effect (and what space use is like in surrounding regions, whether the ship route could/should be diverted? We are not using all the routes right now.)

Bhandari, A-PCCF - Until you survey everything you can't say whether it is or isn't. The coastguard uses all routes, it can go anywhere and everywhere.

ICG Representative - We can help.

Bhandari, A-PCCF - We would like take the whole Andaman area under an IMMA!

Mr Tahir, Directorate Fisheries - Is there any seasonality observed?

> **Mankeshwar** - We don't have enough data yet really but it could be possible.

Mr Singh Ghummo Andaman and rep Chamber of Commerce - If you want more data, it is almost tourist season. Many people are coming in and you could start a citizen science program with them. What we do is we get photographs from tourists. A website is an effort because people have to go to it, but if you use social media like Facebook and Whatsapp, it can be shared easily.

> **Mankeshwar and Sutaria** – Yes, this is an initiative that has already been started but we prefer not to use Facebook. We use Whatsapp and an online site called www.marinemammals.in.

Presentation on dugongs in the South Andamans by Elrika D'Souza

- The population of dugongs is isolated and considered to be Critically Endangered. Surveys since 2007 have photo-identified 20 Dugongs but there could certainly be a few more because the whole Jarawa coastline has not been surveyed.
- Studies since 2006 show that Dugongs feed on *Halodule* sp. and *Halophila* sp. of seagrass.
- 68 seagrass meadows mapped, out of which 48 have seagrass that Dugongs prefer, and of these 24 meadows also have Dugong grazing trails
- The population is geographically so small that 1-2 dugongs use the same beds all through the year and do not need to move between far away meadows. As dugongs breed very slowly (long-lived 70 years or longer) the different populations in these meadows have become small and probably isolated from each other.
- Since 2016, three mother-calf pairs have been sighted which is a sign of hope. Given that enough preferred seagrass is available the recovery of Dugongs can take place.
- Main threat is from drift gill nets and other kinds of gill nets; boat traffic that damages seagrass beds and risk of collision of high speed boats with Dugongs.
- Indigenous tribes have the right to hunt Dugong.
- Increased penalties and legislation are now in place for illegal poaching by settler communities.
- Recognition of IMMA for dugongs could add value to the conservation measures both culturally and biologically.

Questions during Elrika's talk:

Bhandari, A-PCCF - You have said about some of the areas where dugong activities occur and the impact is high, I would like to have that information from you for how to conserve that area.

D'Souza - We have submitted this information to the Department in March 2018.

Mr Singh, Ghummo Andaman and rep Chamber of Commerce - Neil is a visible area, anchoring with the tide, there has to be a harbour in port...

Bhandari, A-PCCF - What is the size of a seagrass meadow? And the depth?

> **D'Souza** - It depends, typically 100 x 200m. The deepest is 18m, In Neil it starts around 2-3m and goes to 13-14m. Neil has the deepest, other regions are sub-tidal. Coming to the point of anchoring, we have lots of suggestions coming up with simple solutions, just to reduce boat speeds in these regions would be very beneficial for the animals and for us.

Bhandari, A-PCCF - Can we shift that anchoring site away from the meadow?

Dr Tripathi Port Management Board - It's not just about the anchoring, it's also the load. If high speed jet skis are operating, that will affect the animals and the seagrass also.

> **D'Souza** – Yes I agree with PMB also, if you just reduce speed, stop using certain nets in areas of high priority, as shown on the map.

Dr Tripathi Port Management Board - Basically I will suggest one thing, if it can be mapped where there are seagrass and Dugongs, then those areas we can exclude and find other areas to operate high speed boats and jet skis. Suppose, around Neil, what are the patches where we need to take care? Those can be excluded from jetskis and other things? Activities like diving etc., can continue...

> **D'Souza** - From what I've seen, Neil, Havelock and Ross are sites in North Andaman where tourism is high, the rest is in uninhabited areas, just leave those alone, let them be.

Bhandari, A-PCCF - We cannot stop activities in these other areas

> **D'Souza** - Yes exactly, but we can consult each other and lower our impact, based on the Dugong maps and this new IMMA layer...

Mr Singh Ghummo Andaman and rep Chamber of Commerce - How many dugongs are there?

> **D'Souza** - I've been able to identify 20 individuals.

Mr Singh Ghummo Andaman and rep Chamber of Commerce - Across all the islands?

> **D'Souza** - Yes, but there are also 3 mother-calf pairs, which is a very good sign, it means that they are breeding. They are low but they are breeding; over the years, growth is possible.

Mr Singh Ghummo Andaman and rep Chamber of Commerce - Is there a possibility of captive breeding?

> **D'Souza** - No, not at all possible, they are very sensitive, the chance of survival is very low. Last year Australia lost a dugong just to tagging. Our population is also connected to other Asian populations.

Dr Tripathi, Port Management Board - If the areas are marked where dugongs are found and seagrasses, then that can be marked urgently as a tourist destination for a different kind of tourism. Neil and Havelock boats can be customised and used for high niche tourism here?

> **D'Souza** - Yes, some of the boat operators in Neil and Havelock say with pride when people come to dive, that we have dugongs here.

A-PCCF Bhandari - We have given the topmost priority to dugongs, they are our state animal, we have declared our intentions with the state agreement.

Mr Singh Ghummo Andaman and rep Chamber of Commerce - For dugong conservation, measures have to be taken, from the state and from tourism, fishing etc

INS representative - The type of outboard engine used in these boats is one with a long stock, and the hull is at 45°, very low, it won't be able to navigate with such low speed. In regions where water depths are very low (Indonesia etc.), these kinds of vehicles are banned. The OBMs cannot be allowed to protrude at this angle; at least in these areas we may set out some guidelines. The animal will not be able to negotiate at such speeds; it doesn't have the reaction time and speed to manoeuvre.

INS representative - What is the regrowth rate of seagrass to grow back to a good munchy state?

> **D'Souza** – Explaining the regrowth rate: it recovers very fast within the span of weeks.

INS representative - Have you explored the viability of introducing more seagrass?

> **D'Souza** - Food is not the problem here. There is enough seagrass that regenerates. It is not a limiting factor and hence no need to introduce more.

Ms Purushotham (Dive India) - I just wanted to add, what you said about boats going slower in low depth areas, it benefits everyone to make sure that animals like dugongs are not accidentally harmed. Monitoring the speed of boats is definitely something we can do. Whatever support is needed, this is something we can do. Education is also definitely one of our prioriities.

DCF-Kumar - Threat perception: fishing is the main concern; the area sensitivity has to be given to operators of trawlers and longliners, if the Fisheries Department can take a lead initiating this.

Mr. Lal (Coral Queen Ferry Captain) - The area should not be closed if you wish to apply legislation. if you do not create a corridor for the animals to move from one meadow to another, the animal will continue to go wherever it pleases. So along with sensitivity map, we also need a corridor of slow speed.

Forest Officer - One suggestion: where the southwest monsoon occurs, you can see that the habitat distribution with respect to monsoon, if you can look into how the monsoon impacts distribution of this species.

> **D'Souza** - Yes this is something we are doing; in fact, this is why most of our records are to the East.

11:32 am – Mr Jon Day from James Cook University and the Great Barrier Reef Marine Park (GBRMP) presents on his experience in GBRMP

KEY POINTS

- Jon stressed that his experience in the Great Barrier Reef was very different from the Andamans; however, some of the experiences could be adapted for the situation in South Andamans.
- Stressed the unique situation in the ANI with regard to the marine values and the current relative pristine situation in many areas.
- Acknowledged that MPAs exist but only in a small part of ANI (with Coast Guard responsible for the remaining coastal waters).
- Given the current and proposed threats to the ANI, to maintain these significant values, management will be required.
- Stressed some of the benefits of management of these marine values, e.g., fish stock spillover to adjacent areas; economic benefits (Maldives' example); cultural and social benefits.
- Showed an example of a spectrum of tourism 'settings' ranging from high use (large vessels with large numbers of people) to a protected setting (only small vessels allowed with limits on numbers of visitors).
- Showed an example of a simple system buoys to minimize damage to coral reefs (could be also applied to seagrass beds).

Questions

A-PCCF Bhandari - One issue we are facing that we are unable to solve is how to move from low end to high end tourism. We are developing country; if we insist on high end tourism we are denying many. How do we ensure this shift?

> **Mr Day, James Cook University** - Maybe one thing you can look at is that all the agencies work together to determine what is appropriate, and use their own laws to determine what happens, rather than creating a new organisation. This group has to recognise, if we go to mass tourism, we end up killing the attractions that drew people; it is good to recognize some areas, e.g., zones for low speeds. There are different ways and management tools we can talk about. This group and other agencies that aren't here today need to work together with the researchers to come up with an approach for this area.

Mr Davis AquaCreed (Recreational Fisher) - I think the main thing is that we need is to cooperate, and if we can jointly come up with a plan to go from low to high end tourism, for instance, if we take mass tourism, there are certain boats with operating limits, they will be mainly operating in areas with low impact for mass tourism, other areas like scuba diving and sport fishing are also operating within certain guidelines. In this way, we may be able to proceed further, because high end tourism is available to a smaller niche market. By coordinating between ourselves we can come up with a solution beneficial to the entire sector.

> **Mr Singh Ghummo Andaman and rep Chamber of Commerce** - We have to sit together to identify what is needed by high and low end tourism. There will definitely be a loss of ecological and biodiversity value, if we don't enforce management properly, there won't be anything to come to in 10 years. Personal will to make this change has to happen, e.g., Neil dugongs, there should be representatives from tourism, government, local etc wanting to conserve and manage.

Mr Davis, AquaCreed - I think the crux, the most important thing we can do as being a community, combined stakeholders, in terms of plans, mass tourism and niche tourism should be kept as equal as possible in terms of availability; then implementation will become much easier. If we make different ways to monitor, it will be difficult to implement.

Questions regarding fisheries restrictions

Mr Singh Ghummo Andaman and rep Chamber of Commerce - Another thing, for the Fisheries Dept.: do we have a green zone?

Mr Tahir, Asst Fishery Director - No we don't.

Mr Singh Ghummo Andaman and rep Chamber of Commerce - There should be zones.

Mr Tahir, Asst Fishery Director - There is a wide gap between exploitable resources and present exploitation. For the present, we cannot stop, we have to sustain fisheries in a way that we can exploit more and we can conserve also. We are not thinking of the number of boats or no green zones, we are just thinking of increasing catch.

> **Mr Day, James Cook University**: This is very dangerous.
>
> (Conversation between Commerce and Fisheries Dept.)
>
> **Mr Day, James Cook University** – (Explains how green zones in Australia act as an insurance for the future.)

Mr Tahir, Asst Fishery Director- Even otherwise, we have lots of reserves where fishing is not allowed; these areas remain protected, and we will take care to the extent we can.

> **Mankeshwar** - In the Andamans, the planning would have to be island-wise, not a general plan as there are different issues for each island.

Mr Tahir, Asst Fishery Director - We can advise them not to fish certain areas. It would be good if NGOs and other researchers could be part of this, to sensitize fishers to self-regulate and conserve.

Ms Purushotham, Dive India where I work, tourism can help with supporting conservation and research. We have 30-40 employees, most from the Andamans. Earlier there were fishers; now they are using their skills and see the value of working in a dive setup, teaching people that there is value in conservation. We want to continue this model. It is easier to show them the effects of pollution etc when we actually take them to the water using marine education and diving as a tool.

Questions regarding the legal status of an IMMA

Mr Anand, DCF - This is the first time I've been introduced to IMMA. Whenever we say community, he (Jon) is including everyone from top positions with us now to educators to the public. From the Indian mind-set, when we say community, we think only of the general public. This is not so. The whole strata of officers have to be sensitized and equally tuned to the policy, so it does not require any enforcement measures. We are in a split mind set; this has to be merged.

Mr Day, James Cook University - I agree, we can have the best laws in the world but people can say "I don't want to follow them". This gets to the importance of education – there are examples of students educating their parents in Australia. If you work with community, agencies, school kids, then you've got something sustainable for the future. As an outsider, what I see today is the start of a conversation between agencies, researchers and community. It has to keep building, has to come over time with everyone working together. Maybe a little subgroup of those present here can meet regularly to see how it moves on.

Questions regarding building capacity and gaining from networks

Mr Kumar DCF - When working with IMMA suggestions and mapping, it would be beneficial if you can give training to the Indian Navy and Coast Guard, basic classification knowledge, so they can provide you with basic data, even if not photos, so that efforts can be concentrated. The forest department can also be trained; lower level staff can be trained as they will be useful to you. All should be taken on board so they can contribute.

> **Sutaria** - Yes absolutely, we have just started this on the mainland as well, showing how to offer training in marine mammal responses etc.

INS representative - From the Navy perspective, we are very cautious for marine mammals. Because of the kind of job we do, we have to retain surveillance day and night and we are trained to look at everything. A personal experience from when I was young, I saw a sea turtle caught in a net and went off to free the turtle, and doing this gave us happiness, even the submarines that came up last week reported whale sounds. **We are very open to help, we mark whale areas as a matter of interest, if that data can be passed on we would be more than happy to pass it on to you if the official channels are created and the administration permits.** To be able to add to the research, since there are so many GIS layers, we would much appreciate if a superimposed map could be given to us with all the species and habitats to be protected. I can guarantee that the Coast Guard and Navy will divert all efforts possible for this.

Mr Lal (Coral Queen Ferry Captain) - It has been 30 years but I still didn't know about the diversity of dolphins and whales found here. Already the Caribbean Coast Guard has a format where you give the sightings, approx. size, and lat long, but it is not easy for a person like me to identify which kind of whale/dolphin/turtle it is. It would be better if we have a pictorial guidance and a Whatsapp number we can send data to. I also sighted a whale this year east of Ross, I never did any reporting because this kind of process is not available.

INS representative - The Pramanika system was launched in 2013. If we meet a fisherman at sea and ask him for his Pramanika ID, if he is unauthorized we have to report it. So if that system is superimposed to the places that fishers are fishing, in relation to enforcement, since the resources are so many, these are already available to us. Pramanika can be used to map the places where the fishermen have gone. A GPS is linked to the ship so we know the locations. I would urge that these options also be explored.

Mr Singh Ghummo Andaman and rep Chamber of Commerce - There is an application called ebird which is used worldwide, researchers are able to use it to predict behaviour. There are many ways an app can be developed for this purpose.

Ms Ramesh - Would the forest dept. be interested in putting up a platform that everyone can add to?

> **Sutaria** - We already have a platform, www.marinemammals.in and it is open to public and all data can be downloaded from there and sightings can be reported there too. The inputs go through review before they become public.

A-PCCF Bhandari - As far as crocodiles are concerned, everyone is very educated. An incident with crocodiles from a few days ago has already been uploaded on Facebook. I am curious why no one has asked what impact the IMMA will have on stakeholders, how will it affect them?

> **Sutaria and Gole** – We don't work on Facebook because it attracts a wide range of reactions that cannot be managed easily. As far as IMMA is concerned, this is only a layer of information that can be used by different managers.

INS representative - If we keep it within this community, it may be easier to enforce, there is no need to proliferate it.

Questions about what next after IMMA?

A-PCCF Bhandari- Has the MoEF accepted the IMMA?

> **Sutaria:** Both IG and DIG at MoEF are aware of the same.

A-PCCF Bhandari - What is the procedure after this? What is the next step?

> **Sutaria** – Flexible. Every 3 years the Task Force will check up on whether the area is still an IMMA, or whether there is an extension required, whether there are changes within the IMMA, etc.

Ms Ramesh ANET- Do IMMA areas also have any implications with Coastal Regulation Zone, MoEF, Government of India?

> **Sutaria** - No, at the moment, the process is purely biocentric; like the animals saying we are here.

Questions regarding tourism potential and its management

Mr Kumar DCF - A few concerns I have, opening new areas for tourism by introducing IMMAs - Andaman has 18 IBAs as designated, the legal and regulatory part is still ongoing. If we open up, we can see the importance in other parts of the world. What will be the perspective of Andaman if we open a few IMMAs to tourism? How will they be managed, what will be the social responsibilities by the promoters. How have IMMAs contributed to conservation , how has tourism been promoted and managed?

> **Mr Day, James Cook University** - We have to be careful, we don't want to tell everyone to come rushing here. The importance of education is to show the value of these areas, work closely with tourist operators to understand what is appropriate and what isn't - feeding, approaching distances to whales. There are international guidelines but it is up to the local people to understand them. Enforcing permits for operating. A way of marketing could be - "I'm taking you to one of the best places to see whales, and you wont have to share it with other people". Regulations need not be too complex. The best is self-regulation where the industry regulates itself, community regulation, to ensure it works in a sustainable way.

Ms Ramesh, ANET - Does the tourism agency come up with regulations or GBRMPA?

> **Mr Day, James Cook University** - GBRMPA works closely to ensure that values are maintained, the tourism agencies did not like the GBR before, but now they work together to regulate - self-regulation again. The techniques used there are very different from here, it seems like lot of expertise in this room, so you will have to come together to identify what is best.

Mr Kumar DCF - We want to know the animal response to tourism?

> **Mr Day, James Cook University** - It depends much on the animals and methods used. Remember that there are many other pressures, if the animal is already under pressure from boat noise, habitat destruction,

climate change, etc., you have to consider those in addition to tourism. But activities such as whale watching and swimming are possible, and a sustainable tourism industry can be built on marine mammals.

Sutaria - Activities in Australia are very well managed, there are boats that go out in the morning and evening. They prefer using a single boat with more people rather than more boats with less people. The advantage of the Andamans is that there are less people than places like Chilika, we have less tourists than the mainland, so we are at the stage where we can put in regulations before it gets out of hand.

A-PCCF Bhandari - You are from Gujarat; suppose you come here to see corals, you are here two days and you are told that you aren't allowed to see corals.

Sutaria - But that can be in an online system; you can see availabilities before and plan when to come based on that.

A-PCCF Bhandari - That is possible in some countries. In India, the management is more tourist-oriented - more tourists, more hotels etc. We have to sit together and find out what we need to do and don't need to do about this.

A-PCCF Bhandari - In Andaman, you see that everyone is not doing scuba as it charges IDR 4000 per dive, it is too expensive so everyone doesn't do it. That kind of restriction can be done.

Mr Singh Ghummo Andaman and rep Chamber of Commerce - Similar with bird watching, 5% of the tourists engage in it. Game fishing also, we have to sit together and figure out what to do and what not.

Sutaria - So in high-impact areas where you know there are animals at risk, you keep only niche tourism, and not mass tourism...that might be the way ahead

Mr Singh Ghummo Andaman and rep Chamber of Commerce - e.g., in Neil, we can take small steps because it is already very exposed to tourism.

A-PCCF Bhandari - That isn't going to happen (Example of a recent incident with tourists).

- Ecotourism is globally a fast-growing sector of tourism.
- increase ecotourism quality versus quantity.
- We need to develop measures in which tour operators are enrolled in a system to discuss guidelines.

Appendix 2 – Excerpt from Southern Andaman Islands IMMA template submission

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Summary for IMMA e-Atlas Pop-up Box

The Andaman and Nicobar Islands are a group of volcanic island systems in the North-eastern Indian Ocean with complex bathymetry, characterized by fringing coral reefs, seagrass beds and mangroves. The IMMA of southern Andaman Islands has 16 species of marine mammals consisting of 15 cetacean species and the Dugong. Seagrass bed occupancy surveys for dugong feeding trails show that four seagrass meadows are being utilised by the remnant population of dugongs. Of the fifteen species of cetaceans recorded from systematic vessel based surveys, ferry-based sighting surveys, opportunistic sightings by network members and past records only *Tursiops aduncus and Dugong dugon* nearshore residents. They have been reported with calves, along with individual re-sightings in the IMMA. *Stenella longirostris, Stenella attenuata, Grampus griseus, and Globicephala macrorhynchus* are other commonly observed species in the area, while *Lagenodelphis hosei*, *Balaenoptera omurai* and *Pseudorca crassidens* have been reported here for the first time.

Description of IMMA

The Andaman and Nicobar archipelago of India is part of the Indo-Myanmar and Sundaland biodiversity hotspot in the Bay of Bengal. The islands have highly diverse terrestrial and marine ecosystems, comprising evergreen and littoral mangrove forests, extensive seagrass meadows, fringing coral reefs and active volcanic islands. With more than 350 islands of which 13 are inhabited, a coastline of 1962 km and an area of 8,249 km [Director-Census Operations 2011]) the archipelago is a significant region for conservation action. This region is significantly influenced by the southwestern and northeastern monsoons (May– December). The Andaman-Nicobar basin is characterized by a complex system of rift valleys and associated volcanic seamounts, because of which the sea-floor west of the islands is characterized by an insular shelf, steep drop-offs and deep-sea ridges reaching depths of 4400m, giving rise to a bathymetrically complex area and favourable habitat for several cetacean species.

The islands have historically been occupied by indigenous negroid people (Jarawa, Great Andamanese, Sentinelese) (Director-Census Operations, 2011). These native groups constitute only about 9 % of the present population, which is dominated by recent (c. 80–100 years) immigrant settlers from mainland India, Bangladesh, Sri Lanka and Myanmar. Agriculture, livestock rearing, fisheries and plantation forestry are the main occupations in the islands, and the indigenous people still significantly depend on minor forest produce and hunting, including ritual hunting of dugongs (D'Souza 2016).

Interview surveys, seagrass distribution and diversity studies, dugong feeding trail surveys and vessel-based sighting surveys for Dugong dugon, hereafter Dugongs have been carried out in the Andaman Nicobar Islands since 2004 (D'souza et al 2012,15, Anonymous 2012). Twelve species of seagrass have been recorded from this region, with *Thalassia hemprichii* and *Cymodocea rotundata* being the predominant species. A systematic database maintained since 2007 has recorded 19 dugongs including 3 mother-calf pairs) (D'Souza Pers Comm).

Prior to 2016, data on cetaceans from the region was limited to opportunistic sightings, carcasses washed ashore or rare bycatch accounts. In 2016, a participatory cetacean monitoring network was established via interviews, and local stakeholders such as fishers, divers, recreational fishers and ferry crew were requested to record their sightings by taking a photo/video whenever possible on their phone cameras (Mankeshwar and Sutaria 2018). Along with the image, the time of day, date, details about the area (coordinates marked on the GPS device or general location) and water depth were requested. Confirmation of species either from the monitoring data or interview surveys was done only on the basis of good quality images obtained from the respondents. Mankeshwar and Sutaria (2018), conducted inter-island ferry-based sighting surveys between January and March 2018, and in October 2018, over three fixed routes. The surveys consisted of 1,782 km and 91 hours of survey effort. Dedicated vessel based surveys to understand space use patterns in waters of Southern Andaman islands IMMA have also been carried out with 739 km and 45.35

hours of survey effort. Fifteen species of cetaceans have been documented from this IMMA, The systematic line-transect surveys from ferries and dedicated vessels documented 11 species of cetaceans. The participatory monitoring network also reported most of these other than Killer whales and False Killer whales; while the Omura's whale was reported twice only from the network. Common dolphins have been reported only in past literature, and not sighted by dedicated surveys nor have network members opportunistically reported them. Finally, the two beaked whale species have been reported only from carcasses washed ashore (with photographic proof). Fraser's dolphins, Striped dolphins, False Killer whales and Omura's whale sightings are all first-time reports from the region. The details are summarized in Figure 1. The photo-documentation of *Balaenoptera omurai* provides the most northern record in its geographic range (Mankeshwar and Sutaria 2018, www.marinemammals.in).

Lagenodelphis hosei, Stenella attenuata, Grampus griseus, Orcinus orca, Pseudorca crassidens and *Kogia sima,* along with mixed species aggregations of *G. griseus* and *Stenella sp.,* and *Globicephala macrorhynchus* and *L. hosei* have also been documented from this IMMA. Since most sightings have been within 7 km off any island in the area, we think that the bathymetric complexity of the Southern Andaman islands IMMA is peculiar and one of the underlying factors that are helping harbour these deep sea species in waters comparatively closer to shore.

Tursiops aduncus hereafter Indo-Pacific bottlenose dolphins (also reported for the Andaman's by Ducci et al 2012) and Dugongs are the only near-shore species observed in the area. Indo-Pacific bottlenose dolphins have been observed with calves; individuals have been re-sighted, and are known to interact with fishing gear. Although the extent of their bycatch is unknown since none are brought to landing centres, fishers have reported net depredation by the animals in nearshore waters.

From the information collected so far, Dugongs and Indo-Pacific bottlenose dolphins are the most vulnerable species in the region. Increasing number of fishing vessels, loss of seagrass habitat to fishing pressure, developing tourism sectors, increasing ferry traffic and waters sport vessels, along with intense naval presence, are all matters that need to be considered and managed.

Common Name	Scientific Name	IMMA Selection Criteria Met (x)							
		A	Bi	Bii	Ci	Cii	Ciii	Di	Dii*
Dugong	*Dugong dugon*	X			X	X			X
Indo-Pacific bottlenose dolphin	*Tursiops aduncus*				X	X			X
Spinner dolphin	*Stenella longirostris*								X
Pantropical spotted dolphin	*Stenella attenuata*								X
Indo-Pacific common dolphin	*Delphinus delphis tropicalis*								X
Striped dolphin	*Stenella coeruleoalba*								X
Fraser's dolphin	*Lagenodelphis hosei*								X
Risso's dolphin	*Grampus griseus*								X
Killer whale	*Orcinus orca*								X
False killer whale	*Pseudorca crassidens*								X
Melon-headed whale	*Peponocephala electra*								X
Short-finned pilot whale	*Globicephala macrorhynchus*								X
Longman's beaked whale	*Indopacetus pacificus*								X
Cuvier's beaked whale	*Ziphius cavirostris*								X
Dwarf sperm whale	*Kogia sima*								X
Sperm whale	*Physeter macrocephalus*								X
Omura's whale	*Balaenoptera omurai*								X

Key to Criteria: A: species and population vulnerability; Bi: small and resident population; Bii: aggregations; Ci: reproductive areas; Cii: feeding areas; Ciii: migration routes; Di: distinctiveness; Dii: diversity.

CRITERION A: Species or Population Vulnerability

The area is known habitat for a very small and Vulnerable population of dugongs (D'Souza et al. 2013, 2015). Stranded dugong calves and adults have also been recorded occasionally. Based on interview surveys with local fishermen, seagrass beds in this IMMA have been identified as 'Critical Dugong Habitat of Andamans' (Sivakumar and Nair, 2013; D'Souza et al., 2013). Further, dugong occupancy across this archipelago is estimated to have declined by 60% over the last 20 years and the present distribution is largely restricted to sheltered bays and channels supporting seagrass meadows dominated by *Halophila* and *Halodule* sp (D'Souza et al., 2013).

CRITERION Ci: Reproductive Areas

A total of 906 interviews were carried out in the Andaman and Nicobar islands (Sivakumar and Nair, 2013), of which 44% of respondents had sighted Dugongs, with a total of 247 encounters reported. Of these 24% were of mother-calf pairs (Sivakumar and Nair, 2013) showing that the IMMA is an important reproductive area. Solitary individuals made up 60% of the observations. Dugong calves have been stranded in this region (www.marinemammals.in).

Indo-Pacific bottlenose dolphins were observed with calves and sub-adults in seven of the thirteen sightings between January and May 2018. The limited sampling effort restricts us from making remarks about reproductive seasons observed in the region but data collected suggests that the near-shore waters host resident populations of the species.

CRITERION Cii: Feeding Areas

Indo-Pacific bottlenose dolphins have been observed foraging and feeding in near-shore waters. The dolphins were seen feeding on *Rastrelliger kanagurta* around reef habitats, and are also known to interact with shore seine nets that are used to catch bait fish species such as *Sardinella sirm, Sardinella longiceps* and *Engraulis sp.* suggesting that these near shore waters are important foraging grounds for the species.

Dugongs are known to use the seagrass meadows in this IMMA and grazing trails were recorded in 11 seagrass meadows in this area (D'Souza et al 2013, 2015). All feeding trails were recorded in meadows comprised of short-lived or early successional seagrasses like *Halophila spp.* and *Halodule spp*.

CRITERION Dii: Diversity

Sixteen species of marine mammals, known to use diverse habitat types, from shallow coastal waters, offshore seas and complex bathymetries have been documented from the waters of South Andaman making this region critical. The record of the Omura's whale, which has been documented twice till date from the IMMA, marks the northern record of the species in the Indian Ocean.

Supporting Information

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Additional Figures and Maps for Inclusion in the PDF Factsheet

Figure 1. Cetacean species documented from the IMMA through data collection sources. S- sighting; Sr- skeletal remains; BC- Bycatch; St- stranding

Species	Monitoring Data			Ferry Surveys	Dedicated surveys
	Literature Records	Past unpublished reports of sightings/stranded animals	Real-time participatory monitoring 2016-2018 (Sightings)	January-May 2018 (Sightings)	March- May 2018 (Sightings)
Tursiops aduncus	S+Sr		Y	Y	Y
Stenella longirostris	S	S+ St	Y	Y	Y
Stenella attenuata	-	S	Y	Y	Y
Stenella coeruleoalba	-	St	Y	-	Y
Delphinus delphis tropicalis	BC	-	-	-	-
Lagenodelphis hosei	-	-	Y	Y	-
Orcinus orca	S	S	-	Y	-
Globicephala macrorhynchus	St	-	Y	Y	-
Grampus griseus	-	St	Y	Y	Y
Peponocephala electra	-	St	-	-	-
Pseudorca crassidens	BC	-	-	-	Y
Kogia sima	BC	-	Y	-	Y
Ziphius cavirostris	-	St	-	-	-
Indopacetus pacificus	-	St	-	-	-
Physeter macrocephalus	S	S + St + Sr	-	-	-
Balaenoptera omurai	-	S	Y	-	-

Figure 2. Risso's dolphins have been observed with calves. ©Sagar Rajpurkar (Mankeshwar and Sutaria 2018)

Figure 3. Fraser's dolphin recorded for the first time from the region.© Sagar Rajpurkar (Mankeshwar and Sutaria , 2018)

Figure 4. Indo-Pacific bottlenose dolphin observed in the near-shore waters of the IMMA.© Mahi Mankeshwar.

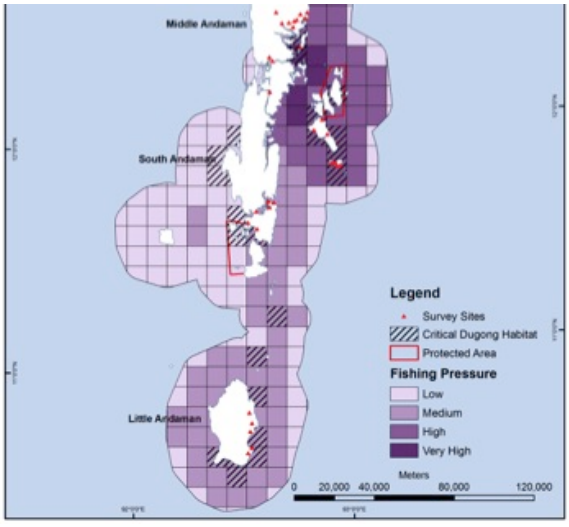
Figure 5. A bottlenose dolphin with a marked dorsal fin. © Mahi Mankeshwar.

Figure 6 (top and bottom). Omura's whale sighted in south Andaman Islands with a thin, backswept dorsal fin and the prominent chevron. © Akshay Malawi (Mankeshwar and Sutaria 2018)

Figure 7. Omura's whale sighted in April 2018 with the right side chevron, and the blow-hole and dorsal fin seen together as the individual surfaces. © Akshay Malawi (Mankeshwar and Sutaria, 2018)

Figure 8. A beached Longman's beaked whale. Only record of the species from the region. © Ajay Saxena (Mankeshwar and Sutaria, 2018)

Figure 9. Maps showing critical dugong habitat in the Andaman Islands using interview surveys (Anonymous 2012).



Appendix 3 – Important facts about dugongs

Life-history traits

- maximum longevity (~70 years or longer)
- low reproductive potential
    - delayed sexual maturity
    - age before breeding (females 6-17 years; males 4-16 years)
    - maximum possible rate of increase (e.g., low natural mortality and no human-induced mortality) is 5% per year
    - only a single calf per birth
    - time between breeding — 3-7 years; not in continuous breeding condition all year-round
- calves rely heavily on mother, both for sustenance and for protection
- migratory (may stay in localised areas or range widely) but mainly use inshore habitats
- primarily graze on seagrass but can also eat marine algae

Worldwide, the dugong is listed in the IUCN Red List as being *Vulnerable* to extinction:

- Andaman Islands dugongs are a geographically and genetically isolated dugong population
- Estimates for the Andamans are at around 15 individuals (very small population)

Appendix 4 — Hazard Risk Assessment Process: Mortality threats to dugongs and marine mammals

To be assessed and completed by community representatives

Major pressure types	Pressures	Likelihood # (considering both current and likely future situation)	Consequence #	Overall Risk (considering both likelihood and consequence)	Possible management response(s)
Land-sourced impacts	Clearing or modifying coastal habitats increasing sediment runoff				
	Habitat loss (e.g., coastal reclamation)				
	Nutrient and pesticides from run-off				
	Industrial/urban pollution				
Marine – sourced impacts	Boat strike (especially near ports, vessel access channels)				
	Noise concerns (e.g., vessels, pile-driving)				
	Changed dugong behaviour because of vessels (e.g., high speed vessels, jet-skis)				
	Poaching/illegal hunting				
	Disease				
	Dredging and/or dumping of dredge material				
	Incidental capture in fishing gear (nets)				
	Marine debris (e.g., ghost nets)				
Climate change	Marine habitat degradation from typhoons				
	Bleaching impacting seagrass				

Use guidance below in Tables 1-4 to assess Consequence, Likelihood and Risk Level.

Assessing consequence. Note that separate tables should be used to define the consequences applicable to environment (ecosystem) and environmental perception, as described in Tables 2 and 3 below:

DESCRIPTION	DEFINITION
CATASTROPHIC	Impact is clearly affecting the nature of the ecosystem over a wide area OR impact is catastrophic and possibly irreversible over a small area or to a sensitive population or community Recovery periods of greater than 20 years likely OR condition of an affected part of the ecosystem irretrievably compromised.
MAJOR	Impact is significant at either a local or wider level or to a sensitive population or community. Recovery periods of 10 - 20 years are likely.
MODERATE	Impact is present at either a local or wider level. Recovery periods of 5 - 10 years anticipated.
MINOR	Impact is present but not to the extent that it would impair the overall condition of the ecosystem, sensitive population or community in the long term.
INSIGNIFICANT	No impact or, if impact is present, then not to an extent that would draw concern from a reasonable person. No impact on the overall condition of the ecosystem.

Table 1: Consequence (Environment –Ecosystem level)

DESCRIPTION	DEFINITION
CATASTROPHIC	Negative and extensive national media attention and national campaigns
MAJOR	Negative national media attention and national campaign
MODERATE	Negative regional media attention and regional group campaign
MINOR	Individual complaints
INSIGNIFICANT	No media attention

Table 2: Consequence (Environmental Perception)

Assessing likelihood. The second step in the hazard risk assessment process is to individually assess the likelihood of the consequences of an event occurring. There are five levels used in this step, as described in Table 3.

DESCRIPTION	FREQUENCY	PROBABILITY
Almost certain	Expected to occur more or less continuously throughout a year (e.g. more than 250 days per year)	95-100% chance of occurring
Likely	Expected to occur once or many times in a year (e.g. 1 to 250 days per year)	71-95% chance of occurring
Possible	Expected to occur once or more in the period of 1 to 10 years	31-70% chance of occurring
Unlikely	Expected to occur once or more in the period of 10 to 100 years	5-30% chance of occurring
Rare	Expected to occur once or more over a timeframe greater than 100 years	0-5% chance of occurring

Table 3: Likelihood

Assessing risk level. Risk = likelihood x consequence. Having determined the likelihood and consequence, Table 4 is used to determine the hazard risk grade (ie., Low, Moderate, High or Extreme).

This provides a uniform, single method of grading hazards against each other in order to determine a priority order for dealing with the risks identified and deciding what resources will be allocated to each hazard. It is important to note that these risk grades have no absolute value and so care may need to be applied for ranking purposes across different States.

	CONSEQUENCE RATING				
LIKELIHOOD	INSIGNIFICANT	MINOR	MODERATE	MAJOR	CATASTROPHIC
ALMOST CERTAIN	M	M	H	E	E
LIKELY	M	M	H	H	E
POSSIBLE	L	M	H	H	E
UNLIKELY	L	L	M	M	H
RARE	L	L	M	M	M

Table 4: Hazard Risk Grade