



**MARINE MAMMAL
PROTECTED AREAS
TASK FORCE**



**Working to Implement Conservation Actions in
Important Marine Mammal Areas (IMMAs)
in Pakistan - Karachi
14th – 20th February 2023**



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Cover photo by Erich Hoyt.

1. Executive summary

A team of three international marine conservation experts from the IUCN Marine Mammal Protected Areas Task Force (the “Task Force”) visited Pakistan in February 2023 to meet with authorities and stakeholders to promote and support the implementation of conservation and management for three Important Marine Mammal Area (IMMAs) within the northern Arabian Sea. IMMAs are discrete portions of habitat, important for one or more marine mammal species, which have the potential to be delineated and managed for conservation. This report describes the efforts conducted in Karachi, Pakistan to evaluate the current conditions of marine mammal populations living in the coastal and offshore waters of the country, and to discuss the opportunities for conservation offered by three IMMAs identified there: “Indus Estuary and Creeks IMMA”, “Miani Hor IMMA”, and “North East Arabian Sea IMMA”.

The IMMAs identified in Pakistan were proposed during the Western Indian Ocean and Arabian Seas IMMA expert workshop held in Salalah, Sultanate of Oman, on 4-8 March 2019. The Oman Workshop was the fourth of ten workshops organised to identify IMMAs in the world ocean, seven of which were supported through the GOBI-IKI initiative. The project includes an implementation component, whereby selected countries hosting IMMAs are visited by exponents of the Task Force to discuss the implications of the IMMA presence with local government and stakeholders and recommend management and conservation actions. Previous implementation trips had been conducted in Palau, the Andamans (India), and Mozambique.

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

The team noted how WWF Pakistan, under the counsel of Dr Moazzam Khan, was well placed, staffed and competent to lead and support the government in implementing management actions in the region conducive to the conservation of cetaceans in the IMMAs identified in Pakistan. Most relevantly, the level of cooperation of the WWF office with high-level government officials that we have observed during our visit shows promise that specific conservation actions benefiting cetacean species found in the Pakistani IMMAs can be included within broader national commitments, such as the obligation to meet the 30x30 target of CBD as part of the National Biodiversity Strategy and Action Plan (NBSAP), framed within the recently-adopted Kunming-Montréal Global Biodiversity Framework.

Recommendations from the IMMA team included: 1) to consider Pakistani IMMAs as sites for the establishment of Marine Protected Areas, 2) development of management plans for IMMAs including monitoring marine mammals, and 3) engagement of local communities on conservation and management. Concerning the more offshore North East Arabian Sea IMMA, regional cooperation for marine mammal conservation through the Arabian Sea Whale Network and Convention on Migratory Species with neighbouring governments was recommended as having the greatest importance for shared marine mammal resources.

2. Background

2.1. The IUCN SSC/WCPA Marine Mammal Protected Areas Task Force and Important Marine Mammal Areas (IMMAs)

The IUCN 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) throughout the world's oceans¹. IMMAs are discrete portions of habitat, important for one or more marine mammal species, that have the potential to be delineated and managed for conservation. IMMAs are an advisory, expert-based classification applied to the world's oceans, coastal waters and shorelines, and relevant inland water bodies and are a purely biocentric classification. To date, there have been 209 IMMAs identified in 67% of the world's oceans.

IMMAs are not marine protected areas (MPAs) and have no legal basis. They do, however, indicate potential sites where MPAs could be considered, and they will help support a marine spatial planning (MSP) process with a robust contribution from science.

Areas awarded IMMA status are globally significant and may thus merit area-based protection and/or monitoring for marine mammals.

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, offers support to the building of institutional capacity at the international and national levels to make substantial contributions to global marine conservation.

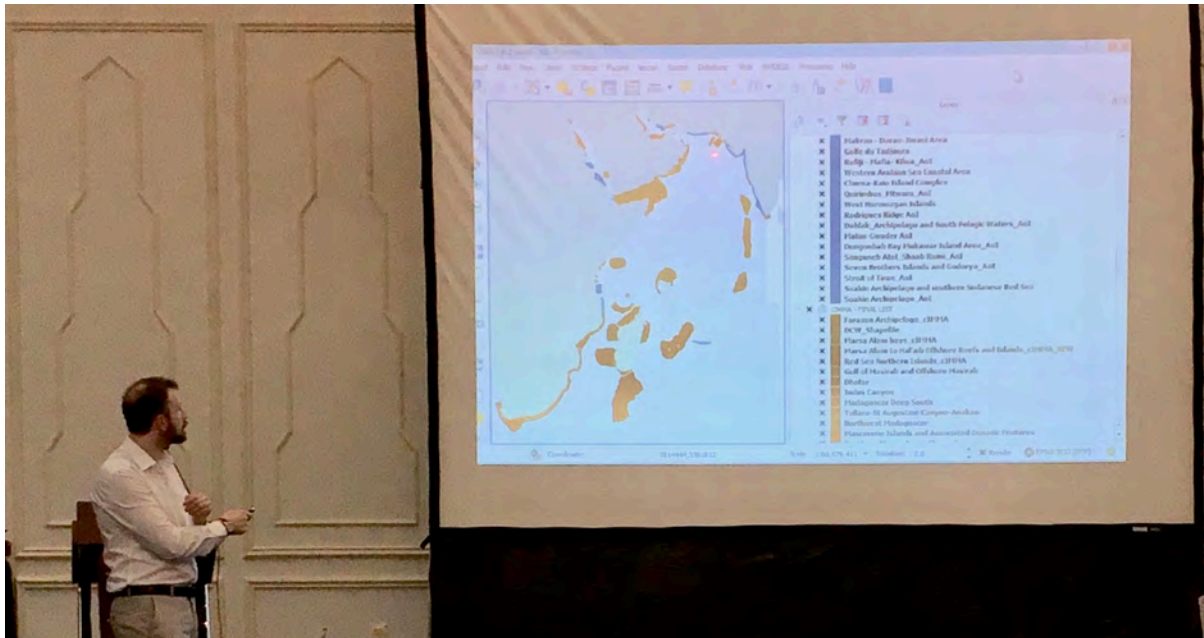


Figure 1. The candidate IMMAs and the Areas of Interest identified during the 2019 workshop on the identification of IMMAs in the Western Indian Ocean and Arabian Seas.

¹ <https://www.marinemammalhabitat.org>

IMMAs harness the fact that marine mammals are flagship and umbrella species, and effective indicators of pelagic biodiversity and the health of ecosystems. IMMAs support the Convention on Biological Diversity (CBD)'s 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 can 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), adopted Resolution 12.13, which 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 selection criterion 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 to assist decision makers and managers in expert-led prioritization of conservation efforts (Tetley et al. 2022).

2.2. Implementing Conservation Actions in Important Marine Mammal Areas identified in Pakistan

The Task Force focused on the Western Indian Ocean and Arabian Seas region (Figure 1) organising an expert workshop which took place in Salalah, Oman, in March 2019. The final report of the West Indian Ocean and Arabian Seas Workshop is available on the Task Force website². The Western Indian Ocean and Arabian Seas IMMA Workshop was the third of seven workshops organised to identify IMMAs in the Southern Hemisphere. Six of these workshops, being held between 2017 and 2022, are part of the framework of the GOBI/IKI Project funded by the International Climate Initiative of the German Federal Ministry for the environment, nature conservation, nuclear safety and consumer protection. 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, Aol identified in these regions.

In cooperation with Dr. Muhammad Moazzam Khan – Technical Advisor to WWF-Pakistan, the IMMAs located in the Pakistani coastal and offshore waters – Miani Hor IMMA, North East Arabian Sea IMMA, and Indus Estuary and Creeks IMMA (Fig. 2 – see Annex for details on each IMMA) – were selected by the Task Force for an in-depth examination with national and local stakeholders in order to facilitate the implementation of conservation actions at the national level.

Given that the Pakistani waters host endangered cetacean species (the Indian Ocean humpback dolphin *Sousa plumbea* and the Indo-Pacific finless porpoise *Neophocaena phocaenoides*) and populations (the Arabian Sea humpback whale *Megaptera novaeangliae*) (see section 2.3), an IMMA status provides the impetus to support a long-term conservation programme for the above taxa in the area, along with contributing to giving the region the recognition it deserves internationally. The process can create a niche for a more aware and knowledge-based development agenda in the future.

This report describes the efforts conducted in Pakistan, leading to a set of management recommendations developed during the team's visit to the area. The work includes:

² <https://www.marinemammalhabitat.org/download/final-report-workshop-nw-indian-ocean-arabian-seas-immas/>

- an analysis of the status of, and threats to marine mammals in the selected target 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).

This report includes a narrative of the visit, with details of the places visited and the meetings convened, providing input and discussion during the visit, followed by a set of management recommendations that could be a starting point to support the continuation of marine mammal conservation policies in Pakistan.

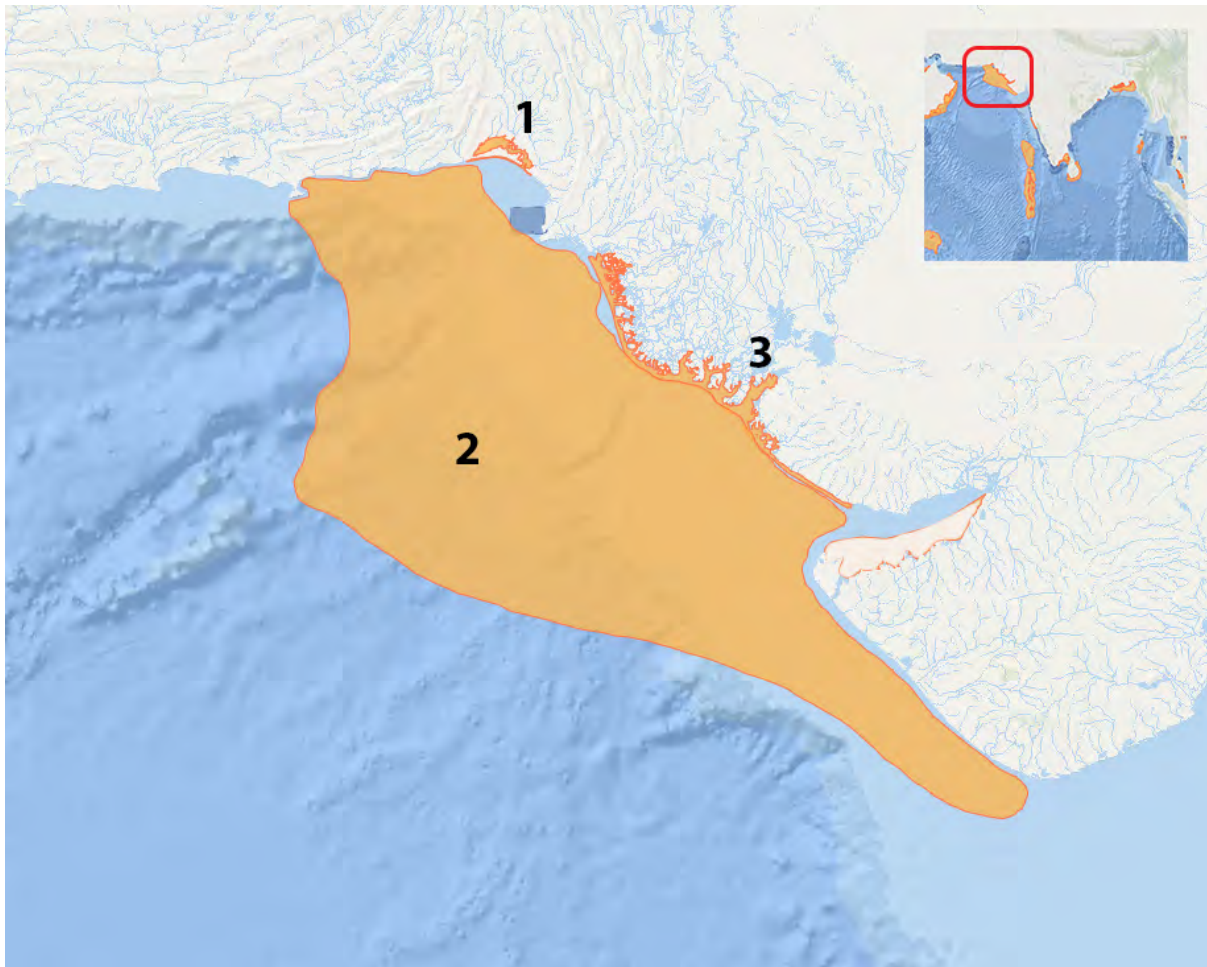


Figure 2. Important Marine Mammal Areas of Pakistan. 1. Miani Hor IMMA. 2. North East Arabian Sea IMMA. 3. Indus Estuary and Creeks IMMA (source: <https://marinemammalhabitat.org>).

2.3. Main marine mammal species found in the Pakistani Important Marine Mammal Areas and their surroundings

Indian Ocean humpback dolphin – *Sousa plumbea*. The Endangered Indian Ocean humpback dolphins are found in a narrow strip of shallow, coastal waters from False Bay, South Africa, in the west, through the coastal waters of South, East and North Africa, and the Middle East to approximately the southern tip of India and possibly further east. Distribution includes the Red Sea, the Arabian/Persian Gulf, the Arabian Sea, the Gulf of Aden, western Madagascar and several offshore islands including the Andamans, Mayotte, and Zanzibar. The level of knowledge about this species is greatest in South Africa, the Southwest Indian Ocean, Oman and the UAE. The species has a very narrow habitat niche and typically occurs less than 3 km from shore and/or in water less than 25 m deep, and populations are usually, but not exclusively, found in locations with extensive shallows such as protected bays and estuaries (Braulik et al. 2017). Suitable habitat for this species in Pakistani waters was recently described in detail by Kiani et al. (2022) and includes much of the coastal areas surrounding the Indus delta and extending into shallow waters of the Gulf of Kutch in neighbouring India.

Indo-Pacific finless porpoise – *Neophocaena phocaenoides*. The Vulnerable Indo-Pacific finless porpoises occur in a narrow strip of shallow (usually <50 m deep) coastal marine waters (as well as some river mouths and estuaries) around the northern rim of the Indian and western Pacific Oceans from the Persian/Arabian Gulf eastwards around the rim of the Indian Ocean to the Indo-Malay region and to Java, Indonesia (but apparently not the Philippines) and northwards to the Taiwan Strait and central Chinese waters. Finless porpoises were the second most frequently sighted species (after Humpback dolphins) during surveys of cetaceans along the Pakistan coast (Gore et al., 2012) Finless porpoises have been recorded in groups of between one and 18 individuals in near-shore waters of both Sindh and Balochistan Provinces, and they generally occur further offshore than humpback dolphins (Gore et al. 2012, Kiani et al., 2022).

Humpback whale, Arabian Sea subpopulation – *Megaptera novaeangliae*. The humpback whale as a species has experienced a spectacular rebound in population size since the cessation of commercial whaling (Cooke 2018), however, the Arabian Sea humpback whale subpopulation is an exception to this, and is considered Endangered on the IUCN Red List because it is geographically, demographically and genetically isolated, with a unique year-round residency in sub-tropical waters of the Arabian Sea. The original size of the subpopulation is unknown. However, the current abundance estimate off the coast of Oman, based on photo-identification, while potentially an underestimate, is 82 animals (95% CI 60-111) (Minton et al. 2008). The basis for an Endangered listing is that the subpopulation is geographically distinct and plausibly contains fewer than 250 mature individuals. Even if the Arabian Sea humpback whale population estimate were biased downward, it is highly unlikely that the total abundance would exceed 400 (Minton et al. 2008).

Several other cetacean species occur in Pakistani waters. In the coastal area, in addition to *S. plumbea* and *N. phocaenoides*, the Near Threatened Indo-Pacific bottlenose dolphin *Tursiops aduncus* is listed as a supporting species in both the Miani Hor IMMA and the Indus Estuary and Creeks IMMA. Further offshore in the North East Arabian Sea IMMA, together with Arabian Sea humpback whale *Megaptera novaeangliae*, the following species are included in the IMMA description as qualifying species

- blue whales *Balaenoptera musculus*,
- dwarf sperm whales *Kogia sima*
- pygmy sperm whales *Kogia breviceps*
- spinner dolphins *Stenella attenuata*

The following species are listed as supporting species in IMMAs and therefore occur less frequently or there is less information on their occurrence:

- sperm whales *Physeter macrocephalus*
- Bryde's whales *Balaenoptera edeni*

- rough-toothed dolphins *Steno bredanensis*
- striped dolphins *Stenella coeruleoalba*
- killer whales *Orcinus orca*
- Risso's dolphins *Grampus griseus*
- Longman's beaked whales *Indopacetus pacificus*
- Cuvier's beaked whales *Ziphius cavirostris*

2.4. Main threats to marine mammal conservation in the Pakistani Important Marine Mammal Areas.

Indian Ocean humpback dolphins

The habitat preference of humpback dolphins for shallow waters places them in some of the world's most intensively utilized, fished, shipped, modified and polluted waters. The primary threat to the Indian Ocean Humpback Dolphin throughout most, or all, of its range, is incidental mortality in fisheries ('bycatch'), including in gillnets throughout its range and in shark control nets in South Africa. Fishing effort is concentrated within the preferred near-shore habitat of humpback dolphin, although it is impossible to evaluate the magnitude in most areas, in all areas where it has been evaluated, the rate of incidental mortality of this species in fisheries appears to be high, unsustainable and causing rapid local population decline

There have been no on-board observer studies from which by-catch estimates could be generated. In Oman, the high incidence of stranded humpback dolphins was presumed to be the result of interactions with fisheries (Collins et al. 2002). Along the entire coastline of Pakistan, accidental entanglement in fishing nets, mostly gillnets, appears to be the principal threat to humpback dolphins (Kiani and Van Waerebeek 2015). The impact is most severe during peak fishing season, i.e., the northeast monsoon from November to February. From 2005 to 2009, humpback dolphins were one of the most commonly stranded cetacean species in Pakistan (24.5%, n=106) (Kiani, 2014). Entangled animals are used opportunistically for various purposes. Fishers in the Indus Delta and Balochistan coast use humpback dolphin oil for the treatment of rheumatism and also apply it on boats for waterproofing (Kiani and Van Waerebeek 2015). Overfishing and the use of destructive gear have resulted in the depletion of fish stocks especially in the mangrove areas and the Indus Delta along the Sindh coast resulting in habitat degradation and loss (Kiani and Van Waerebeek 2015).

There are very few areas within the known range of humpback dolphins where anthropogenic alteration of habitat has not occurred. The destruction of inshore habitats is likely to be one of the greatest threats to humpback dolphins. Dredging, land reclamation, construction blasting, port and harbour construction, pollution, boat traffic, oil and gas exploration and development (including inshore seismic surveys), and other coastal development activities occur, or are concentrated within, humpback dolphin habitat and threaten their survival in ways that are challenging to quantify (IWC 2002). The continued presence of humpback dolphins in highly degraded habitats does not rule out that habitat degradation has had adverse behavioural or health effects (IWC 2002, Piwetz et al. 2015). This is a pervasive threat that is increasing throughout the species range and there is no reason to expect this trend to change in the foreseeable future. In comparison to other marine mammals with wider and more oceanic distributional ranges, the exposure of *S. plumbea* to environmental contaminants and their bioaccumulation is likely to be very high. In Pakistan, industrial and domestic sewage pollution in coastal waters and tidal creeks is a major concern specifically around the populous and rapidly expanding industrial city of Karachi, on the northwestern most part of the delta (Kiani and Van Waerebeek 2015).

Finless Porpoises

Like other phocoenids (Jefferson and Curry 1994), finless porpoises are extremely susceptible to entanglement in gillnets, and large numbers have been, and continue to be, killed in many parts of their range (Jefferson et al. 2002b). Finless Porpoises are caught in nets in Iranian, Indian, Pakistani and

Malaysian coastal waters, although there are no good estimates of the magnitude of such catches (e.g., see Collins et al. 2005, Jaaman et al. 2009, Braulik et al. 2010).

As a coastal species, the Indo-Pacific Finless Porpoise is also affected by habitat loss and degradation, boat traffic, and pollution. The extensive modification of coastlines for shrimp farming, causeways, and harbour (and other) development throughout Asia (including the Persian/Arabian Gulf) means that there is less habitat for Finless Porpoises (Braulik et al. 2010). Although pathology related to contaminant exposure has not been reported in Finless Porpoises, pollution is considered a potentially serious threat. Beach surveys to document dead cetaceans along Pakistan's coast reported that finless porpoises were one of the most frequently stranded species in the country (Gore et al., 2017).

Arabian sea humpback whales

The Arabian Sea humpback whale population is small, and any human-induced mortality, especially of females, is a concern. The observer programme on fishing vessels in Pakistan run by WWF-Pakistan, reported 47 sightings of baleen whales in 2016, which included 12 confirmed sightings of Arabian Sea humpback whales (Moazzam and Nawaz, 2017).

Humpback whales are well-known to be susceptible to entanglement in fishing gear, and this is likely to be the greatest threat to whales in Pakistan. A total of nine humpback whale entanglements in fishing gear have been recorded off the coast of Oman. Eight of these animals were freed, and another was observed swimming but trailing gear (Minton et al. 2022). Analysis of scarring on the caudal peduncle region of photographically identified humpback whales in Oman indicates that between 30-40% are likely to have been involved in entanglements with fishing gear (Minton et al. 2022). Fishing effort off the coast of Oman and in other parts of the Arabian Sea is increasing (FAO 2007) and drifting and set gillnets as well as traps are already widely used (Stengel and Al Harthy 2002).

3. Team involved in the visit

IUCN Marine Mammal Protected Areas Task Force

- Mr Erich Hoyt - Co-chair, Research fellow, Whale and Dolphin Conservation
- Dr Giuseppe Notarbartolo di Sciara - Co-chair, Founder and Honorary President, Tethys Research Institute
- Dr Gill Braulik – Deputy Chair, Sea Mammal Research Unit, Scottish Oceans Institute, University of St.-Andrews

This report is the result of a collective effort of all the persons listed above.



Figure 5. The IMMA Team in the Karachi Pearl Continental Hotel just before the IMMA Stakeholder Meeting. Left: Gill Braulik, Centre: Erich Hoyt, Right: Giuseppe Notarbartolo di Sciarra.

4. Narrative of the visit and meetings

12th – 14th February 2023, Saturday to Tuesday

Gill Braulik arrives in Karachi to conduct planning meetings

Lodging at Karachi Marriott

Meeting with collaborators at WWF – Pakistan Office in Karachi: Dr. Muhammad Moazzam Khan, Technical Advisor, WWF-Pakistan, Mr. Ghazi Salahuddin, Senior Manager, WWF-Pakistan, Dr. Saba Ayub, Senior Conservation Officer, WWF-Pakistan, Ms Mona Zia, Senior Knowledge management Officer, Mr. Saeed ul Islam, WWF-Pakistan, Mr. Umair Shaid, WWF-Pakistan.

Meeting with collaborators at WWF – Pakistan in Lahore: Dr Uzma Khan, Asian Coordinator of the WWF River dolphins initiative, Ms Hamera Aisha, Conservation Manager, WWF-Pakistan

Planning meeting with Dr Shoaib Kiani, Karachi University

16th February 2023, Wednesday

Erich Hoyt and Giuseppe Notarbartolo di Sciarra arrive in Karachi and join Gill Braulik.

Lodging at Karachi Marriott

Meeting with collaborators at WWF – Pakistan Office in Karachi: Dr Muhammad Moazzam Khan, Technical Advisor, WWF-Pakistan, Mr. Ghazi Salahuddin, Senior Manager, WWF-Pakistan, Dr. Saba Ayub, Senior Conservation Officer, WWF-Pakistan, Ms Mona Zia, Senior Knowledge management Officer, Mr Saeed ul Islam, WWF-Pakistan, Mr Umair Shaid, WWF-Pakistan.

17th February 2023, Thursday

Morning:

Meeting with Mrs Shazia Naz, Director General, Marine Fisheries Department, Ministry of Maritime Affairs, at her office in the Fish Harbour, West Wharf, Karachi.

Meeting with Dr Ali Muhammad Mastoi, Director General Fisheries Sindh, at his office at the Poultry Research Institute, Bagh-e-Korangi, Karachi

Afternoon:

Meeting at the WWF-Pakistan Office, Karachi: Dr Muhammad Moazzam Khan and the following visitors:

- Mr Ghulam Qadir Shah, Inspector General (Forest), Ministry of Climate Change, Islamabad,
- Muhammad Anwar, Executive Director, CARD, Balochistan (Miani Hor Fishermen Representative),
- Mr Sharifuddin Baloch, Chief Conservator (Wildlife), Department of Forest and Wildlife, Government of Balochistan, Quetta,
- Mr Syed Zahoor Shah, Director (Fisheries), Department of Fisheries, Government of Balochistan, Quetta,
- Dr Shoaib Kiani, Assistant Professor, Institute of Marine Sciences, University of Karachi, Karachi,
- Dr Ansar Mahmud Chatta, Director General (Wildlife and Fisheries), Department of Wildlife and Fisheries (South Punjab), Government of Punjab, Multan,
- Mr Azeem Zafar, Director, Lahore Zoo, Department of Wildlife and Parks, Government of Punjab, Lahore,
- Dr Muhammad Abid, Director (Fisheries), Department of Fisheries (North Punjab), Government of Punjab, Lahore,
- Mr. Muhammad Ilyas, Director (Fisheries) Headquarter, Department of Fisheries, Government of Khyber Pakhtunkhwa, Peshawar,
- Mr Khan Malook Khan, District Forest Officer, Department of Wildlife, Government of Khyber Pakhtunkhwa, Peshawar
- Mr Mian Anjum Ali, Senior Conservation Officer, WWF-Pakistan, Karachi,
- Mr Farhan Ali, Research Associate, WWF-Pakistan, Karachi,
- Mr Jawad Khan, Manager (Marine), WWF-Pakistan, Karachi.

Evening

- Mr Fawad Soomro Mr Ahmed Shayan ENGRO Foundation

18th February 2023, Friday

Stakeholders Workshop, Pearl Continental Hotel, Karachi

Participants:

- Mr. Muhammad Moazzam Khan, Technical Advisor, WWF-Pakistan, Karachi
- Mr. Ghazi Salahuddin, Senior Manager and Director Sindh Balochistan, WWF-Pakistan, Karachi
- Dr. Uzma Khan, Asian Coordinator WWF River dolphins initiative, WWF-Pakistan, Lahore
- Mr. Saeed ul Islam, Coordinator, WWF-Pakistan, Karachi
- Dr. Saba Ayub, Senior Conservation Officer, WWF-Pakistan, Karachi
- Ms. Mona Zia, Senior Knowledge Management Officer, WWF-Pakistan, Karachi
- Dr. Stina Nyström, Principal Manager/Cetacean Expert, WWF-Sweden
- Mr. Nadeem Sheikh, Senior Mobilizer, WWF-Pakistan, Karachi
- Mr. Altaf Sheikh, Senior Manager, WWF-Pakistan, Lahore
- Mr. Mian Anjum Ali, Senior Conservation Officer, WWF-Pakistan, Karachi
- Mr. Farhan Ali, Research Associate, WWF-Pakistan, Karachi
- Mr. Moahid, Assistant Data Entry Officer, WWF-Pakistan, Karachi
- Mr. Ghulam Qadir Shah, Inspector General (Forest), Ministry of Climate Change, Islamabad
- Mr. Haseebur Rehman, Deputy Director, Marine Fisheries Department. Government of Pakistan

- C.der (Rtd.) Ali Abbas, Director, National Institute of Maritime Affairs, Bahria University, Karachi
- Dr. Asim Kareem, Director (Marine), Department of Fisheries and Coastal Development, Government of Sindh
- Dr. Mir Allahdad Talpur, Director General, Department of Fisheries (Inland) Government of Sindh
- Mr. Muhammad Anwar, Executive Director, CARD, Balochistan (Miani Hor Fishermen Representative)
- Mr. Azan Anwar, Member, CARD, Balochistan (Miani Hor Fishermen Representative)
- Mr. Sharifuddin Baloch, Chief Conservator (Wildlife), Department of Forest and Wildlife, Government of Balochistan, Quetta
- Mr. Syed Zahoor Shah, Director (Fisheries), Department of Fisheries, Government of Balochistan, Quetta
- Dr. Shoaib Kiani, Assistant Professor, Institute of Marine Sciences, University of Karachi, Karachi
- Dr. Ansar Mahmood Chatta, Director General (Wildlife and Fisheries), Department of Wildlife and Fisheries (South Punjab), Government of Punjab, Multan
- Mr. Azeem Zafar, Director (Zoo), Lahore Zoo, Department of Wildlife and Parks, Government of Punjab, Lahore
- Dr. Muhammad Abid, Director (Fisheries), Department of Fisheries (North Punjab), Government of Punjab, Lahore
- Mr. Muhammad Ilyas,, Director (Fisheries) Headquarter, Department of Fisheries, Government of Khyber Pakhtunkhwa, Peshawar
- Mr. Khan Malook Khan, Deputy Conservator/ District Forest Officer, Department of Wildlife, Government of Khyber Pakhtunkhwa, Peshawar
- Mr. Abdul Haleem Khan, Deputy Conservator (Wildlife)/ District Forest Officer, Khyber Division, Department of Wildlife, Government of Khyber Pakhtunkhwa, Peshawar
- Dr. Shenaz Rashid, Assistant Professor, Centre of Excellence in Marine Biology, University of Karachi, Karachi
- Dr. Amjad Ali, Assistant Professor, Centre of Excellence in Marine Biology, University of Karachi, Karachi
- Dr. Muhammad Aslam Buzdar, Dean (Marine Sciences), Lasbela University of Agriculture, Waters and Marine Sciences, Uthal, Balochistan
- Dr. Mohsin Ali Kalhoro, Assistant Professor/Director, Brackish Water Research Centre, Lasbela University of Agriculture, Waters and Marine Sciences, Uthal, Balochistan
- Dr. Karim Gabol, Associate Professor, Department of Zoology, University of Karachi
- Dr. Samina Kidwai, Director General, National Institute of Oceanography, Ministry of Science and Technology, Karachi
- Dr. Khalid Mahmood, Manager (Technical), Fisheries Development Board, Karachi

AGENDA OF THE STAKEHOLDERS WORKSHOP

Time	Event	Speaker
09:30-10:00	Registration	WWF-Pakistan Team
10:00-10:05	Recitation from Holy Quran	TBD
10:05-10:15	Welcome address	Ghazi Salahuddin, Director (Sindh and Balochistan, WWF-Pakistan)
10:15-10:40	An introduction to the IMMA programme, explaining what IMMAs are, how the concept was determined, and the vast reach of the IMMA network.	Dr. Giuseppe Notarbartolo di Sciara, IMMA Network

10:40-11:10	How IMMAs can be used as well as about the local IMMAs that exist and what the needs of them are in terms of monitoring and addressing threats and how they might be used to improve management	Dr. Erich Hoyt/Dr. Gill Braulik, IMMA Network
11:10-11:30	Existing management and conservation regime for marine mammals in Pakistan	Muhammad Moazzam Khan, Technical Advisor, WWF-Pakistan
11:30-11:45	Status of marine mammal in Pakistan-Species and populations	Muhammad Shoaib Kiani, Assistant Professor, Institute of Marine Sciences, University of Karachi
11:45-12:45	Open Discussions	Participants
12:45-12:55	Closing Remarks	Syed Ghulam Qadir Shah, Inspector General (Forest), Ministry of Climate Change, Government of Pakistan
12:55-13:05	Votes of Thanks	Saeedul Islam/Mona Zia, WWF-Pakistan
13:05-14:30	Lunch and Prayer Break	
14:45-14:50	Welcome address	Ghazi Salahuddin, Director (Sindh and Balochistan, WWF-Pakistan
14:50-15:20	Research and Conservation of the River Indus dolphin in Pakistan	Dr. Gill Braulik/Dr. Uzma Khan
15:20-15:35	Conservation and management of the River Indus dolphin in Khyber Pakhtunkhwa	Mr. Khan Malook Khan DFO-Wildlife /Mr. Muhammad Ilyas, Director Fisheries HQ
15:35-15:50	Conservation and management of the River Indus dolphin in Punjab	Mr. Mobeen Ilahi, Director General (Wildlife), Punjab/Dr. Sikandar Hayat, Director General, Fisheries-North, Punjab
15:50-16:05	Conservation and management of the River Indus dolphin in South Punjab	Dr. Ansar Mahmood Chatta, Director General, wildlife and Fisheries, South Punjab
16:05-16:20	Conservation and management of the River Indus dolphin in Sindh	Mr. Javed Mahar, Conservator (Wildlife), Sindh/Dr. Mir Allah Dada Talpur Director General, Inland Fisheries (Sindh)
16:20-16:35	Conservation and management of the River Indus dolphin in Balochistan	Mr. Sharifuddin Baloch, Chief Conservator (Wildlife) Balochistan/Mr. Saifullah Khaitran, Director General (Fisheries), Balochistan
16:35-17:25	Discussions	Participants
17:25-17:35	Concluding Remarks	Dr. Gill Braulik
17:35	Tea	



Figure 3. Some participants to the Stakeholders Workshop of 18 February 2023

Evening:

Meeting with Umair Shahid, WWF Mozambique

19th February 2023, Saturday

Field trip to visit the “Indus Estuary and Creeks IMMA” and connected with local communities

Having left the hotel in Karachi at 7:00 in the company of Mr. Saeed ul Islam and Dr. Saba Ayub, we travelled east along the highway to Thatta until we reached Charo where we stopped for breakfast at Café Imran. From there we resume travel to the south in the estuary zone until we reached the WWF site office in Garho. Here we crossed a wide area formerly occupied by mangrove forests which had been subsequently cut down, and could see the massive mangrove reforestation project undertaken by WWF-Pakistan since 2019. After a short stop at the WWF site office we continued to the Keti Bandar jetty where we boarded WWF’s speedboat for a 1.5 hour-long boat trip.

Aboard the speedboat we had the opportunity of visiting some of the creeks of the Indus (Hajamro, Turchan and Khobar) where we observed two (possibly three) small groups of Indian Ocean humpback dolphins, *Sousa plumbea*. The area was frequented by small local boats intent in capturing jellyfish to be traded in the Far East.

Having disembarked we were driven to the nearby fishing village Mero Dablo where we were met by a delegation of women and entertained by a gentleman whom we assume was the village head. Mr. Saeed ul Islam kindly interpreted the conversation. We then stopped for lunch in a nearby construction.

After lunch we were again driven to the site office in Garho and from there we reached Karachi around sunset.

20st February 2020, Sunday

Departure from Karachi

Having finished their task in Pakistan, the international team departed from Karachi on the 20th February.



Figure 4. Itinerary of the field trip to Kati Bandar, inside the “Indus River Estuary and Creeks IMMA”. The yellow contour is the IMMA boundary. The blue track shows the boat excursion.



Figure 5. Images from the field trip.

5. Concluding considerations

The first overall take-home message was that WWF Pakistan, under the counsel of Dr Muhamad Moazzam Khan, is well placed, staffed and competent to lead on implementing management actions in the region conducive to the conservation of cetaceans in the IMMAs identified in Pakistan. In particular, we were impressed by the ability of WWF Pakistan to raise awareness, mobilise and involve the most relevant government institutions at all levels, from national to regional and local as well as building strong links with local grassroots organisations and communities

Most relevantly, the level of cooperation of the WWF office with high-level government officials that we have observed during our visit shows promise that specific conservation actions benefiting cetacean species found in the Pakistani IMMAs can be included within broader national commitments. More explicitly, we noted the availability of some workshop participants – in particular by Mr Ghulam Qadir Shah, Inspector General of Forests of the Government of Pakistan – to consider that conferring formal protection to all or part of the IMMAs could help Pakistan achieve its obligation to meet the 30x30 target of CBD as part of the National Biodiversity Strategy and Action Plan (NBSAP), framed within the recently-adopted Kunming-Montréal Global Biodiversity Framework. It is important to note that the NBSAP is in the process of being updated following the December CBD meeting and the targets for MPAs going to 30% by 2030. We did find a strong interest in going forward toward greater protection for marine mammals.

The strong commitment expressed by Mr Qadir Shah, Dr Moazzam Khan and others working in administration in the Sindh and Balochistan provinces were positive signs that things can move ahead in the right direction. The discussions around the existing MPA, Astola Island, which is in the process of receiving management protection, and the success of the community work to protect the Miani Hor coastal lagoon ecosystem were very positive and might provide excellent models for other parts of the Pakistani coastal zone. Workshop participants admitted that the percentage of marine surface currently protected is too low and that the ideas discussed regarding establishing new protected areas in and around some of the IMMAs would significantly help Pakistan to meet international commitments.

Presentations from some of the local researchers demonstrate that locally led research capabilities exist and that high-quality outputs are feasible. However, funding limitations restrict the ability of students to engage in marine mammal work, and security constraints can also limit fieldwork activities. There is support for researchers through the Arabian Sea Whale Network, CMS, IOTC and IWC all of which offer local researchers opportunities to expand their knowledge, gain from collaborations with colleagues in nearby countries, and present their work. However, the coastline of Pakistan is long, and the number of researchers is small, and as a result some of the fundamental baseline data that would inform management, such as routine cetacean monitoring, is lacking.

Whilst the discussions held at the workshop with officials from the wildlife departments, NGOs and research institutions were characterised by an upbeat and proactive attitude, we thought that other meetings with fishery officials were not as useful except for the contacts made that might come helpful in the future. Mrs Shazia Naz, Director General of the Marine Fisheries Department at the Ministry of Maritime Affairs and responsible for the management of offshore fisheries at the federal level, was new in office and could not commit to concrete initiatives except for what concerns the mitigation of cetacean bycatch in offshore gillnets by lowering the nets by 2 metres below the surface (cfr. Kiszka et al. 2021). The meeting with Dr Ali Muhammad Mastoi, Director General of Fisheries in the Provincial Government of Sindh, was also mostly a formality and an opportunity for us to inform about the existence and purpose of the IMMAs. The main take-home message from the meetings with fisheries officials was that conservation efforts were going to need to work on a more senior level within the environmental protection sector to make inroads with departments that have a primary focus that is not environmental protection

Our main recommendations included the following:

- All, or part, of the three IMMAs in Pakistan, should be considered as carefully managed Marine Protected Areas. This would help Pakistan achieve its commitment to meet the 30x30 target of CBD as part of the National Biodiversity Strategy and Action Plan (NBSAP).
- Miani Hor IMMA and the Indus Estuary and Creeks IMMA, which are both coastal, would benefit from measures that will reduce the entanglement of small cetaceans in coastal gillnets.

- The provision of government funding to develop a management plan for each IMMA that includes the regular monitoring of marine mammal distribution and abundance, as well as systematic monitoring and reporting on mortalities, and a strategy to engage communities and lower threats is a priority for each IMMA and should utilise the local Pakistan scientific marine mammal expertise.
- Concerning the more offshore North East Arabian Sea IMMA, regional cooperation for marine mammal conservation through the Arabian Sea Whale Network and Convention on Migratory Species with neighbouring governments is of the greatest importance for shared marine mammal resources.

6. Acknowledgments

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8. Acronyms

Aoi	Area(s) of Interest
CBD	Convention on Biological Diversity
cIMMA	Candidate Important Marine Mammal Area
CMS	Convention on Migratory Species
EBSA	Ecologically or Biologically Significant marine Area
GOBI-IKI	Global Ocean Biodiversity Initiative's project supported by the International Climate Initiative
IBA	Important Bird and Biodiversity Area
ICMMPA	International Conference on Marine Mammal Protected Areas
IMMA	Important Marine Mammal Area
IMO	International Maritime Organisation
IOTC	Indian Ocean Tuna Commission
IUCN	International Union for Conservation of Nature
IWC	International Whaling Commission
KBA	Key Biodiversity Area
MMPA	marine mammal protected area
MMPATF	Marine Mammal Protected Areas Task Force
MoU	Memorandum of Understanding
MPA	Marine Protected Area
MSP	Marine Spatial Planning
NBSAP	National Biodiversity Strategy and Action Plan
PSSA	Particularly Sensitive Sea Area
SSC	Species Survival Commission (an IUCN body)
WCPA	World Commission on Protected Areas (an IUCN body)

9. Appendix – IMMAs in Pakistani marine waters

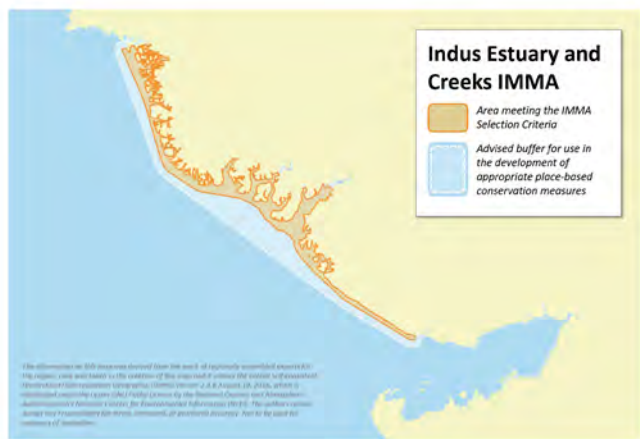
Indus Estuary and Creeks IMMA

Summary (continued)

reports or stranding records. Both species are threatened by accidental entanglements in fishing gear, risk of vessel strikes, habitat degradation, and ambient underwater noise and pollution.

Description

The Indus River is the largest river that discharges into the Arabian Sea. The Indus River Delta covers an area of about 41,440 km² and is one of the most globally important coastal environments in Pakistan (Ahmad, 1998). It was declared a Ramsar site on 5 November 2002, due to its biological diversity and for being the largest stand of mangroves along the Pakistan coast (Ahmad, 1998; Siddiqui *et al.*, 2008). The estuarine creeks and mangrove forests form major nursery grounds for many species of fish and shrimps (Shah *et al.*, 2007). The delta is rich in micro-invertebrates, shrimps, fin-fishes, reptiles, birds and mammals. This area has unique ecological and biological significance because of its variety of habitats and ecosystems including mudflats, shallow to deep creeks, freshwater bodies and sandbars facing open seas. The lower reaches of the Indus River estuary have mangroves consisting of one species, *Avicennia marina*, and is considered the largest arid area mangrove forest in the world. A similar habitat extends beyond the Pakistan border to Mandvi harbor along Indian coast. There are small mangrove patches and associated creeks between Sir Creek and Jakhau whereas between Jakhau and Mandvi harbour the area is mainly sandy shores interspersed with mangrove creeks. The area is known to be inhabited by two cetaceans — the Indian Ocean humpback dolphin (*Sousa plumbea*) and finless porpoise (*Neophocaena phocaenoides*). Both of these species are legally protected in both India and Pakistan; furthermore, the humpback dolphin is Endangered (EN) and finless porpoise is Vulnerable (VU) on the Red List. *Sousa plumbea* is mainly found in coastal waters and in the creeks, but *Neophocaena phocaenoides* is found mainly at the



Area Size

2,686 km²

Qualifying Species and Criteria

Indian Ocean humpback dolphin – *Sousa plumbea*
Criteria A, B1

Indo-Pacific finless porpoise –
Neophocaena phocaenoides
Criteria A, B1

Marine Mammal Diversity

Neophocaena phocaenoides, *Sousa plumbea*,
Tursiops aduncus

Summary

The Indus Estuary and Creeks IMMA comprises an elaborate system of creeks through which the 3,000km-long Indus river disperses and discharges into the Arabian Sea. The lower reaches of these creeks form mangrove channels that extend beyond Pakistan's border to the Mandvi harbour on the Indian coast. The area is inhabited by Endangered Indian Ocean humpback dolphins (*Sousa plumbea*) as well as Vulnerable Indo-Pacific finless porpoises (*Neophocaena phocaenoides*). Surveys conducted between 2005 and 2009 indicate that humpback dolphins are found in the upper, middle and lower sections of creeks in Pakistan, as well as along creek mouths extending to Jhakau and Mandvi Harbour, India. There is evidence that humpback dolphins are feeding and calving in the area. Information about finless porpoises in area is limited to opportunistic

entrance of the creek system and seldom ventures upstream (Gore *et al.*, 2012; Kiani, 2014 ; Kiani and van Waerebeek, 2015; Pilleri and Pilleri, 1979; Ross *et al.*, 1994). Between November 2005 and May 2009, a total of 46 small-boat survey day trips were carried out in various major creeks and smaller interconnecting channels of the Indus Delta. Most of the effort was concentrated during the northeast monsoon (November–February) and the spring inter-monsoonal period (March–May), due to favorable sea conditions. Humpback dolphins and finless porpoise were found in the upper, middle and lower sections of creeks, as well as in nearshore waters contiguous to the creek mouths, extending to Jhakau and further south to Mandvi Harbour (Sutaria *et al.* 2015, Kukadia *et al.* 2016, Sule *et al.* 2017; Marine Mammal Conservation and Research Network of India; Fig. 1).

Besides *S. plumbea*, and *N. phocaenoides*, Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) are also found in inshore waters, yet have never been observed inside the Indus Delta creeks (Ahmad, 1998; Shah *et al.*, 2007; Siddiqui *et al.*, 2008).

Criterion A: Species or Population Vulnerability

The Indian Ocean humpback dolphin (*Sousa plumbea*) is endangered (EN) and the Indo-Pacific finless porpoise (*Neophocaena phocaenoides*) is vulnerable (VU) on the IUCN Red List. Both are obligate nearshore cetaceans, ecologically constrained to a narrow coastal strip, and therefore these species are facing severe threats to their conservation in the Indus estuary and creeks, due to negative impacts from accelerated coastal development and associated human pressure. Known and suspected threats include accidental entanglements in fishing gear, habitat degradation, pollution, probable competition for food due to widespread use of non-selective fishing gears (such as gillnets) and increasing vessel traffic with associated noise pollution and risk of boat strikes (Iqbal, 2014; Kiani, 2014). Coastal areas in close proximity to industries, port installations (e.g. Port Qasim, Mandvi harbour) and major human settlements are of highest concern. Both species, however, are legally protected in both India and

Pakistan. Along the entire Indus estuary, creeks to Mandvi harbour, entanglement in fishing nets appears to be the principal threat to the two species of cetaceans. The impact is most severe during the peak fishing season, i.e., the northeast monsoon (from November to February). Fisheries in the area are generally open access, which resulted in overcapacity of the fishing fleet. Use of gillnets of different types is very common in coastal, as well as offshore waters, with high risk for cetacean entanglements. Industrial and domestic sewage pollution in coastal waters and tidal creeks is a major concern specifically around the populous and rapidly expanding industrial city of Karachi, on the northwestern-most part of the delta, as well as industrial activities in Jahku and Mandvi Harbour area. In the south-eastern region, major pollution sources include pesticides like organochlorines and domestic water flushed into the Indus River from inland areas and from other population centres (Kiani and van Waerebeek, 2015). Loss of habitat (mangrove forest) due to land reclamation for development projects, deforestation and camel grazing are considered important threats to both cetacean species. Mangrove deforestation results in the destruction of vital nursery grounds for small fish, and perhaps other neritic species, that are prey to both cetaceans occurring in the area (Kiani, 2014).

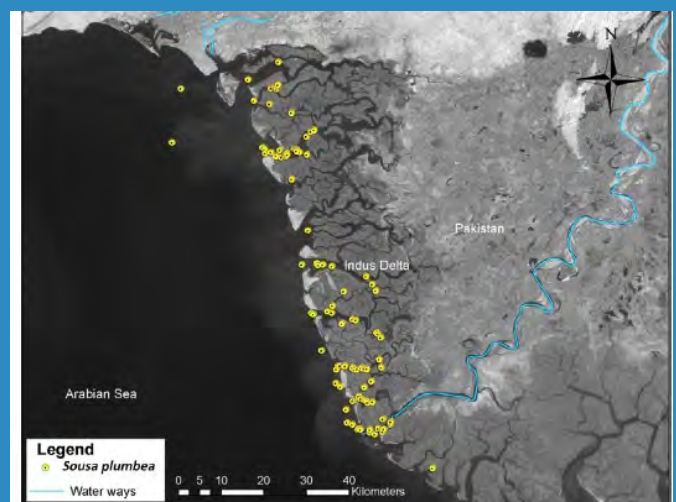


Figure 1. Distribution of all on-effort sightings of Indian Ocean humpback dolphins, *Sousa plumbea*, in the Indus Delta creek system, southeast Pakistan, from November 2005 to May 2009. The Indus River is outlined (long blue line). From Kiani and Van Waerebeek, 2015.

Criterion B: Distribution and Abundance

Sub-criterion B1: Small and Resident Populations

Humpback dolphins and finless porpoises are regularly observed in the Indus estuarine area and associated creeks; large-scale anthropomorphic activity has the potential to significantly alter the long-term survival of both species. In the Indus River Delta, group sizes varied considerably from 1 to 35 animals (Kiani, 2014) whereas 27.6% typically consisted of large solitary animals, probably mostly adult males. Overall, groups of 1–10 animals made up 91% of total sightings. Generally, in the bigger groups, some subgroups stayed close to each other and merged occasionally while chasing prey and feeding. Group composition of Indo-Pacific finless porpoise in the Indus estuary and creeks was highly variable, consisting of only adults, only juveniles, mixed adults and juveniles, mother and calf pairs, and undetermined.



Figure 2: The dorsal fin of an Indian Ocean humpback dolphin (*Sousa plumbea*) breaking the surface. Photo: Moazzam Khan

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MARINE MAMMAL PROTECTED AREAS TASK FORCE

IMMA

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based on a decision of the German Bundestag

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Miani Hor IMMA

Description

Miani Hor, a lagoon located along the Balochistan coast of Pakistan (northern Arabian Sea), is 60 km long and 4 to 5 km wide. Two ephemeral rivers, Porali and Windor, enter the bay in the centre and near its mouth respectively. Most of the lagoon is surrounded by sand dunes. The lagoon has deep water (25-30 m) as well as vast mudflats. Three species of mangroves, *Avicennia marina*, *Rhizophora mucronata* and *Ceriops tagal*, occur naturally in this lagoon. Important fisheries of the lagoon include shrimp, finfish and jellyfish, and these are managed by coastal communities. A resident population of Indian Ocean humpback dolphin (*Sousa plumbea*; Figs. 1 and 3) exists in the lagoon (Gore *et al.*, 2012; Kiani, 2014; Kiani and Van Waerebeek, 1995; Siddiqui, *et al.*, 2008). Miani Hor was declared a Ramsar Site in 2001 due to its biological diversity.

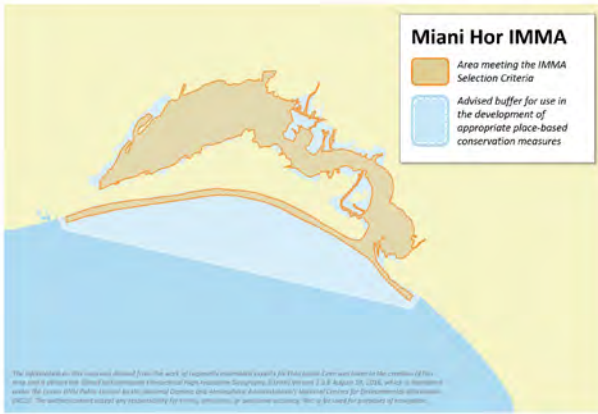
During the last 5 years, dolphin-watching tourism started in Miani Hor and is considered an alternate source of livelihood for coastal communities, yet it is still poorly organized and regulated.

Criterion A: Species or Population Vulnerability

The IUCN status of the two cetacean species in the area is considered threatened, with the Indian Ocean humpback dolphin being classed as Endangered (EN) and Indo-Pacific finless porpoise



Figure 1: Indian Ocean humpback dolphins observed in Miani Hor lagoon. Photo: Moazzam Khan.



Area Size

402 km²

Qualifying Species and Criteria

Indian Ocean humpback dolphin – *Sousa plumbea*

Criterion A, B1

Indo-Pacific finless porpoise –

Neophocaena phocaenoides

Criterion A

Marine Mammal Diversity

Sousa plumbea, *Tursiops aduncus*, *Neophocaena phocaenoides*

Summary

Miani Hor is a coastal lagoon on the Balochistan coast of Pakistan in the northern Arabian Sea. This lagoon includes deep (25-30 m) channels near the lagoon's entrance to the sea as well as vast mudflats and mangrove forests. The lagoon hosts a resident population of Endangered Indian Ocean humpback dolphins (*Sousa plumbea*). A survey carried out in 2012 estimated the population to number between 60 and 80 individuals. Vulnerable Indo-Pacific finless porpoises (*Neophocaena phocaenoides*) are also occasionally seen in Miani Hor, but further research is required to understand their population status and whether or not they are resident in the lagoon. Both species are affected by the threats of fisheries bycatch and habitat degradation through mangrove cutting, pollutants, and increased vessel traffic among other impacts.



Figure 2: Distribution of Indian Ocean humpback dolphin, *Sousa plumbea*, sightings made during nine boat surveys in Miani Hor lagoon, July 2011 and June 2012. From: Kiani and van Waerebeek, 1995

assessed as Vulnerable (VU). The population is threatened mainly because of anthropogenic activity, including entanglements in gillnets, degradation of habitat (mangrove denudation) and infrastructure development (construction of harbours). A few strandings of dolphins were noticed in the lagoon during the studies carried out during July 2011 to June 2012 and in almost all cases these dolphins died due to entanglement in gillnets. There are no major human population centres around the lagoon and fishermen of three nearby settlements consider the dolphins and porpoises as sacred animals; therefore, there are no recent records of any deliberate killing of a dolphin. In previous decades, fishermen used to kill about two to three dolphins annually for extracting their fats, which was believed locally to have some medicinal properties. However, this practice is no longer performed in these areas.

Criterion B: Distribution and Abundance

Sub-criterion B1: Small and Resident Populations

Miani Hor is known for having a small resident population of humpback dolphins. A single event that could significantly alter the long-term survival of the population. A total of 36 Indian Ocean humpback dolphin (*Sousa plumbea*) sightings were recorded in waters 3–13 m deep at Miani Hor during nine survey days from July 2011 to June 2012 as conducted by the SDO (Fig. 2). The mean group size was 11.89 to 13.59 animals and the largest group, estimated at 68 animals, was encountered in 6 m deep water on 12 November 2010. More recently a survey carried out by a community-based organization revealed that the total number of dolphins in the area is only between 60 and 80.

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Figure 3: Mother and calf Indian Ocean humpback dolphins (*Sousa plumbea*), observed in Miani Hor lagoon. From: SDO, 2012.

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North East Arabian Sea IMMA

Summary

The North East Arabian Sea IMMA includes the coastal and offshore waters from Ormara (Pakistan) to Kutch-Saurashtra (India). This area is known for the diversity of marine mammals, including Arabian Sea humpback whales (*Megaptera novaeangliae*), blue whales (*Balaenoptera musculus*) and Bryde's whales (*Balaenoptera edeni*). Arabian Sea humpback whales form a small, isolated subpopulation that is genetically distinct from other populations of humpback whales and remains in the Arabian Sea year-round. Illegal Soviet whaling in the 1960s, much of it concentrated in this IMMA, is thought to have greatly reduced this whale population, which is designated as Endangered on the IUCN Red List. Systematically reported observations by fishermen in Pakistan and India indicate that the area is still used by humpback whales today. In addition, large schools of spinner dolphins (*Stenella longirostris*) and Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) are frequently observed in the area.

Description

The North East Arabian Sea Important Marine Mammal Area is located in the northeastern part of the Arabian Sea from Ormara along the Balochistan (Pakistan coast) and extending to Kutch-Saurashtra coasts of India. The northern part of the IMMA lies along the drylands of the Balochistan coast, which is known for its headlands and bays. The rocky headland of the areas off Malan, Kund Malir, and Ormara have a prominent tombolo bay on both sides. It has a small island (Churna Island) which is known to be rich in coral and invertebrate diversity. The transboundary waters of Pakistan and India, where the river Indus empties its sediment load every monsoon, are highly productive and important fishing grounds. The Indus plume reaches across the coastal and offshore waters of Balochistan in Pakistan and Kutch-Saurashtra coasts of India. The area hosts several commercially important fisheries, with a large



Area Size

147,200 km²

Qualifying Species and Criteria

Humpback whale – *Megaptera novaeangliae*
Criterion C1

Blue whale – *Balaenoptera musculus*
Criteria A, B2, C2

Dwarf sperm whale – *Kogia sima*
Criterion B2

Pygmy sperm whale – *Kogia breviceps*
Criterion B2

Indo-Pacific bottlenose dolphin – *Tursiops aduncus*
Criterion B2

Spinner dolphin – *Stenella longirostris*
Criterion B2

Marine Mammal Diversity (D2)

Megaptera novaeangliae, *Balaenoptera musculus*, *Sousa plumbea*, *Physeter macrocephalus*, *Kogia sima*, *Kogia breviceps*, *Balaenoptera edeni*, *Tursiops aduncus*, *Stenella longirostris*, *Stenella attenuata*, *Steno bredanensis*, *Stenella coeruleoalba*, *Orcinus orca*, *Indopacetus pacificus*, *Ziphius cavirostris*, *Grampus griseus*

fleet of Indian and Pakistani fishing vessels, along the entire stretch of the IMMA.

The area also includes the Indus Canyon (also known as the Swatch), which is a fissure in the continental shelf of Pakistan facing the Indus River delta. It includes a continental shelf and slope area of the northern Arabian Sea and has a maximum depth of 1800 m. Because of its physiographic and oceanographic features, the Indus Canyon is known for its biological productivity and diverse marine fauna. The Murray Ridge, located in the northern Arabian Sea, forms the extension of the Owen Fracture Zone and comprises part of the boundary between the Indian and Arabian plates. The area where the Owen Fracture Zone changes direction to an easterly trend marks the southern end of the Murray Ridge. The northern end of the Murray Ridge, the Indian-Arabian plate boundary, terminates at a triple junction near Karachi. The Murray Ridge has a maximum relief of about 2500 m in the middle part and a relief as large as 3500 m in its southern part. The depth range is between 650 m to 3,500 m making it an ideal habitat for deep sea dwelling cetacean species.

The most significant feature of the IMMA is the high diversity of cetacean fauna. This area is specifically important for large whales-including Arabian Sea humpback whales (which are genetically distinct from other populations of humpback whales), blue whales and Bryde's whales. While no systematic surveys have been carried out here, it is known from whaling data that Soviet factory ships took 164 humpback whales in this area in November 1966 (Mikhalev 1997).

Criterion A: Species or Population Vulnerability

The blue whale has been assessed as an Endangered (EN) species on the IUCN Red List while the Arabian Sea humpback whale sub-population is considered Endangered. Arabian Sea humpback whales are present throughout the year and are seen more commonly in the area during post-winter months, making them prone to entanglement in gillnets which are used in the area throughout the year (Moazzam and Nawaz, 2018).

Criterion B: Distribution and Abundance Sub-Criterion B2: Aggregations

Presence of large whales, including Arabian Sea humpback whales (*Megaptera novaeangliae*) and blue whales (*Balaenoptera musculus*) have been documented through crew-based observer programme of WWF-Pakistan. Records of 42 sightings of Arabian Sea humpback whales and 13 sightings of blue whales (Moazzam and Nawaz, 2018) were reported. In addition, in 2018 a total of 13 new sightings of Arabian Sea humpback whales and 2 sightings of blue whales were made in the same area (Moazzam and Nawaz, 2019). In India, through the work of a participatory sightings network, aggregations of Arabian Sea humpback whales were mainly sighted on the continental shelf and slope area along the coasts of Jakhau and Veraval (Sutaria et al 2017, Sutaria 2018).



Figure 1: Distribution of *Kogia* spp. along the Murray ridge area (Moazzam and Sutaria, unpublished data).

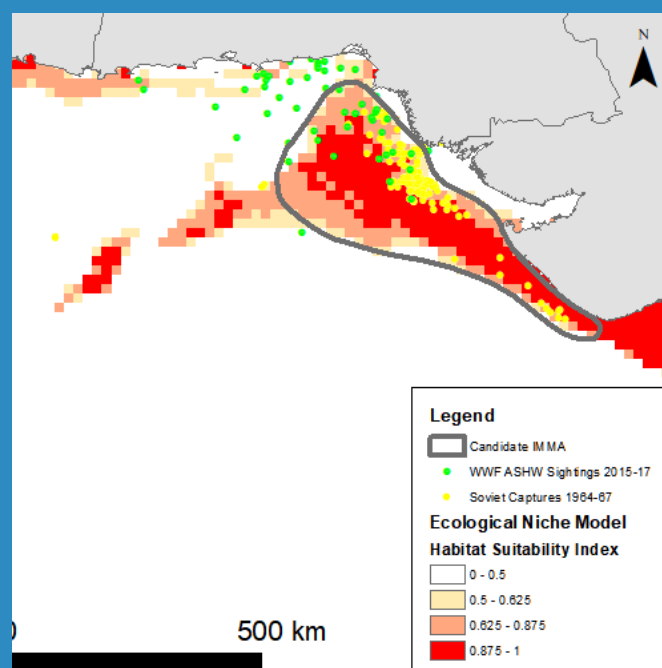


Figure 2: Habitat suitability niche model for Arabian Sea humpback whales. Yellow dots represent Pakistani sightings from fisheries reports between 2015 and 2017. Green dots represent a subset of Soviet catch records between 1964 and 1967.

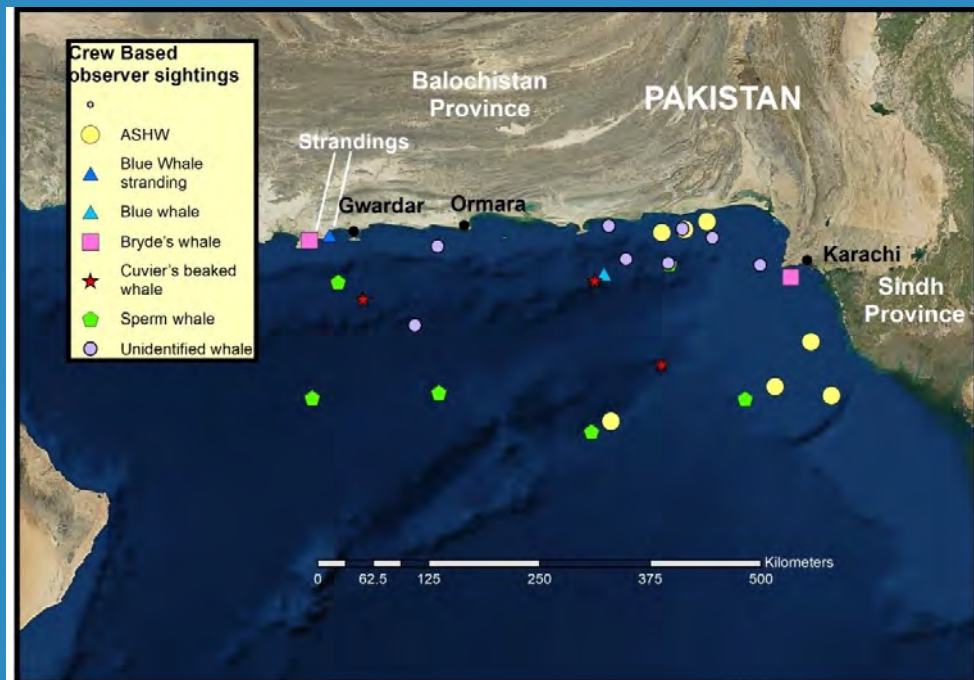


Figure 3: Cetacean sightings in the northern Arabian Sea along the Coast of Pakistan in 2019 based on the information obtained through the Fisheries Crew-Based observer programme. (From: Moazzam et al., 2020).

Large schools of dolphins are frequently observed in the area including pods of spinner dolphin (*Stenella longirostris*) and Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) recorded over shelf and up-sloping bathymetry (M. Khan, unpublished data; Gore et al., 2012; Iqbal, 2014; Kiani, 2014; Kiani and Waerebeek, 2015). Entanglements of dwarf sperm whale and pygmy sperm whale have also been reported, with the main aggregation of such events occurring on shelf/slope boundary waters.

Criterion C: Key Life Cycle Activities Sub-Criterion C2: Feeding Areas

Moazzam and Nawaz (2017; 2018) reported feeding of Arabian humpback and blue whales on planktonic shrimp and sardinillas in the coastal waters in the IMMA. These whales were hunted by the Russian fleets in 1966, who also observed similar foraging in the area. Fishermen today further describe foraging behaviour in aggregations of more than 10 whales in these waters (Khan, M., Unpublished; Sutaria, D., unpublished). The area is also known for dense concentrations of purpleback flying squids (*Sthenoteuthis oualaniensis*). This large squid lives in open waters from the surface of the ocean down to depths of around 1,000 m. It exhibits diurnal vertical migration and moves to deeper layers in the day and to surface or shallower waters during night.

Japanese Research vessel "R/V Shoyo Maru" located dense concentration of this squid in the area during surveys in 1975 (Yatsu, et al., 1998). Presence of sperm whale, pygmy sperm and dwarf sperm whales in the area may be attributed to their feeding on *Sthenoteuthis oualaniensis*.

Criterion D: Special Attributes Sub-criterion D2: Diversity

This IMMA is specifically known for populations of large whales, including Arabian Sea humpback whale (*Megaptera novaeangliae*), blue whales (*Balaenoptera musculus*) and Bryde's whale (*Balaenoptera edeni*). Large school of dolphins can also be frequently located in the area, and individuals or small groups of Indian Ocean humpback dolphin (*Sousa plumbea*) and Indo-Pacific finless porpoise (*Neophocaena phocaenoides*) are also commonly observed. Pods of spinner dolphin (*Stenella longirostris*) and Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) are frequently reported from the area, and rough-toothed dolphin (*Steno bredanensis*) and striped dolphin (*Stenella coeruleoalba*) reports are from offshore of the Indus Delta. There are also rare occurrences of Cuvier's beaked whale (*Ziphius cavirostris*), Risso's dolphin (*Grampus griseus*), and killer whale (*Orcinus orca*). A few entanglements of dwarf sperm whale (*Kogia sima*) and pygmy sperm whale (*K. breviceps*) have

also been reported (Gore et al., 2012; Iqbal, 2014; Kiani, 2014; Kiani and Waerebeek, 2015; Moazzam and Nawaz, 2018; Moazzam and Nawaz, 2019).

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