Area Size

40 112 km²

Qualifying Species and Criteria

Irrawaddy dolphin – *Orcaella brevirostris*

Criterion A; B (2); C (1)

Indo-Pacific finless porpoise – *Neophocaena phocaenoides*

Criterion A; B (2); C (1)

Indo-Pacific humpback dolphin – *Sousa chinensis*

Criterion A; B (2); C (1); D (1)

Marine Mammal Diversity

Balaenoptera edeni, Neophocaena phocaenoides Orcaella brevirostris, Sousa chinensis, Tursiops aduncus

Summary

The IMMA in coastal waters of the northern Bay of Bengal is located at the outflow of world's third largest river system, fed by biological production in the world's largest mangrove forest, and includes a seasonally reversing current gyre with associated eddies. These oceanographic conditions combine to support threatened cetaceans in numbers generally much higher than in other coastal waters where the same species occur in the Indo-Pacific. Threatened species present in globally significant
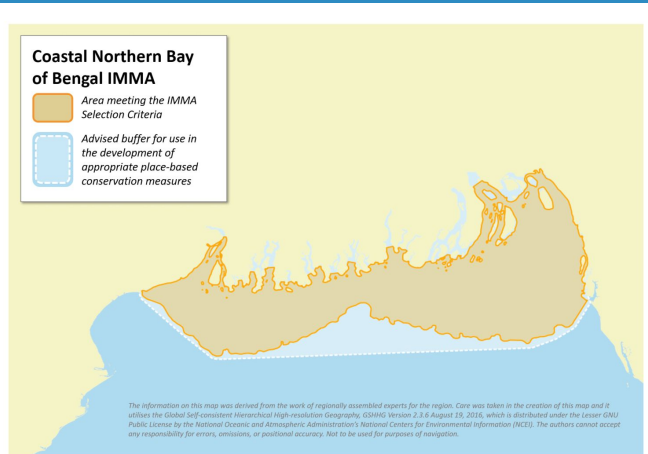
Coastal Northern Bay of Bengal IMMA

Summary, continued.

numbers include Endangered Irrawaddy dolphins and Vulnerable Indo-Pacific humpback dolphins and finless porpoises. Recent genetic studies indicate that humpback dolphins inhabiting the IMMA are genetically distinct from neighbouring populations to the east and west.

Description

The northern Bay of Bengal is influenced by discharge from the world's third-largest river system – the Ganges/Brahmaputra/Meghna (GBM). The GBM supplies 1.5% of the total riverine input to the world's oceans (Sarin et al., 1989) with freshwater, sediments and nutrients circulated by a seasonally reversing, basin-scale gyre with adjacent mesoscale eddies. These oceanographic conditions combine to produce a highly stratified and productive sea-surface layer in shallow coastal waters with depths less than 10 m covering about 24,000 km² (Kabir et al., 2004). Coriolis forces produce tidal amplitudes of up to 6m with associated currents of up to 3.8 m/s (Kottke et al., 2003). Relatively light northeast winds drive clockwise currents in the winter and much stronger southeast winds drive counter-clockwise currents in the summer. The biological characteristics of the IMMA reflect the spatial complexity and temporal dynamism of interaction between the enormous discharge from the GBM system and a basin-scale gyre.

Abundance estimates using a distance sampling techniques indicate that in 2004, 5,383 Irrawaddy dolphins (95% CI = 2,385-12,150 – which is the world's largest populations) and 1,382 finless porpoises (95%

CI = 475-4,020 – which is among the world's largest populations) were present in the Bangladesh side of the IMMA (Smith et al., 2008). A Generalised Additive Model of environmental and presence-absence data found that Irrawaddy dolphin distribution was conditionally dependent (p<0.05) on low salinity and shallow depth (Smith et al., 2008). This explains, at least in part, the high numbers of Irrawaddy dolphins found in the IMMA.

Abundance estimates using a robust mark-resight technique indicate that in 2010-2013, 132 (95% CI = 115-153), 131 (95% CI = 124-137), and 636 (95% CI = 531-761) Indo-Pacific humpback dolphins were present, respectively, in coastal waters offshore from the mangrove forest in Bangladesh, which cover about half of the IMMA. The substantial increase in population size in the third year of the study can be explained by the large number of animals observed for the first time in a single group with 205 photo-identified individuals. The humpback dolphins offshore the Sundarbans in Bangladesh are likely part of a superpopulation that occupies more extensive coastal waters across the border in India (Smith et al., 2015).

Probabilistic habitat selection models and predictive distribution maps were generated from 58 sightings of Irrawaddy dolphins, 88 sightings of Indo-Pacific humpback dolphins, 39 sightings of finless porpoises, made during the winter seasons (December to February) of 2010-2013 in estuarine waters offshore the Sundarbans mangrove forest. These maps indicate a high probability of occurrence of all three species in the IMMA, including across the Indian side of the border where no empirical information is available on cetacean occurrence, during the northeast and southwest monsoon seasons.

Although the data have not yet been analysed, a survey conducted along the entire coast of Bangladesh in December 2017 and January 2018 indicated that the number of sightings and encounter rates of all three-primary species (Irrawaddy and humpback dolphins and finless porpoises) in the IMMA were comparable to the survey conducted in 2004. Additionally, one sighting of a mother-young pair of Bryde's whales and one sighting of a large group of Indo-Pacific bottlenose dolphins in coastal waters outside of the Swatch-of-No-Ground submarine canyon means that these cetaceans can be considered as secondary species in the Northern Coastal Bay of Bengal IMMA.

Criterion A: Species or Population Vulnerability

The IMMA supports the world's largest population of Irrawaddy dolphins. This species was up listed as Endangered in the IUCN Red Listed of Threatened Species in 2017, due to a suspected population size reduction of ≥50% over the past 60 years, future 60 years, and encompassing 60 years in both the past and future (Minton et al., 2017). The IMMA also supports among the world's largest populations of Indo-Pacific finless porpoise and Indo-Pacific humpback dolphins. Both of these species are considered Vulnerable due to a suspected or inferred decline of at least 30% over the last three generations, over three generations into the future, and over a three-generation period that includes both the past and the future (Jefferson et al., 2017, Wang and Reeves, 2017). For all three species, the factor most responsible for population declines is incidental mortality in fisheries. This means that, even though all three populations are relatively large, mortality from entanglements in fisheries and suspected declines make them vulnerable to extinction, thereby meeting Criterion A.

Figure 1: Irrawaddy dolphin entanglement. Photo: WCS Bangladesh

Figure 2: Dead Finless porpoise with entangled net (large mesh). Photo: WCS Bangladesh

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

Extraordinary bio-productivity, driven by the enormous discharge from the Ganges / Brahmaputra / Meghna river system, redistribution and retention of nutrients in a basin-scale current gyre and upwelling in a submarine canyon, supports among the world's largest resident populations of three globally threatened species. This gives aggregations of all three primary species occurring in the IMMA vital importance as a potential safety net to safeguard species extinction.

Criterion C: Key Life Cycle Activities
Sub-Criterion C1: Reproductive Areas

Frequent sightings of Irrawaddy and Indo-Pacific humpback dolphin calves in the IMMA combined with their relative high population size implies that the area plays a particularly important role in the reproduction of these species. The cryptic nature of finless porpoises means that calves are rarely identified in the field but the high concentration of these animals in the northern Bay of Bengal surrounded to the east and west by waters that support much lower densities implies that the IMMA also has a significant role as a reproductive area for this species.

Criterion D: Special Attributes
Sub-criterion D1: Distinctiveness

Humpback dolphins in the IMMA are phylogenetically unique from neighboring populations to the east and west. Levels of genetic divergence indicate that humpback dolphins in the IMMA are as different from the other putative *Sousa* species as they are from each other. The productive ecological conditions in the northern Bay of Bengal may explain the genetic distinctiveness of humpback dolphins in these waters (Amaral et al., 2016).

Figure 3: Indo-Pacific humpback dolphin (*Sousa chinensis*) along the coast of east India, showing a relatively short fin on a wide base and loss of pigmentation in adults. Humpback dolphins in the Bay of Bengal are genetically distinct from humpback dolphins to the east and west. Photo: Dipani Sutaria

Supporting Information

Amaral, A.R., Smith, B.D., Mansur, R.M., Brownell, R.L. and Rosenbaum, H.C. 2017. Oceanographic drivers of population differentiation in Indo-Pacific bottlenose (*Tursiops aduncus*) and humpback (*Sousa* spp.) dolphins of the northern Bay of Bengal'. Conservation Genetics, 18(2): 371-381.

Jefferson, T.A., Smith, B.D., Braulik, G.T. and Perrin, W. 2017. *Sousa chinensis* (errata version published in 2018). The IUCN Red List of Threatened Species 2017: e.T82031425A123794774.

Kabir, D.S., Muzaffar, S.B., Devnath, R.K. and Haque, M.M. 2004. The state of biodiversity in the Eastern Coast of Bangladesh'. In: Proceeding of coastal wetlands in Bangladesh: Nature, livelihoods and participation held in Cox's Bazar and organized by Bangladesh POUSH on 14th February. 7-9.

Kottke, B., Schwenk, T., Breitzke, M., Wiedicke, M., Kudrass, H.R. and Spiess, V. 2003. Acoustic facies and depositional processes in the upper submarine canyon Swatch-of-No-Ground (Bay of Bengal). Deep Sea Research Part II: Topical Studies in Oceanography, 50(5): 979-1001.

Milliman, J.D. and Syvitski, P.M. 1992. Geomorphic / tectonic control of sediment discharge to the ocean. J. Geology 100: 524-44.

Minton, G., Smith, B.D., Braulik, G.T., Kreb, D., Sutaria, D. and Reeves, R. 2017. *Orcaella brevirostris* (errata version published in 2018). The IUCN Red List of Threatened Species 2017: e.T15419A123790805 http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T15419A50367860.en

Sarin, M.M., Krishnaswami, S., Dilli, K., Somayajulu, B.L.Y. and Moore, W.S. 1989. Major ion chemistry of the Ganges-Brahmaputra river system: weathering processes and fluxes to the Bay of Bengal. Geochim. Cosmochim Acta 53: 997-1009.

Shiklomanov, I.A. 1993. World freshwater resources. pp.13-24. In: Gleick, P. (ed). Water in Crises, a Guide to the World's Freshwater Resources. Oxford University Press, New York. 473 pp.

Smith, B.D., Ahmed, B., Mowgli, R.M. and Strindberg, S. 2008. Species occurrence and distributional ecology of nearshore cetaceans in the Bay of Bengal, Bangladesh, with abundance estimates for Irrawaddy dolphins *Orcaella brevirostris* and finless porpoises *Neophocaena phocaenoides*. J. Cetacean Res. Manage, 10(1): 45-58.

Smith, B.D., Mansur, R.M., Strindberg, S., Redfern, J. and Moore, T. 2015. Population demographics, habitat selection, and a spatial and photographic analysis of bycatch risk of Indo-Pacific humpback dolphins *Sousa chinensis* and bottlenose dolphins *Tursiops aduncus* in the northern Bay of Bengal. International Whaling Commission Scientific Committee Report. 30 pp.

Wang, J.Y. and Reeves, R. 2017. *Neophocaena phocaenoides*. The IUCN Red List of Threatened Species 2017: e.T198920A50386795.
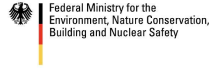
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