

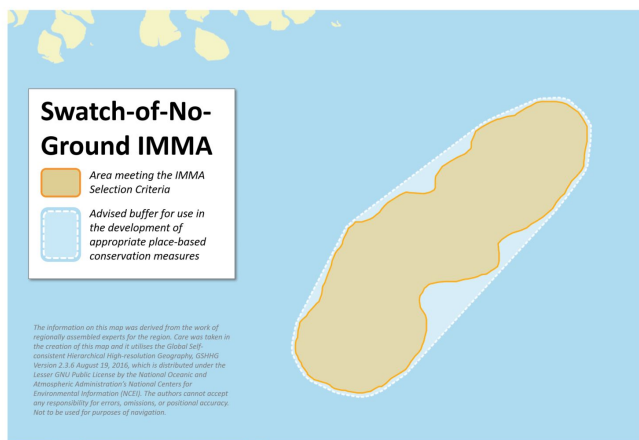
Swatch-of-No-Ground IMMA

Summary, continued.

feature of the canyon, and these aggregations may further imply additional importance for associated foraging and reproductive behaviours. Finally, it is determined that these locally occurring animals of both species are genetically different from many other populations of the same species in the Indo-Pacific, qualifying the area as an IMMA under Criterion D1.

Description

The Swatch-of-No-Ground (or “SoNG”) is a cone shaped submarine canyon that incises to within 40 km of the Sundarbans mangrove forest. The canyon was formed approximately 125,000 years ago (Curry et al., 2003) by river flow from the Ganges River system and underwater currents in the northern Bay of Bengal. It has relatively steep walls (12°–15°), ranges from about 40 km wide at its mouth to about 6 km wide at its head, and it carries sediments that sustain the world's largest submarine fan (Michels et al., 2003; Subrahmanyam et al., 2008). Bryde's whales (*Balaenoptera edeni*) and Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) occur along a gradient of fairly shallow (19 m) to deep-water (>200 m) habitat at the head of the SoNG. Pelagic delphinids including spinner (*Stenella longirostris*) and pantropical spotted (*Stenella attenuata*) dolphins occur in deeper waters of the canyon with a band of distributional overlap where all four species occasionally co-occur (Smith et al., 2008). Occasional sightings of rough toothed dolphins (*Steno bredanensis*) and false killer whales (*Pseudorca crassidens*) have also been documented in the SoNG IMMA (Smith, unpublished).



Area Size

1 960 km²

Qualifying Species and Criteria

Indo-Pacific bottlenose dolphins –

Tursiops aduncus

Criterion B (2); D (1)

Bryde's whale – *Balaenoptera edeni*

Criterion B (2); D (1)

Marine Mammal Diversity

Tursiops aduncus, *Balaenoptera edeni*,

Stenella attenuata, *Stenella longirostris*,

Steno bredanensis, *Pseudorca crassidens*

Summary

The head of the Swatch-of-No-Ground submarine canyon provides the physical conditions that support extraordinary biological productivity including globally significant populations of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) and Bryde's whales (*Balaenoptera edeni*) as well as large numbers of spinner (*Stenella longirostris*) and spotted dolphins (*Stenella attenuata*) and small numbers of rough toothed dolphins (*Steno bredanensis*) and false killer whales (*Pseudorca crassidens*). This qualifies the area as an IMMA under Criterion B2 – Aggregations for the regular concentrations of the species associated with the undersea



Figure 1: *Tursiops aduncus* in Swatch-of-No-Ground IMMA. Photo: WCS Bangladesh

A mark-resight analysis under Pollock's robust design of 1,144 photo-identified Indo-Pacific bottlenose dolphins and unmarked individuals in the SoNG during the winter seasons of 2005–2009 was conducted. The analysis generated abundance estimates of 1,701 (95% confidence interval [CI] = 1,533–1,888), 1,927 (95% CI = 1,851–2,006), 2,150 (95% CI = 1,906–2,425), and 2,239 (95% CI = 1,985–2,524) individuals for seasons 1–4, respectively. These estimates make the bottlenose dolphin population in the SoNG among the largest assessed of the species. Apparent survival was estimated as 0.958 (95% CI = 0.802–0.992). There is an apparent increase in abundance in the study area, indicate that the identified dolphins are part of a larger superpopulation moving throughout a more extensive geographic area. Of the photo-identified dolphins, more than one quarter exhibited injuries related to entanglements with fishing gear (Mansur et al., 2012). In addition, a plot of 412 unpublished sightings of Indo-Pacific bottlenose made during winter seasons of 2004–2012 confirmed that the head of the submarine canyon is particularly important for the species.

A study of the mitochondrial DNA control region of 17 bottlenose dolphins from the SoNG compared to the results of previously published sequences within the genus found that dolphins in the SoNG are genetically different from neighbouring populations. The bottlenose dolphin population in the SoNG appears to be more closely related to the African *T. aduncus* form than the Pacific form. The genetic distinctiveness of this population compared to populations in the Pacific has important evolutionary implications, due to their isolation in a geographic cul-de-sac characterized by an extreme infusion, redistribution and recycling of biological productivity, and conservation implications since their survival is particularly threatened by fatal interactions with fisheries. The extreme oceanographic conditions found in the SoNG may be driving speciation in these dolphins (Amarul et al., 2016).

A plot of 128 sightings of Bryde's whales made in winter seasons of 2004–2012 confirmed that the area is particularly important for this species. A phylogenetic study of Bryde's whales across the Western and Central Indo-Pacific and Northwest



Figure 2: Bryde's whale, *Balaenoptera edeni*. Photo: WCS Bangladesh

Pacific Ocean found subspecific differences between populations of the species with *B. e. brydei* occurring in the Maldives, Java and in the Northwest Pacific and *B. e. edeni* in the waters offshore of Oman, Bangladesh (SoNG submarine canyon) and coastal waters of southern Japan. In addition, population level differences were found within *B. e. edeni* between whales occurring in the Bangladesh and Oman, and in the Sea of Japan. Extremely low genetic diversity and population structure was found for *B. e. edeni* in the samples offshore of Oman and Bangladesh at a level that has not been documented in baleen whales (Kershaw et al, 2013).

Criterion B: Distribution and Abundance

Sub-criterion B2: Aggregations

Productivity at the head of the Swatch-of-No-Ground supports one of the world's largest aggregations of Indo-Pacific bottlenose dolphins. Although no estimate of population size exists for Bryde's whales, frequent sightings in the head of the submarine canyon and the general absence of sightings in

waters outside of the Swatch-of-No-Ground (Smith, unpublished) imply that the IMMA may also support a globally significant number of a distinctive small form of the species.

Frequent sightings of bottlenose dolphin and Bryde's whale calves in the head of the Swatch-of-No-Ground imply that the IMMA may be particularly important for reproduction in both species. In addition, frequent observations of feeding behaviour also reinforces that these important aggregations may be connected to important foraging activities and prey abundances within the IMMA.

Criterion D: Special Attributes

Sub-criterion D1: Distinctiveness

The IMMA supports two cetaceans (Bryde's whales and Indo-Pacific bottlenose dolphins) that have been the topic of recent studies indicating more complex genetic structure than previously recognized. Although these studies have not identified populations in the IMMA as genetically unique from

all other members of their putative species (e.g. Bryde's whales in the IMMA are closely related to those in Oman while Indo-Pacific bottlenose dolphins in the IMMA are closely related to the African *T. aduncus*), the disjunctive distribution of both forms of Bryde's whales and Indo-Pacific bottlenose dolphins and previously unrecognized genetic structure imply a level of genetic distinctiveness from other populations of the same species that meets Criterion D1 for designating the area as an IMMA. The bottlenose dolphin population found in the Swatch-of-No-Ground also showed a relatively low level of haplotype diversity, but a high level of nucleotide diversity, which is consistent with a situation where a small population becomes isolated from a source population with higher levels of genetic diversity (Amaral et al., 2016).



Figure 3: Spinner dolphin, *Stenella longirostris*.
Photo: WCS Bangladesh



Figure 4: Pantropical spotted dolphins, *Stenella attenuata*
Photo: WCS Bangladesh

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.

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**MARINE MAMMAL
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