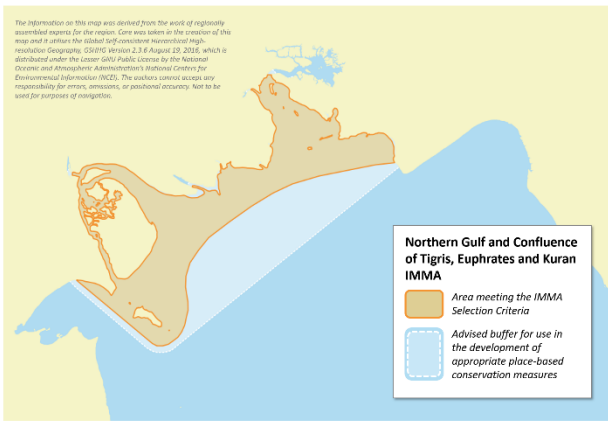


The information on this map was derived from the world of regionally assembled datasets for the region. Some areas shown in the creation of this map and it differs the Global Self-Consistent Hierarchical High-Resolution Geographic (SHoG) Version 2.3.6 August 29, 2015, which is distributed under the Lesser GNU Public License by the National Oceanic and Atmospheric Administration's National Center for Environmental Information (NCEI). The authors cannot accept any responsibility for errors, omissions, or positional accuracy. Not to be used for purposes of navigation.



## Area Size

4,220 km<sup>2</sup>

## Qualifying Species and Criteria

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

## Marine Mammal Diversity (D2)

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

## Summary

This IMMA sits at the northernmost tip of the Arabian/Persian Gulf and encompasses the delta created by the confluence of the Tigris, Euphrates, and Kuran rivers, extending to estuarine environments on the eastern side of Musa Bay (Ra's-e Barkan). This transboundary area (shared by Kuwait, Iraq and Iran) is characterized by very shallow waters and a number of islands. The area includes important habitat for Endangered Indian Ocean humpback dolphins (*Sousa plumbea*). Dedicated surveys have yielded encounter rates and abundance estimates for this species in two core areas surrounding Boubyan Island (Kuwait) and Musa Bay (Iran). Indo-Pacific finless porpoises (*Neophocaena phocaenoides*) are also likely to occur in this area.

# Northern Gulf and Confluence of the Tigris, Euphrates, and Kuran IMMA

## Description

The Northern Arabian Gulf and confluence of the Tigris, Euphrates and Kuran is a transboundary area that comprises national waters of Kuwait, Iraq and Iran. It includes the delta area related to the confluence of the Tigris, Euphrates, and Kuran rivers and additional estuarine environments across to the eastern side of Musa Bay (Ra's-e Barkan) in western Iran. Within this area, two core areas of importance for humpback dolphins were identified based on published evidence. The first is around Boubiyan Island (Kuwait) and the second in Khor Musa (Iran). The northern limits of the IMMA in Kuwait are defined by the central line along Khor Abdullah channel, which forms the border between Iraq and Kuwait. This area is characterized by the estuarine environment surrounding the depositional islands of Warbah and Boubiyan, and it is comprised of a network of tidal channels (khors) and extensive mudflats. This area is known for its ecological value as a wetland for birds and marine species and was designated as the Mubarak Al Kabeer Marine Reserve (MAKMR). This area also gained Ramsar site status in 2015. The western limit of the Ramsar site flanks the shoreline of Khor As Subiyah and the mudflats to the north side of Kuwait Bay. To the south, it includes the islands of Ouha, Failakah and Mischan where the influence of the estuarine system is diminished and the marine processes of the northern Gulf become the dominant influence. Kuwait Bay, at the southern part of the IMMA, is understood to be highly productive with mudflats and subtidal benthic habitats that serve as an important nursery area for many marine vertebrates.



Figure 1: *Sousa plumbea* swimming in the Northern Gulf and Confluence of the Tigris, Euphrates and Kuran IMMA. Photo: Yusuf Bohadi



Figure 2: Dorsal fin images (used for photo-identification) of Indian Ocean humpback dolphin in the Northern Gulf and Confluence of the Tigris, Euphrates and Kuran IMMA. Photo: Yusuf Bohadi

## Criterion A: Species or Population Vulnerability

Indian Ocean humpback dolphins are considered "Endangered" in the IUCN Red List (Braulik et al., 2017). This area has been defined as important for humpback dolphins based on evidence from two dedicated surveys and a number of incidental sightings (Bishop and Alsafar, 2008; Himami et al. 2018; Braulik et al, 2010). From Kuwait-based surveys, Bishop and Alsafar (2008) report the humpback dolphins encountered were morphologically similar to *Sousa plumbea*, although the publication formally refers to them as *Sousa chinensis*. After taxonomic review, the Humpback dolphins within this range are now classified as *Sousa plumbea* (Mendez et al., 2013; Braulik et al. 2015; Braulik et al 2017).

## Criterion B: Distribution and Abundance Sub-criterion B1: Small and Resident Populations

Indian Ocean humpback dolphin populations generally exhibit high degrees of residency (Braulik et al., 2015). Surveys conducted in northern waters of Kuwait in 2004 and 2005 covered waters around Boubyan Island. Humpback dolphins were present throughout the year with peaks in April (3.3/h) and

September (1.8/h) and they are considered to be resident. The maximum number of individuals encountered in a day along one continuous transect was 66 and extrapolations resulted in conservative estimate of at least 100 individuals in the area. In the Iranian waters of the IMMA, Hemami et al. (2018) details encounters from 'distance' based line transect surveys conducted between December 2014 and February 2016 in Mousa Bay, part of the Shadegan wildlife refuge. Over 1,200km of line transect surveys resulted in encounters with 75 humpback dolphin groups, producing an encounter rate of 0.058 groups/km. Mean group size was 2.71 dolphins per group with a range from 1-15 animals. An abundance of 92 animals was calculated for this area (95% CI 64-131) and density of 0.123 (95% CI 0.086-0.176) (Hemami et al., 2018). After evaluating the environmental variables, the authors noted that the highest densities were found within 1-2 km from the shore where water depth was approximately 30m and with the highest densities of chlorophyll a. Overall, although preliminary, these data support the existence of a small population with many animals resident in the IMMA. During their survey Bishop and Alsafar (2008) commonly observed adult humpback dolphins with juveniles, and long dive times, that likely indicated feeding. Cooperative feeding behaviour was also observed in shallow waters, and on one occasion a group of 10 was observed working a shoal of gulf herring (*Herklotsichthys lossei*). Considering the likely residency of humpback dolphins in the area, combined with the prey and the behaviour data, it is plausible that the area is utilized as a feeding ground.

## Supporting Information

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**MARINE MAMMAL  
PROTECTED AREAS  
TASK FORCE**




**IMMA**

Supported by:



Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety



WHALE AND DOLPHIN CONSERVATION



based on a decision of the German Bundestag



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