

# Gulf of Masirah and Offshore Waters IMMA

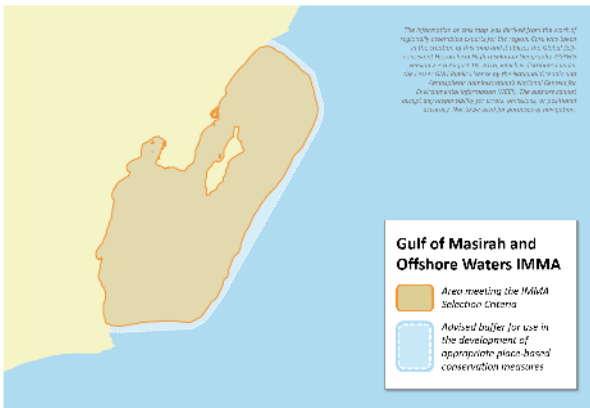
## Summary (continued)

frequent, which may be linked to bycatch and/or displacement. Pelagic species observed on the eastern side of the area include killer whales (*Orcinus orca*), false killer whales (*Pseudorca crassidens*), Cuvier's beaked whales (*Ziphius cavirostris*) and sperm whales (*Physeter macrocephalus*). Recorded strandings and entanglements suggest several species are threatened with bycatch in gillnet fisheries.

## Description

This area includes the waters of the Gulf of Masirah (GoM), which is limited to the on-shelf area within the 200 m isobath, as well as the waters of Masirah Island, which extend to depths exceeding 3,000 m. Satellite imagery reveals that net primary productivity within the GoM is elevated year-round (Willson et al. 2017). This productivity is driven by the southwest (summer) and northeast (winter) monsoons, which drive nutrient-rich upwelling along the Arabian Sea coast (Sheppard et al., 2018). Productivity can increase tenfold from  $<0.1 \text{ g C m}^{-2} \text{ d}^{-1}$  during the inter-monsoon period to above  $1.1 \text{ g C m}^{-2} \text{ d}^{-1}$  during the monsoon (Brock and McClain, 1992). The upwelling is considered to be a pivotal mechanism supporting cetacean prey abundance (e.g. Papastavavrou and Van Waerebeek, 1997) for a range of species documented in Omani waters (e.g. Baldwin et al., 1999).

The IMMA is one of the most important areas for endangered Arabian Sea humpback whales (ASHW). Within the GoM (Fig. 1). Indian Ocean humpback dolphins have regularly been sighted in the shallow sandy shorelines and seagrass area in the western and north western portion of the Gulf, including Bar al Hikman, the Ghubbat Hashish and in several locations between Ras bin Tawt and Ras Madrasah, and including around the Port of Duqm (Environment Society of Oman, 2018). This indicates a near ubiquitous coastal distribution in the area. Frequent



## Area Size

23,881 km<sup>2</sup>

## Qualifying Species and Criteria

Humpback whale – *Megaptera novaeangliae*  
Criteria A, C2

Indian Ocean humpback dolphin – *Sousa plumbea*  
Criterion A

## Marine Mammal Diversity (D2)

*Balaenoptera edeni*, *Delphinus delphis tropicalis*, *Megaptera novaeangliae*, *Orcinus orca*, *Physeter macrocephalus*, *Pseudorca crassidens*, *Sousa plumbea*, *Stenella longirostris*, *Tursiops aduncus*, *Tursiops truncatus*, *Ziphius cavirostris*

## Summary

Strong upwelling associated with the southwest monsoon supports high primary productivity in the Gulf of Masirah region. The area is among the most important habitats for endangered Arabian Sea humpback whales (*Megaptera novaeangliae*). Sightings, acoustic records, telemetry data and whaling records confirm its importance for both feeding and breeding. The endangered Indian Ocean humpback dolphin (*Sousa plumbea*) occurs in several locations along the coast, with higher densities recorded in the large shallow bay of the Ghubbat Hashish in the northwest corner of the IMMA. Bryde's whales (*Balaenoptera edeni*) have been observed with calves and feeding in the northern Gulf of Masirah, and feeding east of Masirah Island. Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) were regularly observed in inshore waters during surveys in the early 2000's, but sightings in recent years have been less

year-round sightings have been made from shore-based observations from Duqm south to Ras Markaz. A key habitat identified in 2002 was the northern part of Duqm bay (now buried under Duqm port) (Minton, 2004; Minton et al., 2010). Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) were once commonly encountered but are now very infrequently observed in the GoM area (Baldwin and Collins, pers. obs). The inner GoM, characterized by shallow depths (<200 m) and a generally uniform sandy seafloor, is considered to have reduced species diversity compared with offshore areas near and beyond the shelf edge (Environment Society of Oman, 2018). Killer whales (*Orcinus orca*), false killer whales (*Pseudorca crassidens*), spinner dolphins (*Stenella longirostris*), Indo-Pacific common dolphins (*Delphinus delphis tropicalis*), sperm whales (*Physeter macrocephalus*) and Cuvier's beaked whales (*Ziphius cavirostris*) have been recorded in deeper (>200m) offshore waters, particular to the east of Masirah Island. Notable sightings include killer whales in pursuit of Indo-Pacific common dolphins and sperm whales displaying the Marguerite formation (Environment Society of Oman, 2018).

## Criterion A: Species or Population Variability

The IUCN Red list currently classifies humpback whales globally as Least Concern. ASHW are listed by IUCN as 'Endangered' (Minton et al., 2008). This population is non-migratory, a trait unique among all humpback whale populations globally. They do not migrate between low-latitude breeding grounds and high latitude feeding grounds (e.g. Minton et al., 2011; Minton et al., 2008; Thomas et al., 2015; Reeves et al., 1991). The population is genetically distinct and reproductively isolated from other populations (Pomilla et al., 2014). The Indian Ocean humpback dolphin (*Sousa plumbea*) is listed as 'Endangered' throughout its range by the IUCN Red List (Braulik et al., 2017). A total of 40 sightings of humpback dolphins were recorded within the IMMA during dedicated vessel surveys between 1986 and 2006. However, search effort was rarely directed towards finding humpback dolphins, but several authors have noted the regions importance for this species (e.g. Baldwin et al., 2004; Minton, 2004a; Minton et al., 2010;

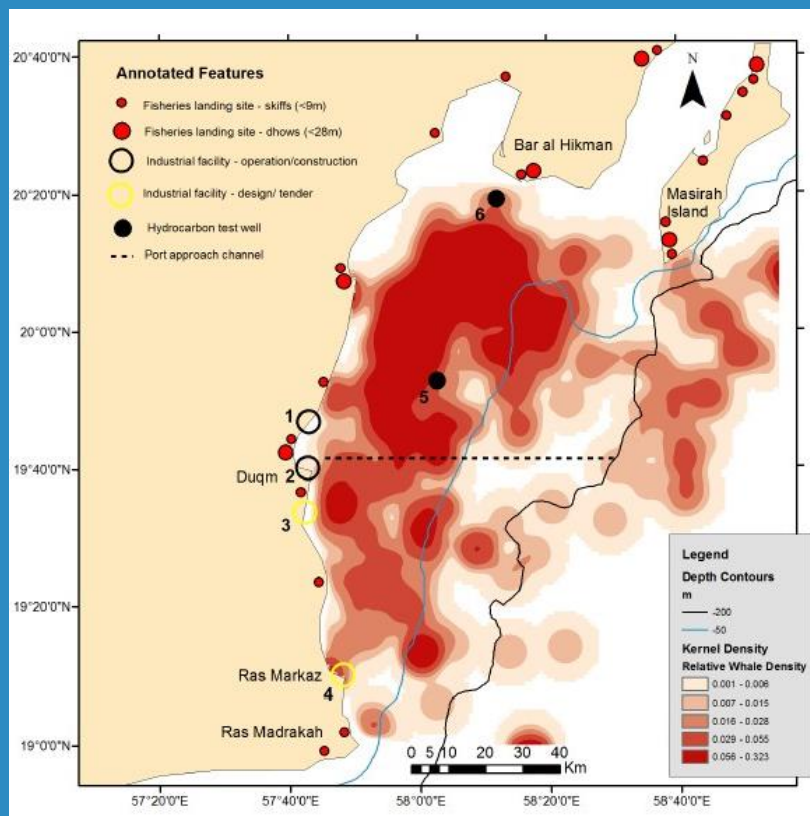


Figure 1: Kernel density of Arabian Sea humpback whale (*Megaptera novaeangliae*) habitat utilization derived modelled telemetry locations within the Gulf of Masirah, with annotated artisanal fisheries, shipping, and industrial activities within range of the study area (obtained from third party sources). From: Willson et al., 2016.



Figure 2: An Arabian Sea humpback whale breaches off the coast of the Dhofar region, southern Oman. Photo: Darryl MacDonald for the Environment Society of Oman.

Braulik et al., 2017). Recorded group sizes range between one to 100 individuals, including some of the largest groups sizes ever recorded (Baldwin et al., 2004; Environment Society of Oman, 2018). Although no dedicated studies have been conducted in the area, the species is known to be a nearshore limited species with restricted home ranges (Braulik et al., 2017; Jefferson and Curry, 2015; Parra and Jefferson, 2018). As such, it can be inferred that all ecological requirements for the species are likely to be contained within the IMMA. Bryde's whales (*Balaenoptera edeni*) as a species is designated as Least Concern in IUCN Red List (Cooke and Brownell, 2018a). However this assessment does not make a distinction between any different forms of the species. In the Arabian Sea and Sea of Oman, illegal Soviet whaling in the mid-1960s resulted in the recorded mortality of 849 individuals (Mikhalev, 2000). There is little current information on the status of the Bryde's whales in the region, and on whether both forms share the same status (Kershaw et al., 2013). Evidence from relatively frequent strandings throughout much of the species' NW Indian Ocean

range suggests they are vulnerable to entanglement in gill nets and ship strikes as are other large whale species in the region (Baldwin, 2003; Baldwin et al., 2015).

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

The GoM is extremely productive, especially at the end of, and directly following the southwest monsoon season, as indicated by some of the highest remotely sensed Chlorophyll A values of any portion of Oman's coastline (Banse and English, 2000; Brock and McClain, 1992; Piontkovski and Al Jufaili, 2013). This productivity is associated with a high fish biomass, supporting an expanding fisheries industry. It is also associated with a relatively high rate of observed feeding or suspected feeding behaviour for both humpback whales and Bryde's whales (Minton, 2004b; Minton et al., 2011). Analysis of stomach contents from humpback whales taken from the Arabian Sea (n=190) showed that over 50% had 'moderate' to 'plentiful' stomach contents (Mikhalev,

1997; Mikhalev, 2000). Catch locations curated by the International Whaling Commission indicate that at least 30 of these individuals were taken from the GoM (Allison, 2016) and it is likely that they are represented in the sample of examined stomachs. Bryde's whales are also thought to be feeding regularly in the area, supported by multiple observations during dedicated cetacean surveys of lunge feeding and/or whales in association with large shoals or sardines and other bait fish (Baldwin et al., 1999; Ponnampalam, 2009; Minton, 2004b; Environment Society of Oman, 2018).

## Criterion D: Special Attributes

### Sub-criterion D2: Diversity

The IMMA provides habitats for a minimum of 11 cetacean species that have been confirmed (Minton et al. 2011; Baldwin et al. 2011; Willson et al. 2015; Environmental Society of Oman, 2018). Available habitats vary considerably, with humpback dolphins occupying nearshore waters (ranging from shallow bays to rocky headlands) and other species distributed exclusively offshore, including killer whales (*Orcinus orca*), false killer whales (*Pseudorca crassidens*), spinner dolphins (*Stenella longirostris*), Indo-Pacific common dolphins (*Delphinus delphis tropicalis*). Sperm whales (*Physeter macrocephalus*) and Cuvier's beaked whales (*Ziphius cavirostris*) have been recorded in deeper (>200m) offshore waters, particular to the east of Masirah Island. Data richness for the area is uneven, with the majority of observations recorded in the GoM and far fewer for offshore areas, including deep-water habitats and regions of very high productivity.

## Supporting Information

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**MARINE MAMMAL  
PROTECTED AREAS  
TASK FORCE**



**IMMA**

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