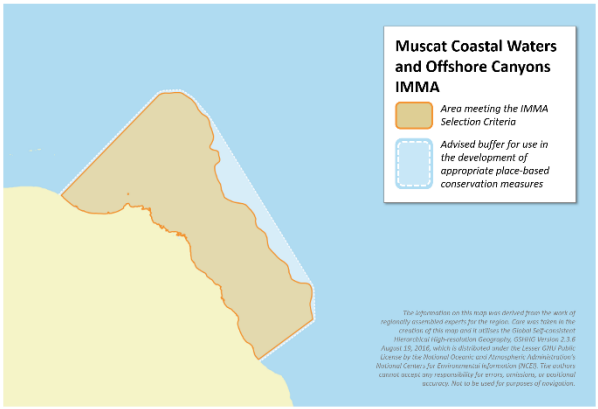

Area Size

4,703 km²

Qualifying Species and Criteria

Spinner dolphin – *Stenella longirostris*
Criteria C1, C2

Common dolphin – *Delphinus delphis tropicalis*
Criteria C1, C2

Common bottlenose dolphin – *Tursiops truncatus*
Criteria C1, C2

Bryde's whale – *Balaenoptera edeni*
Criterion C2

Sperm whale – *Physeter macrocephalus*
Criterion C2

False killer whale – *Pseudorca crassidens*
Criterion C2

Marine Mammal Diversity (D2)

Balaenoptera edeni, Balaenoptera musculus indica, Delphinus delphis tropicalis, Feresa attenuata, Grampus griseus, Kogia sima, Megaptera novaeangliae, Orcinus orca, Physeter macrocephalus, Pseudorca crassidens, Stenella attenuata, Stenella coeruleoalba, Stenella longirostris, Tursiops truncatus

Muscat Coastal Waters and Offshore Canyons IMMA

Summary

The Muscat coastal area in the Sea of Oman comprises a range of different habitats, including low energy, gently sloping sandy coastline with a wide continental shelf in the west of the IMMA, a complex network of rocky headlands, inlets and islands to the east, and a series of deep canyons and gullies offshore. These diverse habitats host at least 14 species of cetaceans with confirmed observations in the Muscat Coastal Area. While spinner dolphins (*Stenella longirostris*; Fig. 1) and common dolphins (*Delphinus delphis*; Fig. 2) are the species most frequently observed, seven species, including Bryde's whales (*Balaenoptera edeni*), sperm whales (*Physeter macrocephalus*), common bottlenose dolphins (*Tursiops truncatus*) and Risso's dolphins (*Grampus griseus*) have been observed feeding on, or in clear association with suspected prey species and/or habitats. Three species, including spinner, common and bottlenose dolphins, are present year-round and have been often been documented with calves, indicating that the area is an important reproductive habitat for them. These resident species are also the focus of a growing dolphin watching industry in the Muscat area.

Description

The Muscat coastal area is a portion of the Sea of Oman that includes varied coastal features consisting of sandy bays, sheltered embayments and rocky outcrops (Sheppard et al., 1992). The western portion of the area from Ras Suwadi to Qurum is comprised of open sandy coastline with a wide continental shelf. This coastal region is used for agriculture, recreation, tourism and coastal urban development. The eastern portion of this area from Qurum to Quriyat includes rocky beaches, and a complex network of rocky headlands, coastal inlets and islands such as Fahal Island. The continental shelf here is narrower, marked by deep gullies and canyons, with depths of greater than 1000m within 10km of shore in some areas (Harris et al., 2014).

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

Ponnampalam (2009) reports that calves were observed in 77% (n=133) of all cetacean groups observed during dedicated cetacean surveys conducted in the Muscat area between 2004 and 2006. Calves were most frequently seen in spinner dolphin (n=55), common dolphin (n=32), and common bottlenose dolphin (n=33) groups. These three species are observed in all months of the year in the Muscat area (Minton et al., 2010; Minton, 2004; Ponnampalam, 2009; Oman, 2019). While no photo-identification or genetic sampling studies have been conducted to confirm residence of the same individuals, the regularity of their presence and the frequency with which these species are observed with calves provides strong evidence that the Muscat area is important for these species' reproduction.

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

Oceanographic data from the Muscat area indicates that it is a highly productive region supporting a thriving artisanal fishery (Al-Oufi et al., 2000). Seven of the 14 cetacean species observed in the Muscat Area have been observed feeding in the IMMA. Spinner dolphins and common dolphins frequently occur in mixed species groups of 100 individuals or more (Minton et al., 2010; Minton, 2004; Ponnampalam, 2009; Oman, 2019), often also in association with artisanal fishing boats using baited handlines to fish for yellowfin tuna in among large schools of *Sardinella longiceps*. Behaviour of dolphins in these groups was often consistent with feeding (long dives, fast direction changes), although direct feeding was not always observed. Ponnampalam et al. (2012) documented the stomach

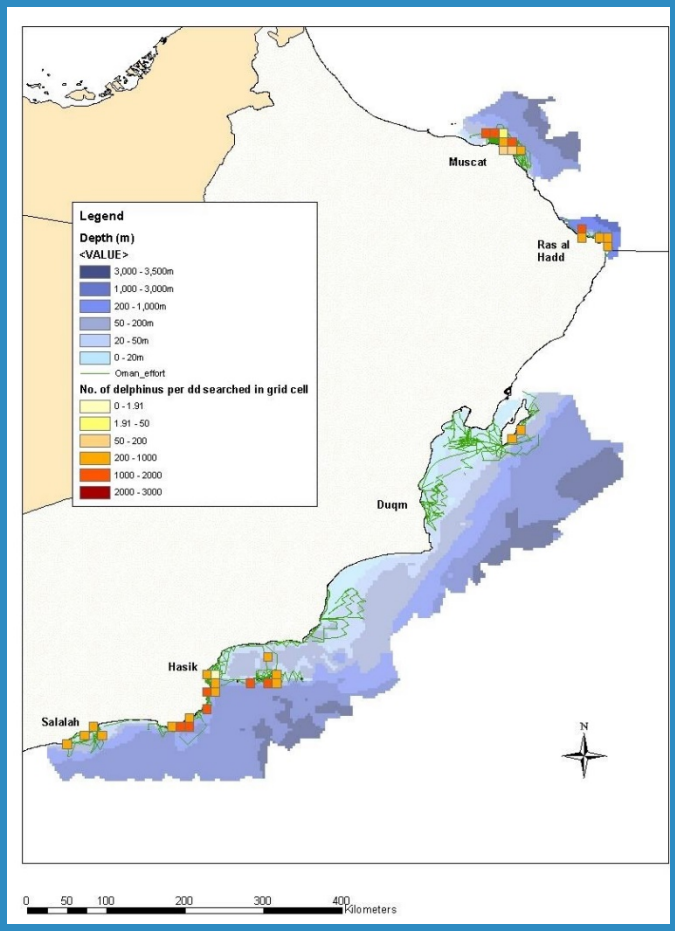

Figure 1: Relative encounter rates of *Delphinus delphis* per 0.1 x 0.1 decimal degree grid cell. Encounter rates were calculated as the total number of *Delphinus delphis* encountered in the grid cell divided by the distance searched (decimal degrees) in the grid cell. From: Minton, 2004.

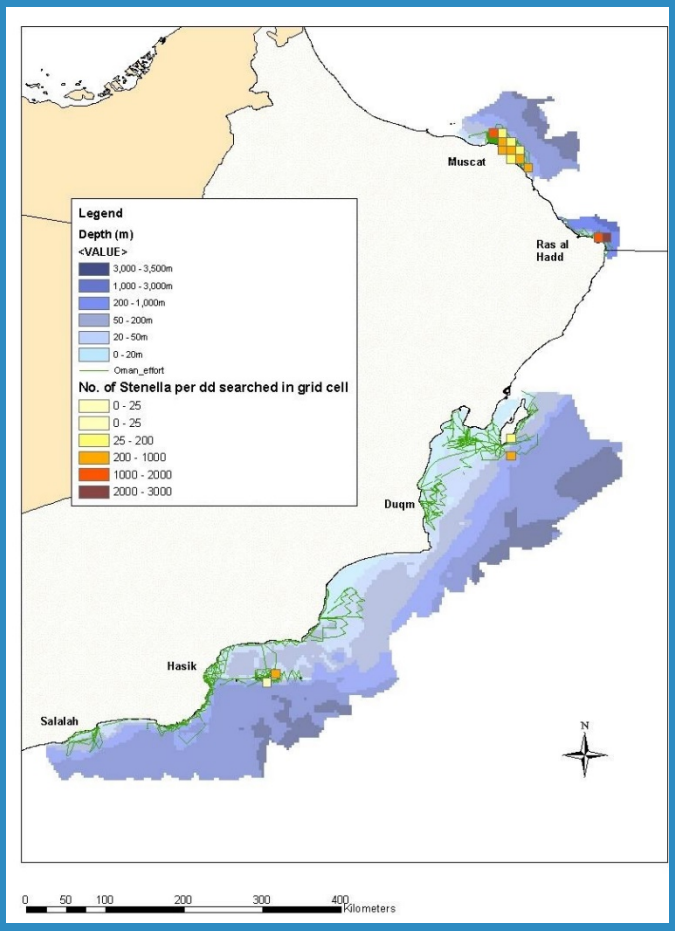

Figure 2: Relative encounter rates of *Stenella longirostris* per 0.1 x 0.1 decimal degree grid cell. Encounter rates were calculated as the total number of *Stenella longirostris* encountered in the grid cell divided by the distance searched (decimal degrees) in the grid cell. From: Minton, 2004.

contents of stranded spinner and common bottlenose dolphins found in the Muscat area. In the case of spinner dolphins, myctophids (lanternfish species) comprised the most represented prey family in terms of number and frequency of occurrence (99.4% and 100.0% respectively for the two specimens examined), although cephalopods were also present in one specimen. Myctophids are generally found in the mesopelagic layer of deeper waters, which can be found closer to shore in the Muscat area than in the area further to the north where the continental shelf is wider. Ponnampalam et. al (2012) concluded that spinner dolphins were most likely feeding in the deeper waters at night, and migrating closer inshore during the day, as is common for the species in other areas where it has been studied (e.g. Benoit-Bird and Au, 2003; Ponnampalam et al., 2012; Tyne et al., 2017). The same study documented the stomach contents of a single specimen of *Tursiops truncatus* stranded in the Muscat area, and also revealed a predominance of deep-water prey species – in this case cephalopods associated with the mesopelagic layer (Ponnampalam et al., 2012). Stomach content analysis was not available for other species observed live or stranded in the Muscat area. However, both common dolphins and Bryde's whales have been observed regularly in association with shoaling sardines, in some cases lunge feeding among them (Minton unpublished data; Collins unpublished data; Oman, 2019). Risso's dolphins, sperm whales, and false killer whales, have also either been observed feeding, or are presumed to feed in the area based on their known prey and feeding habitats in other parts of their global range, where they are known to be associated with shelf edges and nearshore canyons and gullies, such as those found in the Muscat area (e.g. Azzellino et al., 2008; Baird, 2018; Cañadas et al., 2002).

Criterion D: Special Attributes
Sub-criterion D2: Diversity

The Muscat area includes various habitats, namely wide sandy coastal shelves, sheltered rocky embayment, and steeply shelving deep-water canyons close to shore. This diversity in habitats supports a number of cetacean species, some of which are confirmed to be resident year-round. Fourteen cetacean species have been observed at sea in the Muscat area according to the Oman Cetacean Database, curated by the Environment Society of Oman. This database includes observations documented from the 1960s onward, ranging from incidental observations made by qualified observers during the course of other coastal/marine work, to those made during dedicated cetacean surveys. Records in the OMCD include those from a series of surveys conducted between 2001 and 2003, and analysed as part of a PhD thesis by G. Minton (2, 264km/104 hours of search effort) (Minton, 2004), and those made during a series of surveys between 2004 and 2006 and analysed as part of a PhD thesis by L. Ponnampalam (2610.4km/112.3 hours of search effort) (Ponnampalam, 2009). The five most frequently observed species in both studies and in the Oman Cetacean Database as of 2019 are (in order of frequency), spinner dolphins, common dolphins, common bottlenose dolphins, Risso's dolphins, and Bryde's whales (Fig. 4), each of which were represented by over 50 sightings (Ponnampalam, 2009; Minton, 2004; Oman, 2019). As described above, spinner, common and bottlenose dolphins are likely to be both feeding and breeding in the area, while Risso's dolphins and Bryde's whales are likely feeding. False killer whales were the next most regularly observed species (25 recorded observations), and when their behaviour could be accurately classified, they were most often traveling. Sperm whales were observed on 14 occasions, including a documented observation of 35 individuals in a marguerite formation and in association with Risso's and bottlenose dolphins (Ponnampalam, 2016). Ten observations of Arabian Sea humpback whales have been recorded in the Muscat Area, including two animals that were entangled in fishing gear and released through human intervention (Oman 2019). By applying spatial eigenvector filtering to models based on baleen whale sightings data collected in Oman through 2004, Corkeron et al. (2011) determined that while the Arabian Sea coast of Oman was more important habitat for Arabian Sea humpback whales, the Muscat Area was of higher relative importance for Bryde's whales. Other species with fewer than 10, but more than 2 documented observations at sea include blue whales, pantropical spotted dolphins and dwarf sperm whales. Striped dolphins were documented in

Figure 4: A Bryde's whale charges to the surface off the coast of Oman. Photo: Amy Kennedy for the Environmental Society of Oman

the Muscat area only once (Oman, 2019). Species that would be expected to be observed in deeper offshore waters are most likely under-represented in the Oman Cetacean Database, as survey effort and incidental sightings are concentrated in nearshore waters. Perhaps surprisingly, bottlenose dolphin sightings in the Muscat area comprise only sightings of *T. truncatus*, with no confirmed sightings of *T. aduncus*, although this smaller tropical species is observed further south on the Arabian Sea coast of Oman. Strandings documented in the Muscat Area through 2002 reflect the same species composition and relative abundance/frequencies as those documented through live sightings, with spinner and common and bottlenose dolphins being the most frequently observed stranded species (e.g. Collins et al., 2002).

Supporting Information

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