

Shark Bay IMMA

Summary cont....

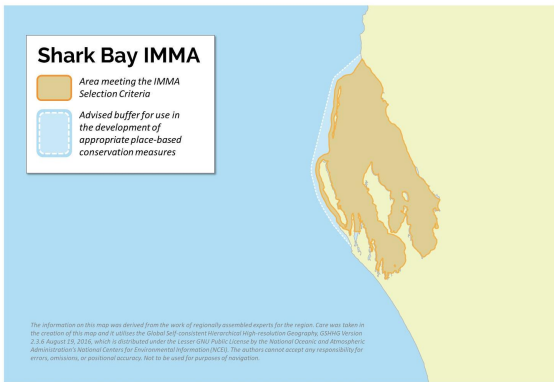
challenges of finding food and avoiding predators. With a myriad of niches to exploit, but intense competition for food and mates, the Shark Bay dolphins have complex social lives and exhibit an intriguing repertoire of foraging specialisations, including tool use. This important and unique ecosystem is also being affected by climate change.

Description:

At the most westerly point of the Australian continent, Shark Bay, is the largest semi enclosed bay in Australia and is bordered by a chain of barrier islands. The significance of the area and its marine habitats have been recognised at local, national, and international levels with its designation as State and Commonwealth marine protected areas and the Shark Bay World Heritage Area. Shark Bay has some exceptional natural features including its well-studied Indo-Pacific bottlenose dolphins, its vast seagrass beds, which are the largest (4,800 km²) in the world and contain a rich diversity of seagrass species (12 species); its dugong population; and its stromatolites (colonies of algae which form hard, dome-shaped deposits, among the oldest forms of life on earth). Vast seagrass meadows provide forage for dugongs, and a nursery for fish; shallow sand



Figure 1 – Bottlenose dolphins in Shark Bay. Image provided by the Marine Science Program at the Department of Biodiversity Conservation and Attractions.



Area Size

17,266km²

Qualifying Species and Criteria

Dugong – *Dugong dugon*

Criterion A, B1, C1, C2

Indo Pacific bottlenose dolphin – *Tursiops aduncus*

Criterion B1, C1, C2, D1

Marine Mammal Diversity

Megaptera novaeangliae, *Sousa sahalensis*,

Eubalaena australis

Summary

Shark Bay, Western Australia, includes a large sheltered embayment containing extensive seagrass meadows (4,800 km²), coral, and stromatolites. Dugongs and Indo-Pacific bottlenose dolphins reside in the bay, with several migratory whale species as seasonal visitors. Shark Bay is important for the conservation of dugongs, which contributed to its World Heritage listing. The dugong population represents a significant part of the dugong population in Western Australia. The dolphins of Shark Bay have been studied in detail for more than 35 years, with scientific research providing insight into their behaviour, genetics, communication, and ecology, including the daily

flats and mangroves are home to invertebrates, rays and small sharks; deeper channels support sponge gardens and rocky reefs, providing hunting grounds for sea snakes, large sharks and dolphins.

Criterion A – Species or Population

Vulnerability

The dugong is listed as Vulnerable on the IUCN Red List (Parra et al. 2017a, Parra et al. 2017b, Marsh and Sobotzick 2019). In Australia, the dugong is also considered a Matter of National Environmental Significance under the *Environment Protection and Biodiversity Act 1999* (EPBC Act) and both the Australian humpback dolphin and the dugong are also listed as Vulnerable in Queensland under the Nature Conservation Act 1992.

Criterion B: Distribution and Abundance

Sub-criterion B1: Small and Resident Populations

Abundance estimates of Indo-Pacific bottlenose dolphins in the western gulf range from 115 (s.e. 5.2, 95% CI 105–126) individuals in 2008 to 208 (s.e. 17.3, 95% CI 177–245) in 2010. The variability is likely a reflection of how individuals used the study area, rather than fluctuations in true population size. This study provides a robust baseline in the western gulf, which may be of importance should climate change or increasing human activity affect this population (Nicholson et al., 2012). Apparent annual survival rate was estimated at 0.95 (s.e. 0.02) (Nicholson et al., 2012). Following the 2011 marine heatwave, capture–recapture analyses indicated 5.9% and 12.2% post-heatwave declines in the survival of dolphins (Wild et al., 2019). Lower survival has persisted post-heatwave, suggesting that habitat loss following extreme weather events may have prolonged, negative impacts on even behaviourally flexible, higher-trophic level predators. There is a resident population of dugongs in Shark Bay and abundance

and distribution of this population has been monitored every five years since 1989 using aerial surveys. The dugong population is estimated to be between approx. 10,000–14,000 (Preen et al., 1997, Hodgson, 2007, Holley et al., 2006, Bayliss et al., 2019) representing the highest density of dugongs worldwide. The population has been shown to be relatively stable over time, with some relatively long-range scale movement between the Ningaloo-Exmouth region and Shark Bay being detected after the decimation of seagrass habitat following Cyclone Vance in 1999 (Gales et al., 2004).

Criterion C: Key Life Cycle Activities

Sub-criterion C1: Reproductive Areas

There are resident populations of both Indo-Pacific bottlenose dolphins and dugongs in Shark Bay and reproductive behaviour, including presence of calves has been reported for both these resident populations. There is extensive research on bottlenose dolphin reproductive behaviour, mating strategies and calf development, particularly for the eastern gulf (e.g. Mann et al., 2000, Manlik et al., 2016). Long-term demographic data on Shark Bay's resident Indo-Pacific bottlenose dolphin (*Tursiops aduncus*)

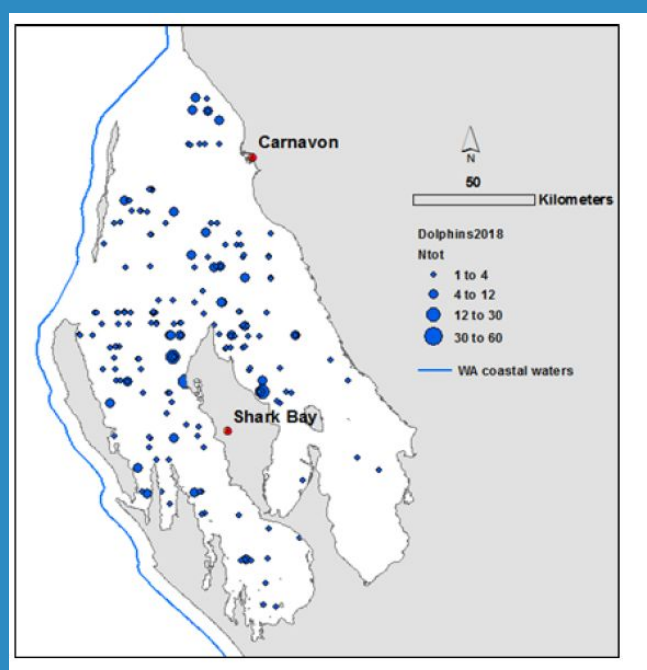


Figure 2 – Dolphin sightings during aerial survey, June 2018 (Bayliss et al 2018).

population revealed a significant decline in female reproductive rates following a heatwave (Wild et al., 2019). The presence of dugong calves has been recorded during aerial surveys (e.g. Preen et al., 1997) and in particular Bayliss et al., (2018) noted the potential collapse of breeding post the 2011 marine heatwave and loss of seagrass with recovery noted in the presence of a high number of calves in the 2018 aerial survey. A mating strategy only observed in Shark Bay has been noted to be used by male dugongs, where they lek (Anderson 1997).

Sub-criterion C2: Feeding Areas

One of the values for which the Bay was nominated as a World Heritage Area is the large expanses of seagrass meadows (4,800 km²) and the rich diversity of seagrass species (12 species) (Walker et al., 1988). Dugongs are herbivores and spend significant portions of the day feeding. High numbers of foraging dugongs are sustained by the extensive seagrass meadows in Shark Bay (Anderson, 1982, Anderson, 1997), and the loss of seagrass following the 2011 marine heatwave caused a decline in dugong density (Nowicki et al., 2019). The dolphin population that inhabits Shark Bay has been recorded employing a variety of foraging strategies, some targeted at specific foraging habitat, notably sponge feeding in deep channels (Patterson and Mann, 2011, Tyne et al., 2012) and extensive foraging in seagrass meadows (Sargeant et al., 2007). The Shark Bay World Heritage Area endured an unprecedented marine heatwave in 2011 (Thomson et al., 2015). Catastrophic losses of seagrass meadows followed, along with mass mortality in invertebrate and fish communities (Thomson et al., 2015, Strydom et al., 2020).

Criterion D: Special Attributes

Sub-criterion D1: Distinctiveness

The dolphins of Shark Bay have been studied in detail for more than 35 years (Connor and Smolker, 1985),

with scientific research providing insight into their behaviour (Smolker et al., 1997), genetics (Krützen et al., 2004), communication (King et al., 2018, Smolker et al., 1993) and ecology (Tyne et al., 2012), including the daily challenges of finding food and avoiding predators. With a myriad of niches to exploit, but intense competition for food and mates, the Shark Bay dolphins have complex social lives and exhibit a repertoire of foraging specialisations, including tool use. The dolphins use a conical shaped sponge as a protective tool on their rostrum to forage in the rubble-littered substrate in the deeper channels of Shark Bay (Patterson and Mann, 2011, Tyne et al., 2012). A number of other unique foraging strategies have been documented within this population including feeding with conch shells (Allen et al., 2011), kerplunking (Connor et al., 2000) and beach stranding (Sargeant et al., 2005).

Supporting Information

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Figure 3– Dugongs in Shark Bay. Image provided by the Marine Science Program at the Department of Biodiversity Conservation and Attractions.

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We would like to thank the participants of the 2020 IMMA Regional Expert Workshop for the identification of IMMAs in the Australia, New Zealand and South East Indian Ocean seas region. Funding for the identification of this IMMA was provided by the Global Ocean Biodiversity Initiative funded by the German government's International Climate Initiative (IKI). Support was also provided by Whale and Dolphin Conservation and the Tethys Research Institute.

Suggested Citation: IUCN-MMPATF (2022). Shark Bay IMMA Factsheet. IUCN Joint SSC/WCPA Marine Mammal Protected Areas Task Force, 2022.

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