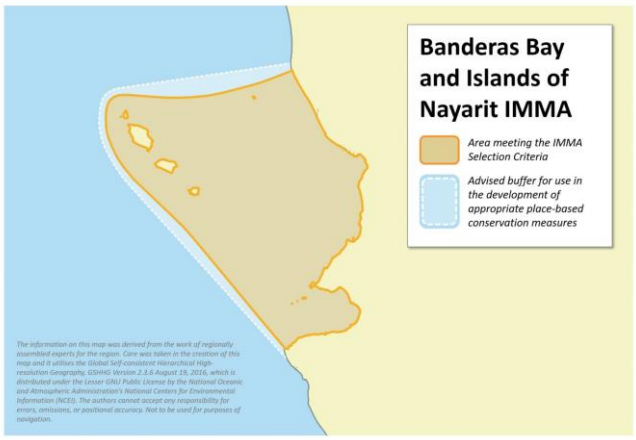

Area Size

2 174 km^2

Qualifying Species and Criteria

Humpback whale – *Megaptera novaeangliae*

Criterion A; C (1)

Marine Mammal Diversity

Criterion D (2)

Balaenoptera edeni, Eschrichtius robustus, Kogia sima, Megaptera novaeangliae kuzira, Orcinus orca, Pseudorca crassidens, Physeter macrocephalus, Stenella attenuata attenuata, Stenella attenuata graffmani, Stenella longirostris orientalis, Steno bredanensis, Tursiops truncatus, Ziphius cavirostris

Summary

Banderas Bay and Islands of Nayarit IMMA encompasses the Isla Isabel National Park and Islas Marías UNESCO biosphere reserve. It is situated below the entrance to the Gulf of California, considered one of the most biodiverse marine ecosystems in the world, and is at the juncture where several biogeographic areas meet. Bordered by the Middle-America Trench, deep and shallow waters combine with warm and cool mixing currents, create a unique marine environment that supports high cetacean diversity. In total, 13 cetacean species are

Banderas Bay and Islands of Nayarit IMMA

Summary, continued.

regularly encountered in the area, with year-round sightings of false killer whales (*Pseudorca crassidens*), killer whales (*Orcinus orca*), and a resident population of dwarf sperm whales (*Kogia sima*) found in the southern area of the IMMA. The threatened Mexican Distinct Population Segment (DPS) of North Pacific humpback whales (*Megaptera novaeangliae kuzira*) assemble in large numbers during the winter months to breed, calve and nurse, while humpback whales from the endangered Central America DPS migrate through the IMMA.

Description:

The Banderas Bay and Islands of Nayarit Important Marine Mammal Area (IMMA), is situated halfway down the Pacific coast of Mexico, below the entrance to the Gulf of California (Figure 1). The IMMA starts in the south around the Tropic of Cancer (N20°C) in Banderas Bay, a large coastal embayment split between the state waters of both Jalisco and Nayarit. It then continues over 150 km north along the coast of Nayarit to a small volcanic island 25 km from the coast, the Isla Isabel National Park. It then stretches out approximately 120 km offshore to the Islas Tres Marías UNESCO (United Nations Educational, Scientific and Cultural Organization) biosphere reserve. The IMMA is situated in an area where several biogeographic regions meet; the Gulf of California, one of the most bio-diverse marine ecosystems in the world (Enríquez-Andrade et al., 2005); the Eastern Tropical Pacific (which extends south to northern Peru), considered one of the most productive ocean environments in the world (Fiedler et al., 2017), and the temperate North Pacific.

Figure 1: An adult humpback whale (*Megaptera novaeangliae*) breaching. Photo credit: Nicola Ransome.

Consequently, it is influenced by the cool California Current, warm Equatorial Currents and the Mexican Coastal Current (Gómez-Valdivia et al., 2015; Kessler, 2006)

The continental shelf narrows at the south of Banderas Bay and a deep sub-marine canyon drops down to around 1100 m, which constitutes the northern section of the Middle America Trench (Mortera Gutiérrez et al., 2016). A seasonal upwelling occurs caused by winds and tidal currents interacting with the beginning of the slope of the canyon (de la Torre Vázquez et al., 2017). This leads to increased primary productivity from January to June, with a peak from February to May (López-Sandoval et al., 2009). In the middle of the IMMA, just north of Banderas Bay, the continental shelf becomes notably wide, almost twice the width of the shelf of most of Pacific Mexico (where it is typically <50 km), stretching approximately 120 km from the coast and out to the Islas Tres Marías. The IMMA includes the Islas Marías and surrounding waters out to 10km from each island. Only 5km from the west coast of the largest Marías island, the Middle America Trench continues, and drops down over 4 km. This creates both nearshore and pelagic deep-water environments, and an extensive area of shallow protected water at the center of the IMMA.

These environmental conditions combine to create a unique marine environment, which supports a diverse array of cetacean species (Arroyo Sánchez, 2017). This includes both warm water and cool water species, and deep water and shallow water species. Additionally, the region is important seasonal habitat for migratory humpback whales (*Megaptera novaeangliae*) that enter the shallow and sheltered regions for breeding (Calambokidis et al., 2008).

Lastly wind driven upwelling regions in the south of the IMMA attract feeding aggregations of cetaceans during the highly productive winter months when there is an abundance of zooplankton and small schooling fish (Domínguez-Hernández et al., 2020; López-Sandoval et al., 2009).

Criterion A: Species or Population Vulnerability

Humpback whales that migrate to the region are part of the Mexico Distinct Population Segment (DPS), which in 2016 was classified as "Threatened" by the US Government's National Oceanic and Atmospheric Administration (NOAA) as part of the Endangered Species Act (NOAA, 2016). Additionally, humpback whales of the Central America DPS, which were classified as "Endangered" (NOAA, 2016), migrate through the region on the way to their breeding areas further south (Calambokidis et al., 2008; Mate et al., 2018). Justification for these "At Risk" DPS status were that for the Mexico DPS there is an absence of regional information on population growth in the last decades, and that whales of the DPS are threatened significantly by fishing gear entanglement (NOAA, 2016). The Central America DPS was considered to be at risk of extinction due to the low abundance estimate of ~600 non-calf individuals (Calambokidis et al., 2008; NOAA, 2016), although Bettridge et al. (2015) noted there was "considerable uncertainty about the actual population size". A recent study, using a one-dimensional spatial capture-recapture model, has estimated the population to be significantly larger – at approximately ~1500 non-calf individuals (Curtis et al., 2022) – although still smaller than estimates of the neighbouring Mexico DPS (Calambokidis et al., 2008).

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

Most populations of humpback whales undertake extensive migrations each year between high latitude summer cold-water feeding areas and low-latitude winter tropical breeding areas (Dawbin, 1966). Nineteenth Century whaling data show that humpback whales have been visiting this IMMA seasonally for several hundred years (Townsend, 1935). The first research surveys, which were conducted in the 1960s (after heavy harvesting of the species and eventual international protection), found humpback whales distributed throughout the region although at a very low abundance of an estimated few hundred animals (Rice, 1966). Today, the population has grown significantly and each year during winter and early spring humpback whales assemble around the islands and in the shallow coastal waters of the IMMA to mate, calve and nurse their young (Calambokidis et al., 2008; Espinoza Rodríguez et al., 2021; Zavala-Alarcón et al., 2021). Using mark-recapture models and data collected between 2004 – 2006 the mainland Mexico breeding area was estimated to host approximately ~3,000 – 5,000 non-calf individuals with increases of approximately 5 – 6 % annually (Martínez-Aguilar et al., 2018). Males are commonly encountered singing in the region (Darling et al., 2019) and competitive courtship behaviour is regularly observed (Espinoza Rodríguez et al., 2021; Ransome et al., 2021; Zavala-Alarcón et al., 2021; Ransome et al., 2022). Humpback whale births have been documented in the Banderas Bay region of the IMMA (Ransome et al., 2021), and females may have extended seasonal residencies of five or more weeks when nursing their calves (Ransome et al., 2022). Additionally, atypical feeding by large aggregations of humpback whales was first documented during the La Niña year of 2011/2012 in Banderas Bay (Frisch-Jordán et al., 2019), and observations of

Figure 2: Rough-toothed dolphins (*Steno bredanensis*). Photo credit: Úrsula González Peral.

feeding have been continued in years of colder sea surface temperatures (Nicola Ransome, unpublished data).

Criterion D: Special Attributes
Sub-criterion D2: Diversity

Most of the focus of cetacean research has been in the south of the IMMA in Banderas Bay and its nearby waters. Between 1981 – 2015, 954 research trips, comprising over 4,631 hours of survey effort and covering more than 2,000 km, documented 20 marine mammal species (2 pinniped species and 18 cetacean species) involving 5,232 unique sightings (Arroyo Sánchez, 2017). Of these, 11 species of cetaceans were documented over 10 times. The most commonly encountered was the humpback whale (~4,000 sightings) followed by the coastal pantropical spotted dolphin (*Stenella attenuata graffmani;* ~1,000 sightings) and the common bottlenose dolphin (*Tursiops truncatus;* ~1,000 sightings). The other seven frequently encountered species were dwarf sperm whales (*Kogia sima;* ~100 sightings), rough toothed dolphins (*Steno bredanensis;* ~100 sightings), Bryde's whales (*Balaenoptera edeni;* ~30 sightings), gray whales (*Eschrichtius robustus;* ~30 sightings), eastern spinner dolphins (*Stenella longirostris orientalis;* ~20 sightings), false killer whales (*Pseudorca crassidens;* ~20 sightings), killer whales (*Orcinus orca;* ~20 sightings) and Cuvier's beaked whales (*Ziphius Cavirostris;* ~10 sightings) (Arroyo Sánchez, 2017). Additionally, increased observations of sperm whales (*Physeter macrocephalus*) during vessel surveys and aerial surveys have been made in the IMMA during the last five years, including groups of up to 30 animals (Nicola Ransome, unpublished data).

Supporting Information

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