

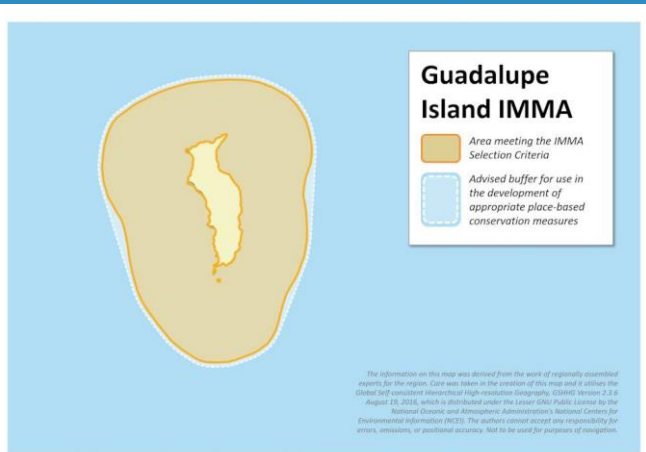
Guadalupe Island IMMA

Summary, continued.

It is one of the most biologically important sites in Mexico. Because of its isolation and the low impact of current anthropogenic activities, Guadalupe Island offers an opportunity to study the processes of regeneration, succession, and colonization. This island is the only breeding site for Guadalupe fur seals (*Arctocephalus philippii townsendi*), as well as the main breeding location in Mexico for northern elephant seals (*Mirounga angustirostris*). A small colony of California sea lions (*Zalophus californianus*) is also found on this island. A resident population of Cuvier's beaked whales (*Ziphius cavirostris*) forages and reproduces in this area, and around 13 cetacean species use the area regularly.

Description:

Guadalupe Island is located around 250 km west of the Baja California Peninsula, Mexico. This island is a volcanic formation that developed on the oceanic ridge of the eastern Pacific ridge, with a spreading activity that ceased 11 million years ago. 99% of the island perimeter, which is around 180 km long, is made up of cliffs more than 200 m high. Primary productivity in this region is accelerated because the island is located south of the California Current System. Physical forcing processes cause a sinking of the pycnocline and the nutricline, affecting the nutrient input to the euphotic zone. The sea surface temperature oscillates between 14.9 and 21.7°C. In relation to monthly sea surface temperatures, the southern part of the island is always warmer than the north. This difference ranges from 0.45°C in April to 0.59°C in December. As a result of this pattern, the difference in temperature between the north and south clearly denotes the cooling effect of the



Area Size

2 754 km²

Qualifying Species and Criteria

Guadalupe fur seal –

Arctocephalus philippii townsendi

Criterion A; B (1, 2); C (1, 2)

Northern elephant seal – *Mirounga angustirostris*

Criterion A; B (1); C (1)

Cuvier's beaked whale – *Ziphius cavirostris*

Criterion B (1); C (1)

Marine Mammal Diversity

Criterion D (2)

Zalophus californianus, *Tursiops truncatus*,

Lagenorhynchus obliquidens, *Delphinus delphis*,

Megaptera novaeangliae, *Balaenoptera musculus*,

Orcinus orca, *Balaenoptera edeni*,

Balaenoptera physalus, *Globicephala*

macrorhynchus, *Grampus griseus*,

Physeter macrocephalus

Summary

Guadalupe Island is a Biosphere Reserve, located 250km West of the Baja California Peninsula, Mexico. It is surrounded by nutrient rich waters, including undersea canyons that reach depths of up to 4,000 m. Guadalupe island and its islets were declared a Biosphere Reserve (BR) in 2005 due to their biological and ecological relevance.

California Current on the northern portion of Guadalupe Island. In terms of the bathymetry of the area, there are deep canyons in different parts of the northeastern coast, reaching depths up to 4,000 m. There are also other canyons found in other areas located in the middle portion of the island and towards the southeastern zone (Pares-Sierra et al., 1997; Gallo-Reynoso & Figueroa, 2005; Programa de Manejo- Reserva de la Biosfera Isla Guadalupe, 2013).

Guadalupe island and its islets were declared a Biosphere Reserve (BR) due to their biological and ecological importance on April 25, 2005. It is one of the most biologically important sites in Mexico. Because of its isolation and the low impact of current anthropogenic activities, Guadalupe Island offers an opportunity to study the processes of regeneration, succession, and colonization. The core zone of this BR is made up of Guadalupe Island and its islets: Islote Toro, Islote Zapato and Morro Prieto.



Figure 1: Map of the Guadalupe Island IMMA.

Criterion A: Species or Population Vulnerability

The Guadalupe fur seal (*Arctocephalus philippii townsendi*) was severely exploited in the late 18th and early 19th centuries, being declared as commercially extinct in 1897 (Hubbs, 1956). Its pre-exploitation population size reached 100,000-200,000 individuals (Hubbs, 1979) with a distribution from the Revillagigedo Islands, Mexico, to areas offshore from

Washington State, USA (Etnier, 2002). Currently its only remaining well-established breeding site is Guadalupe Island. Fur seals are mainly found along the east side of the island, and especially on the southern portion, called Punta Sur, where the largest aggregation of fur seals is located (Figure 2). There are also non-breeding sites on San Benito and in the Gulf of California (García-Aguilar et al., 2018a; Elorriaga-Verplancken et al., 2021; Gutiérrez-Ozuna et al., 2021; Gálvez et al., 2022). The species' current abundance is estimated as 57,199-72,631 individuals (Juárez-Ruiz et al., 2022), still under recovery and impacted by an unusual mortality event from 2015 to 2021 along the California, Washington, and Oregon coastlines (NOAA-Fisheries, 2021) as well as a 2015-2016 El Niño associated decline at San Benito (Elorriaga-Verplancken et al., 2016). These warm anomalies can change Guadalupe fur seal movement patterns due to changes in the availability of prey (Amador-Capitanachi et al., 2020). Although this fur seal species and the subspecies is currently classified as Least Concern (LC) on the IUCN Red List, it is 'Endangered' under Mexican Law (Norma-Oficial-Mexicana-NOM-059-SEMARNAT-2010) and 'Threatened' under the U.S. Endangered Species Act of 1973.



Figure 2: Guadalupe fur seals (mother and pup) at Punta Sur in Guadalupe Island. Photo credit: Fernando Elorriaga-Verplancken / CICIMAR-IPN.



Figure 3: Northern elephant seal colony at Guadalupe Island. Photo credit: Fernando Elorriaga-Verplancken / CICIMAR-IPN.

The northern elephant seal (*Mirounga angustirostris*) colony (Figure 3) on Guadalupe Island is one of the three main breeding locations (Guadalupe, San Benito Archipelago, and Cedros Island) off the Baja California Peninsula (Arias del Razo et al., 2017). The abundance of northern elephant seals in Baja California colonies, including Guadalupe Island, has decreased during the last three decades, probably as a consequence of increased local air temperatures. This species is classified as 'Threatened' under Mexican Law (Norma-Oficial-Mexicana-NOM-059-SEMARNAT-2010).

An indicator of this decline is that the contribution of the Baja California (Mexico) colonies in terms of number of births for the entire species decreased from 25% in the early 1990s to 11% in 2009 (García-Aguilar et al., 2018b). This represents a significant

number in relation to the population of around 201,000 in California (Lowry et al., 2014) and around 22,000 on the Baja California Peninsula, Mexico (García-Aguilar et al., 2018b). Even though they are mainly present in winter and spring-summer for breeding and moulting, respectively, they are present on the island year-round (Programa de Manejo-Reserva de la Biosfera Isla Guadalupe, 2013). Adult female and male northern elephant seals perform two annual migrations off Guadalupe Island to the northern Pacific, where their main foraging grounds are located; one is accomplished after the breeding season in winter and another one after the moulting season in spring-autumn (Robinson et al., 2012).

Preliminary photo-identification studies combined with the data collected by Cárdenas-Hinojosa et al. (2015), indicated a total of 87 individual Cuvier's

beaked whales (*Ziphius cavirostris*) (Figure 4) are likely resident in the waters around the island. More than half of these photo-identified individuals were seen more than once (n= 57) (Cárdenas-Hinojosa et al., 2022).

A long-term acoustic monitoring using a High-frequency Acoustic Recording Package (HARP) deployed from November 2018 to October 2020 in Bahía Norte, revealed year-round presence of Cuvier's beaked whales around Guadalupe Island (Cárdenas-Hinojosa et al., 2015, 2022).



Figure 4: Beaked whales (*Ziphius cavirostris*) off Guadalupe Island. Photo credit: Daniel Martínez.

Sub-criterion B2: Aggregations

The largest aggregation of Guadalupe fur seals anywhere in the species' range is on the east coast of Guadalupe Island. This represents almost the entire

extant population for the species. More than 99% of all births take place on this island. Hence, even though there are non-breeding Guadalupe fur seal sites elsewhere (Elorriaga-Verplancken et al., 2021; Gutiérrez-Osuna et al., 2021; Gálvez et al., 2022), all individuals are part of the Guadalupe Island population, since they were born on this island (García-Aguilar et al., 2018a). Most of the colony remains on the island year-round, although male Guadalupe fur seals seem to perform migrations off Guadalupe Island once the breeding season is over (Pierson, 1987; Gallo-Reynoso, 1994). Additionally, juvenile, subadult, and adult males also perform seasonal migrations to the San Benito Archipelago (Aurioles et al., 2010; Elorriaga-Verplancken et al., 2016) and to the Gulf of California (Elorriaga-Verplancken et al., 2021; Gálvez et al., 2022).

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

Guadalupe Island is the only known reproductive site for the Guadalupe fur seals, with reproductive areas located along the entire east coast (García-Aguilar et al., 2018 ; Juárez-Ruiz et al., 2022). The number of Guadalupe fur seal pups born on this island is related to annual shifts in sea surface temperature. Numbers ranged between ~12,500 and 15,400 in 2018-2019 (Juárez-Ruiz et al., 2022). Northern elephant seals also breed on Guadalupe Island and this colony on the island represents around 60% of the births (around 3,000 in 2009) in the Baja California (Mexico) population (García-Aguilar et al., 2018b). Resident Cuvier's beaked whales also reproduce in the area (Cárdenas-Hinojosa et al., 2016). Surveys conducted from October 2016 to February 2021 documented a total of 384 sightings, of which 93 were of mother and calf pairs (Cárdenas-Hinojosa et al., 2022).

Sub-criterion C2: Feeding Areas

Guadalupe fur seals undertake foraging trips around Guadalupe Island. Preliminary data suggest that a foraging area around Guadalupe Island is occupied in around 40% of the time by this species (Amador-Capitanachi, 2018). Like other otariids (Boness and Bowen, 1996), adult females that give birth every summer, must alternate maternal care with localised foraging trips during the 8–9-month lactation period until pups are weaned (Gallo-Reynoso, 1994). This fur seal diet is primarily teutophagous in this region, mostly comprising jumbo squid (*Dosidicus gigas*) and opalescent squid (*Doryteuthis opalescens*), as well as other squid species and Myctophidae members (Amador-Capitanachi et al., 2020).

Criterion D: Special Attributes

Sub-criterion D2: Diversity

High levels of productivity and a wide range of habitats from beaches to deep near-shore canyons support a wide range of marine mammal species off Guadalupe Island. Perhaps the most notable species is the Guadalupe fur seal, which resides in the IMMA year-round and breeds on the island. Cuvier's beaked whales and northern elephant seals are also present throughout most of the year, as are California sea lions. Other cetacean species that are regularly observed in the Guadalupe Island IMMA include fin whales (*Balaenoptera physalus*), blue whales (*Balaenoptera musculus*), Bryde's whales (*Balaenoptera edeni*), humpback whales (*Megaptera novaeangliae*), common bottlenose dolphins (*Tursiops truncatus*), common dolphins (*Delphinus delphis*), short-finned pilot whales (*Globicephala macrorhynchus*), Risso's dolphins (*Grampus griseus*), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), killer whales (*Orcinus orca*), sperm whales (*Physeter macrocephalus*), as well as dwarf and pygmy sperm whales (*Kogia* spp) (Gallo-Reynoso

and Figueroa-Carranza, 2005 ; Programa de Manejo-Reserva de la Biosfera Isla Guadalupe, 2013; Cárdenas-Hinojosa, unpublished data).

Supporting Information

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