

# Pacific Coast of Baja California Peninsula IMMA

## Summary, continued.

nurse young in the area, and the behavior of satellite-tracked individuals suggests they also feed in the waters of this IMMA.

## Description:

This region is influenced by the southern end of the California Current (CC) and the eastern boundary upwelling system. It's considered a transition zone (Roden, 1971) due to the confluence of water masses with different physicochemical properties: subarctic water that is transported southward by the CC, tropical surface water, and subtropical surface water that flows from the areas south and southwest of the peninsula.

Biological diversity and the physicochemical variability in the region are modulated by the interactions and boundaries between the water masses and their spatiotemporal variability. For example, the CC is more intense and influences the entire area off Baja California during spring, whereas during autumn–winter, the weakening of this current allows waters of tropical and subtropical origin to enter the region (De la Cruz-Orozco et al., 2017). This variability divides the peninsula into two regions: one with subarctic characteristics north of Punta Eugenia and one with warmer conditions south of Punta Eugenia (Durazo, 2015).

The California Current System is a transitional area that extends along the entire west coast of Baja California. It is a transition area consisting of surface



## Area Size

239 132 km<sup>2</sup>

## Qualifying Species and Criteria

Blue whale – *Balaenoptera musculus*

Criterion A; C (2, 3); D2

Humpback whale – *Megaptera novaeangliae*

Criterion B (2); C (3)

Gray whale – *Eschrichtius robustus*

Criterion A; B (2); C (1,3)

## Marine Mammal Diversity

Criterion D (2)

*Balaenoptera musculus*, *Megaptera novaeangliae*, *Eschrichtius robustus*

## Summary

The Pacific Coast of Baja California is one of the richest and most diverse marine mammal areas worldwide, with around 26 species of cetaceans and pinnipeds regularly present in the area. Eastern North Pacific gray whales and the endangered Western North Pacific gray whales (*Eschrichtius robustus*) use the areas for breeding, suggesting that interbreeding between these two populations during the winter breeding season may occur. Humpback whales (*Megaptera novaeangliae*) and Endangered blue whales (*Balaenoptera musculus*) also migrate along this coast. Blue whales are known to mate, calve and

current transporting water from the subarctic divergence towards Equator. This also includes water from the eastern North Pacific Central, coming from the west along its course. Seasonal upwelling provides the system with water rich in nutrients (Lluch-Belda et al., 2003). According to Moser et al. (1987), the major faunal assemblages that result from these oceanographic conditions in the region are: *transitional*, or the California Current System itself, limited to the north by the *subarctic*, to the west by the *central* and by the *equatorial* domains at the south (Lluch-Belda et al., 2003). The California Current System fauna is a mixture of species from each of these domains plus some that are endemic, reflecting its transitional nature (Moser et al., 1987).

A 2002 decree published in the Mexican Federal Register established the protection of all large whale species, larger than 4 meters in size, included in the suborders Mysticeti and Odontoceti all in Mexican waters. Specific MPAs in this include the gray whale sanctuaries declared in 1972 for Ojo de Liebre Lagoon and 1979 for San Ignacio Lagoon. Since 1993, both lagoons have formed part of the Biosphere Reserve of El Vizcaino, a World Heritage Site.

## **Criterion A: Species or Population Vulnerability**

Two gray whale (*Eschrichtius robustus*) populations occur in the North Pacific. Both eastern and western populations were dramatically reduced by commercial whaling during the 19<sup>th</sup> and 20<sup>th</sup> centuries. While the Eastern North Pacific (ENP) population is now considered the Least Concern on the IUCN Red List of Threatened Species (Cooke, 2018), the Western gray whale subpopulation is Endangered (Cooke et al., 2018). Western gray whales feed in the Okhotsk Sea off Sakhalin Island, Russia, and in nearshore waters of the south-eastern Kamchatka Peninsula (southwestern Bering Sea).

Little is known about the current migratory routes and wintering areas of the WNP population, but historical evidence indicates that the coastal waters of eastern Russia, the Korean Peninsula, and Japan were part of the migratory route and that areas in the South China Sea were used as wintering grounds (see review by Weller et al., 2002). However, photo-identification records provide evidence that at least 54 gray whales migrated from the feeding grounds in Russia to the eastern Pacific and the wintering grounds encompassed by this IMMA in Baja California. These whales represent nearly 20% of the known Sakhalin Island gray whale population. Cook et al. (2019) estimated the proportion of the Sakhalin feeding population that migrates to the Eastern North Pacific to be 45-80%.

The Western North Pacific population of gray whales numbered 175 animals (Bayesian 95% CI 158-193) in 2016 (Cook et al., 2016). Although there is evidence that the population is slowly recovering, it remains on the edge of survival (<https://iwc.int/management-and-conservation/conservation-management-plans/western-gray-whale-cmp>). Abundance estimates for the Western Feeding Group in 2017 range from about 150 to 320 whales (aged 1 yr and over) depending on the assumptions used for stock structure hypotheses (Cooke, 2019). Photo-identification and genetic studies have shown the complexity of mixing between the WNP and ENP.

## **Criterion B: Distribution and Abundance Sub-criterion B2: Aggregations**

Eastern gray whales winter in the breeding lagoons and adjacent waters of Baja California, Mexico, and then migrate north along the west coast of North America to feed in the Bering and Chukchi Seas during summer (Rice & Wolman, 1971). It is well documented that individuals from the western

populations aggregate in the breeding lagoons in Mexico (Weller et al., 2012; Mate et al., 2015). The lagoons within this IMMA represent the only known regular breeding grounds for the species, constituting significant aggregations for the species (Figure 1).

## **Criterion C: Key Life Cycle Activities**

### **Sub-criterion C1: Reproductive Areas**

Gray whales from the Eastern and Western north Pacific spend about 3 months in the Mexican wintering areas, where they mate and give birth between December and April (Jones & Swartz, 1984; Swartz, 1986). Gray whales' calving areas along the west coast of the Baja California Peninsula are

Laguna Ojo de Liebre (Scammon's Lagoon); Laguna Guerrero Negro (when its entrance is open); Laguna San Ignacio; and Bahía Magdalena and adjacent waters (from Estero Las Animas to Bahía Almejas). About the 70% of the mothers with calves are concentrated in Laguna Ojo de Liebre, 14% in Laguna San Ignacio, and 16% in the Bahía Magdalena-Bahía Almejas complex. The average duration of stay in a breeding lagoon for breeding adults is 10 days, although females with calves may stay a month or longer in one area (Urban et al., 2003). Whales have typically departed from the Baja lagoons by late March. Genetic studies suggest interbreeding between Eastern and Western populations during the winter breeding season (Brüniche-Olsen et al., 2018; Lang et al., 2021) (Figure 2).



Figure 1: Gray whale (*Eschrichtius robustus*). Photo credit: Jorge Urbán PRIMMA/UABCS.

Blue Whales: although blue whale births have not been documented off the western Baja Peninsula or in the Gulf of California, females with nursing calves occur in the Gulf. It is assumed that calving occurs in open, offshore waters (Sears et al., 2013), and the waters off western Baja are a strong possibility.



Figure 2: Gray whales in the breeding lagoons. a) mother and calf; b) male gray whale mating. Photo credits: Sergio Martínez PRIMMA/UABCS.

### Sub-criterion C2: Feeding Areas

North Pacific blue whales spend their summers off the west coast of the United States, where they do most of their feeding for the year, and then migrate to warmer, less productive waters during the winter, where calving occurs. Although rorquals have generally been thought to fast while on the breeding grounds, blue whales are also known to feed on their wintering/breeding grounds in the ETP and Gulf of California (Busquets-Vass et al., 2021). Data inferred

from satellite-tracked blue whales show that in addition to the summer feeding areas off California and Oregon, much additional feeding apparently occurs off the west coast of Baja, in the Gulf of California, and on the Costa Rica Dome (Johnson et al., 2022) (Figure 3).



Figure 3: Blue whales on the west coast of the Baja California Peninsula. Photo credit: Sergio Martínez PRIMMA/UABCS.

### Sub-criterion C3: Migratory Areas

Gray whales migrate along the outer coast of the Baja California Peninsula, heading north in the Northern Hemisphere spring and south in the Northern Hemisphere autumn (Rice & Wolman, 1971; Jones & Swartz, 1984; Rugh et al., 2001; Urbán et al., 2021).

Additionally, two separate and largely allopatric populations of blue whales occur in ETP waters, one that derives from the Northern Hemisphere, the other from the Southern. Most ETP blue whales are from the North Pacific; they spend the summer feeding in

the California Current or further north and then migrate to winter feeding and nursery grounds in the Gulf of California or the Costa Rica Dome (Reilly & Thayer, 1990; Ballance et al., 2006; Hamilton et al., 2009; Busquets-Vass et al., 2021), although a few blue whales can be found year-round on these 'wintering' grounds (Busquets-Vass et al., 2021). Southern Hemisphere blue whales occur off Ecuador and in the Galapagos Islands mostly during the austral winter. Most migrating eastern North Pacific blue whales travel along the coast of Baja California; those that make it to the tip of the Baja peninsula either turn up into the Gulf of California or continue south to the Costa Rica Dome.

The waters along the west coast of the Baja California Peninsula serve as a migratory corridor for humpback

whales traveling from their feeding grounds along the west coast of USA and British Columbia to their wintering grounds in the coastal waters mainland Mexico and Central America (Urban et al., 2000; González-Peral, 2011).

## Criterion D: Special Attributes

### Sub-criterion D2: Diversity

There are 22 species of cetaceans and 4 of pinnipeds within this IMMA (Hamilton et al., 2009; Medrano & Urbán, 2018). Among the cetacean populations are resident populations of bottlenose dolphins (*Tursiops truncatus*). Migratory whales such as blue, humpback and gray whales also use the area as a wintering ground.

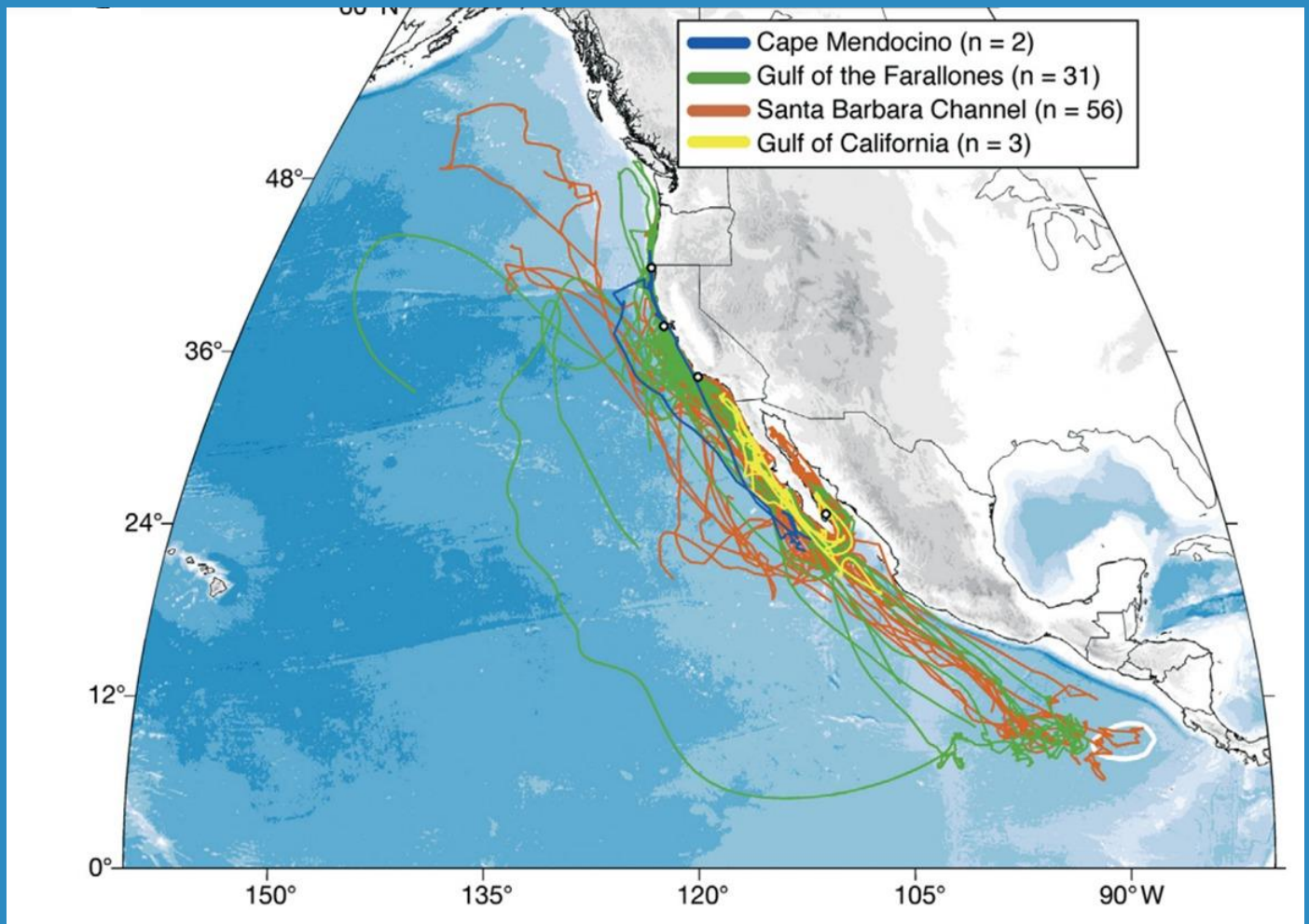


Figure 4: *Balaenoptera musculus*. Individual switching state-space model (SSSM)-derived tracks for 92 tags on blue whales deployed between 1994 and 2007 that transmitted for more than 7 d, color coded by deployment location. Reproduced from Bailey et al. (2009).

## Supporting Information

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