Area Size

205 564 km²

Qualifying Species and Criteria

Humpback whale – *Megaptera novaeangliae*

[North Pacific – *M. n. kuzira*]

Criterion A; C (2, 3)

Marine Mammal Diversity

Megaptera novaeangliae, Balaenoptera edeni, Delphinus delphis, Grampus griseus, Kogia sima, Mesoplodon peruvianus, Orcinus orca, Pseudorca crassidens, Stenella attenuata, Stenella coeruleoalba, Stenella longirostris, Tursiops truncatus, Steno bredanensis

Summary

This IMMA encompasses coastal waters of Central America and the adjacent waters of Southern Mexico, which host multiple sites important for the reproduction and migration of North Pacific humpback whales (*Megaptera novaeangliae kuzira*). The population using this area is the Central America Distinct Population Segment, which is designated as Endangered under the United States Endangered Species Act due to its low numbers, genetic discreteness, and exposure to human influences. Boat-based surveys, acoustic monitoring, satellite telemetry

Central America Humpback Whale Corridor IMMA

Summary, continued.

and photo-identification show that whales exhibit high site fidelity to this area and that they move between multiple sites within the wider area during the breeding season. Observations indicate that whales mate, calve, nurse, and travel in this large IMMA, and that opportunistic feeding occurs regularly off the coasts of Nicaragua and Costa Rica.

Description:

The humpback whale breeding and migratory corridor in the Eastern Pacific is characterized by the presence of a continental shelf that extends from southern Mexico through Central America south to Panama's most southern border. Globally, humpback whale breeding areas occur in the tropics, usually in warm water temperatures ranging from 21°C to 29°C (Rasmussen et al., 2007; Derville et al., 2018; Rasmussen et al., 2017) and in relatively shallow depths of less than 200 m (Rasmussen et al., 2017; Meynecke et al., 2021).

The IMMA is part of the wider Eastern Tropical Pacific (ETP) region (Heileman, 2008). The ETP is characterized by a strong shallow thermocline, and relatively high sea surface temperatures and strong winds (Heileman, 2008). The southern part of Mexico and northern part of Central America form part of the eastern Pacific warm pool, which constitutes an open-ocean biogeographic province with a distinct biological community (Fiedler & Talley, 2006; Lavín et al., 2006). The IMMA is part of a marine mega-ecosystem characterized by gulfs, bays, coastal lagoons, and extensive intertidal areas and barriers.

Important geographic features include the transboundary Gulf of Fonseca, which is shared by Nicaragua, Honduras, and El Salvador; and the highly productive Gulf of Nicoya, and Golfo Dulce, which represent some of the deepest embayments within the IMMA, both in Costa Rica (Gocke et al., 2001; Lizano & Alfaro, 2004).

The IMMA also encompasses the Costa Rica Dome, an open-ocean upwelling region caused by a seasonally changing combination of interconnected features including the Intertropical Convergence Zone, coastal jets and eddies, and geostrophic balance at the eastern extreme of the 10°N thermocline ridge. The Dome has relatively high primary and secondary production. As a result, it supports a higher density of marine fauna, including cetaceans, than other parts of the Central American marine ecosystem (Fiedler & Talley, 2006; Lavín et al., 2006). It likely influences the high productivity of the Pacific Central American coast (Heileman, 2008).

The climate varies from tropical to temperate, with a dry period during the winter months, coinciding with the months that humpback whales are present in the region. The Central American region is also affected by the El Niño Southern Oscillation (ENSO), which drastically changes the marine environment at unpredictable intervals, causing high inter-annual oceanic and atmospheric variation (Fiedler & Talley, 2006; Heileman, 2008; Wang & Fiedler, 2006). Further, ENSO appears to decrease the encounter rates of species such as the North Pacific humpback whale (*Megaptera novaeangliae kuzira*) in Costa Rica (Pelayo-Gonzalez et al., 2022).

The IMMA has several anthropogenic influences. Human population growth, overfishing, bycatch, chemical pollution, and wastewater discharges are among the top potential threats (Heileman, 2008; CPPS, 2000; PNUMA, 2001; Rubio et al., 2001; Sanchez, 2001). The major ports along the IMMA include the Port of Manzanillo (Mexico; Kaluza et al., 2020), Panama Canal (Panama; Guzman et al., 2020), and San Jose (Guatemala; Kaluza et al., 2010).

Information on existing protective measures and jurisdiction is limited. In Costa Rica, the Government declared the country's Exclusive Economic Zone (EEZ) as a "Santuario de Ballenas y Delfines" (Sanctuary for Whales and Dolphins), in a Presidential Decree in 2008 (Figure 1). The Pacific portion of this sanctuary covers 580,000 km². It includes part of the Costa Rican Thermal Dome area, the Cocos Submarine Range, and three gulfs. In Panama, a similar legislation was implemented and declares that the protection and conservation of all marine mammals in its territorial waters. All the countries that are part of this IMMA are members of the International Marine Organization, a specialized agency of the United Nations which is responsible for measures to improve the safety and security of international shipping and to prevent pollution from ships (https://www.imo.org).

Criterion A: Species or Population Vulnerability

North Pacific humpback whales that use the IMMA are part of the Central America Distinct Population Segment (DPS) which is classified as 'Endangered' by the United States Endangered Species Act (81 FR 62260, September 8, 2016). The Central America DPS is one of 14 DPS of humpback whales around the world, and one of only four DPS listed as endangered (Bettridge et al., 2015).

A DPS is made up of whales that share the same latitude breeding area but migrate seasonally to specific mid-to high latitude feeding grounds that may differ among individuals (Bettridge, 2019). The Central America DPS is composed of whales that

Figure 1: The Costa Rica Exclusive Economic Zone which was declared as a "Santuario de Ballenas y Delfines" (Sanctuary for Whales and Dolphins) in the 2008 Presidential Decree. Source: Instituto Nacional Geographico Nacional de Costa Rica, Registro Nacional Edicion 1-IGNCR 2018).

breed along the Pacific coast of Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama (Bettridge et al., 2015; Curtis et al., 2022; Taylor et al., 2021). This DPS wintering area is understood to extend into southern Mexico (Wade, 2016; Curtis et al., 2022).

The population estimate for the Central America DPS varies between 500-700 individuals depending on the mark-recapture method used (Calambokidis et al., 2008; Barlow et al., 2011; Wade, 2016). The population estimate of this IMMA, which includes the Southern Mexico-Central America region, is approximately 1,500 whales (Curtis et al., 2022). In comparison, the abundance of humpback whales off the United States west coast, which includes some of the Central America DPS whales, is estimated to be approximately 5,000 individuals (Calambokidis & Barlow, 2020).

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

There are critical calving and reproductive habitats for the North Pacific humpback whales all along the Pacific coast of southern Mexico (Martínez-Loustalot et al., 2023), Guatemala (Quintana-Rizzo, 2019), El Salvador, Nicaragua (De Weerdt et al., 2022), Costa Rica, and Panama. In each of these areas, visual and acoustic monitoring have identified group compositions and behaviour associated with reproductive areas.

Singing males have been observed and recorded in Guatemala (Quintana-Rizzo, 2011, 2019), Nicaragua (De Weerdt et al., 2022), Costa Rica (Chereskin et al., 2019), and Panama (Rasmussen et al., 2011).

Competitive groups, in which males presumably compete for access to receptive females, have been identified in multiple sites throughout the area (Figure 2) (Rasmussen et al., 2011; Vazquez-Cuevas et al., 2021; De Weerdt et al., 2022).

Females with calves of different sizes have also been documented in every study area in the region and represent between 18% and 28% of the local sightings in different sites (Rasmussen et al., 2011; Rasmussen et al., 2017; Quintana-Rizzo, 2019; Vazquez-Cuevas et al., 2021; De Weerdt et al., 2022; Figure 3). As has been documented on other humpback whale reproductive grounds, females with calves appear to prefer inshore areas and protected bays all along the IMMA (De Weerdt et al., 2022; Quintana Rizzo, 2011, 2019).

A few sightings (<10 individuals) of humpback whales, including adults and calves, have been reported between February and April off the coast of Colombia (Avila et al., 2013, 2020; Palacios et al., 2012), which coincides with the breeding season of *M. n. kuzira*. No photo-identification records exist to confirm whether these individuals are part of the

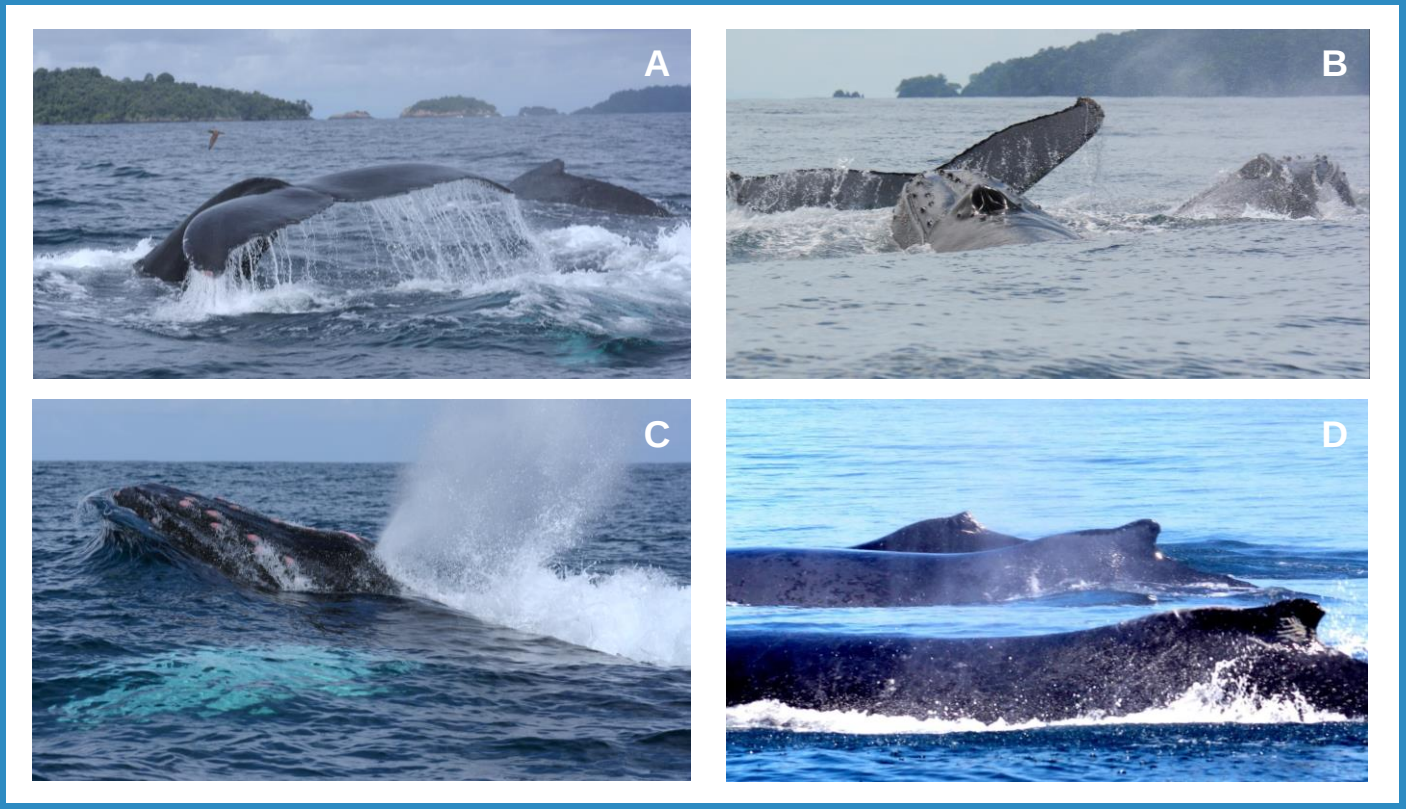

Figure 2: Different competitive groups of humpback whales sighted in Panama (A-C, Photo credit: Kristin Rasmussen) and Guatemala (D, Photo credit: Ester Quintana-Rizzo). Bloody tubercles are a common feature of this type of groups.

Figure 3: Humpback whale females with calves sighted in different parts of the IMMA. Left: Costa Rica (Photo credit: Frank Garita) and right: Guatemala (Photo credit: Ester Quintana-Rizzo).

Figure 4: Humpback whales traveling in the Humpback Whale Central America corridor. Top: Costa Rica (Photo credit: Frank Garita) and bottom: Guatemala (Photo credit: Ester Quintana-Rizzo).

Northern Hemisphere population. Future research will help understand if the extent of the IMMA for the Central America humpback whale corridor should be expanded further to the south.

Sub-criterion C3: Migration Routes

Humpback whales undertake extensive seasonal migrations between high latitude summer feeding grounds and low latitude wintering grounds. Winters are spent mating and calving in warm sub-tropical waters, with an annual migration back to colder waters to feed. In the north Pacific, their breeding and migratory corridor includes the Pacific continental shelf from the southern portion of Mexico and Central America. During their migration to/from Central America, these whales use the coastal waters of Southern Mexico (Martínez-Loustalot et al., 2023).

Within a breeding season, resightings between study areas encompassed by this IMMA suggest that individual whales can visit multiple areas within Central America (Quintana-Rizzo & Calambokidis, 2017; Curtis et al., 2022). This highlights the interconnectivity of the different sites (Mate et al., 2018) and that this IMMA also serves as a migratory corridor for the species.

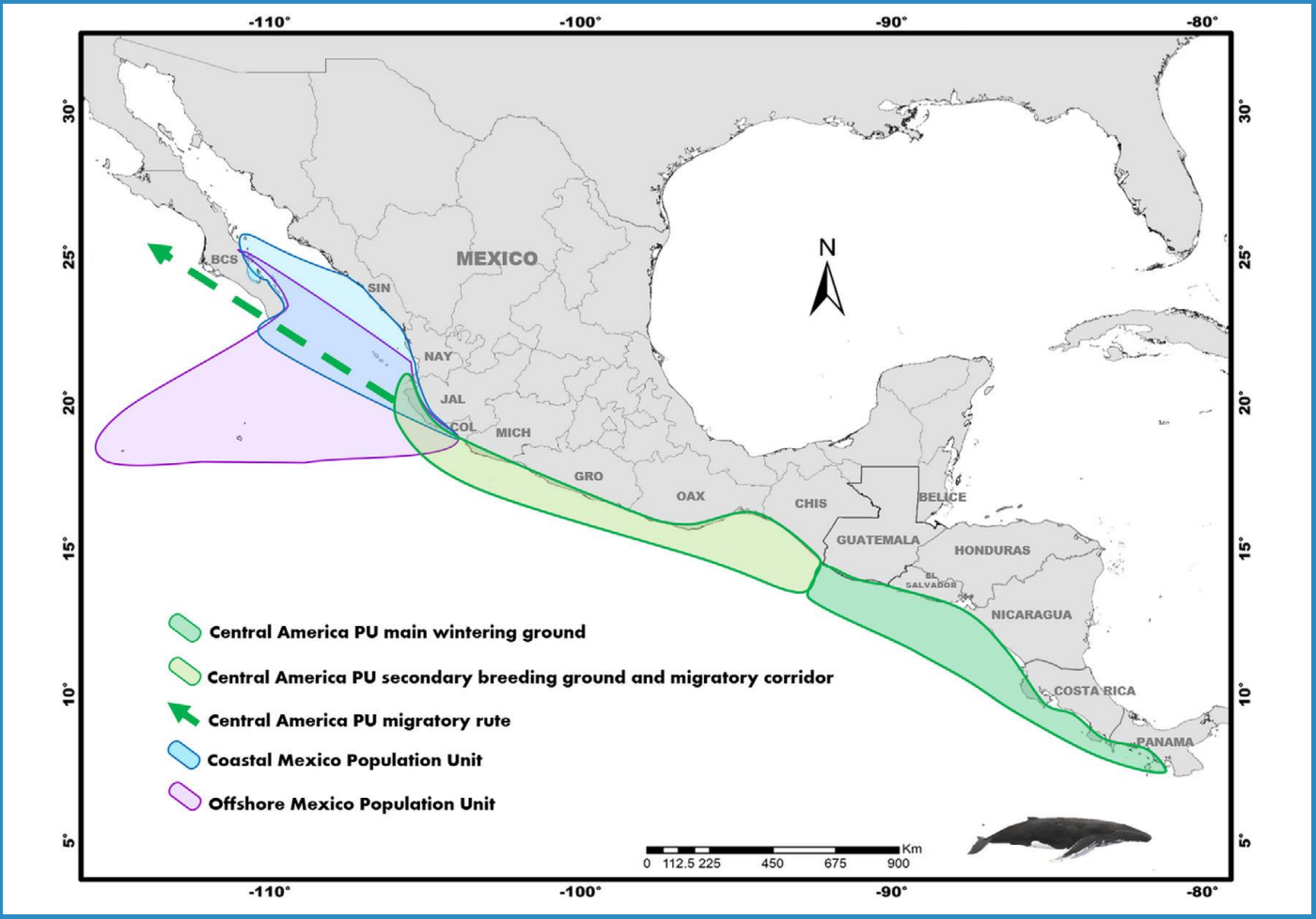

Figure 5: Martínez-Loustalot et al. (2023) proposed a new Central America Population Unit (PU) corridor and main wintering ground of humpback whales (*Megaptera novaeangliae*). This is a modified version of the original Central America distinctive population segment (81 FR 62260, September 8, 2016). The proposed three PU areas of the Mexican Pacific coincide with Coastal Mexico PU, Offshore México PU, and Central American PU.

Supporting Information

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