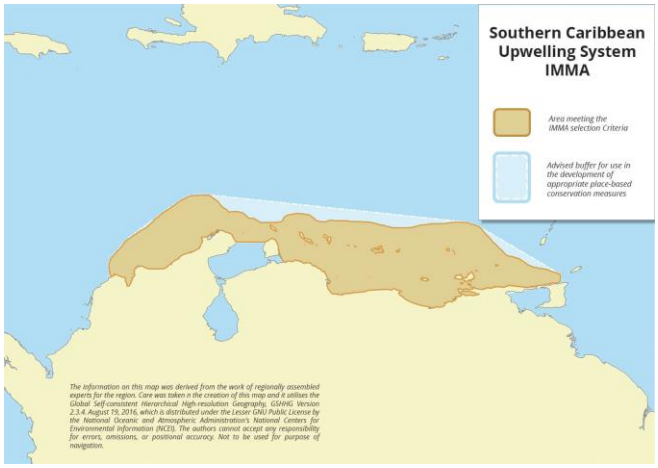
# Southern Caribbean Upwelling System IMMA




## Area Size

245,226 km²

## Qualifying Species and Criteria

Sperm Whale – *Physeter macrocephalus*

Criterion A; C (2)

Bryde's Whale – *Balaenoptera edeni*

Criterion C (2)

Common Dolphin – *Delphinus delphis*

Criterion C (2); D (1)

Pantropical Spotted Dolphin – *Stenella attenuata*

Criterion C (2)

Atlantic Spotted Dolphin – *Stenella frontalis*

Criterion B (1); C (2)

Spinner Dolphin – *Stenella longirostris*

Criterion C (2)

Rough-toothed Dolphin – *Steno bredanensis*

Criterion C (2)

Common Bottlenose Dolphin – *Tursiops truncatus*

Criterion B (1); C (2)

Humpback Whale – *Megaptera Novaeangliae*

Criterion C (1)

Criterion D (2) – Marine Mammal Diversity

*Balaenoptera edeni, Delphinus delphis, Globicephala macrorhynchus, Megaptera novaeangliae, Orcinus orca, Physeter macrocephalus, Sotalia guianensis, Stenella attenuata, Stenella frontalis, Stenella longirostris, Steno bredanensis, Tursiops truncatus*

## Other Marine Mammal Species Documented

*Feresa attenuata, Grampus griseus, Kogia sima, Mesoplodon europaeus, Peponocephala electra, Pseudorca crassidens, Stenella clymene, Stenella coeruleoalba, Trichechus manatus manatus, Ziphius cavirostris*

## Summary

The Southern Caribbean Upwelling System IMMA is located off the north coast of Venezuela. It extends from the mouth of the Magdalena River in Colombia, along the continental margin, to the north coast of Trinidad Island, 166 km offshore, and encompasses a number of recurrent upwelling foci areas that influence the sea surface temperature and primary productivity of this area. The high primary productivity supports a considerable biomass of small pelagic fish, and a high marine mammal species diversity. It provides feeding areas for sperm whales (*Physeter macrocephalus*), Bryde's whales (*Balaenoptera edeni*), common dolphins (*Delphinus delphis*), Atlantic spotted dolphins (*Stenella frontalis*), common bottlenose dolphins (*Tursiops truncatus*), pantropical spotted dolphins (*Stenella attenuata*), rough-toothed dolphins (*Steno bredanensis*), and Gray's spinner dolphins (*Stenella longirostris longirostris*). Guiana dolphins (*Sotalia Guianensis*) and short-finned pilot whales (*Globicephala macrorhynchus*) are regularly sighted too. Humpback whales (*Megaptera novaeangliae*) are observed primarily during the Northern Hemisphere winter months. A total 22 species occur in this productive seascape. Furthermore, there is evidence for distinctiveness for common dolphins within this IMMA that also encompasses several MPAs.

## Description:

The Southern Caribbean Upwelling System is located off the north coast of South America. With an area of 253,000 km$^2$ from the continental margin at the mouth of the Magdalena River (Arévalo-Martínez &

Franco-Herrera, 2008) to the easternmost point of the north of Trinidad and Tobago Islands, extending over 166 km offshore to encompass the 24-degree Celsius isotherm (Müller-Karger et al., 2001, 2004; Rueda-Roa & Müller- Karger, 2013). It includes the Aruba-Bonaire-Curaçao Islands and many key archipelagos, as well as important features of high topographic complexity such as the Cariaco Trench. This area hosts a great diversity of cetaceans, particularly related to the increased productivity due to coastal upwelling, characterized by low Sea Surface Temperature (SST) values, with 8.5 months where SSTs is below 26 degrees Celsius. In this region, 21 recurrent coastal upwelling foci (f1-f21, see Appendix B, in Rueda-Roa & Müller-Karger, 2013) and their corresponding plumes occur over a variable continental shelf, increasing the retention mechanisms for small pelagic eggs and larvae. This habitat supports a large Spanish sardine fishery. The IMMA includes several Marine Protected Areas. In Colombia, the MPAs from west to east include five areas: the Isla de Salamanca National Natural Park (NNP), Ciénaga Grande de Santa Marta Fauna and Flora Sanctuary, Los Flamencos NNP, Pastos Marinos Sawairo Integrated Management District, and Bahía Portete – Kaurrele NNP. In Venezuela, the Mochima, Morrocoy, and Archipiélago de los Roques National Parks are included.  In Bonaire, the entire Economic Exclusive Zone is designated as Yarari Marine Mammal & Shark Sanctuary.

## Criterion A: Species or Population Vulnerability

This IMMA hosts the regular presence of sperm whales (*Physeter macrocephalus*), which are globally assessed as 'Vulnerable' according to the IUCN Red List (Taylor et al., 2019), with data indicating a concerning decline in populations over time (Whitehead & Shin, 2022). Concerns persist in the neighboring community of sperm whales in the Lesser Antilles which continue to decline (Gero & Whitehead, 2016). This is exacerbated by the species' complex social organization. Culture appears to structure communities of females into clans based on coda vocalizations (Gero et al., 2016; Rendell & Whitehead, 2003), indicating cultural ecological specialization and habitat partitioning on flexible spatial scales according to local conditions (Vachon et al., 2022).

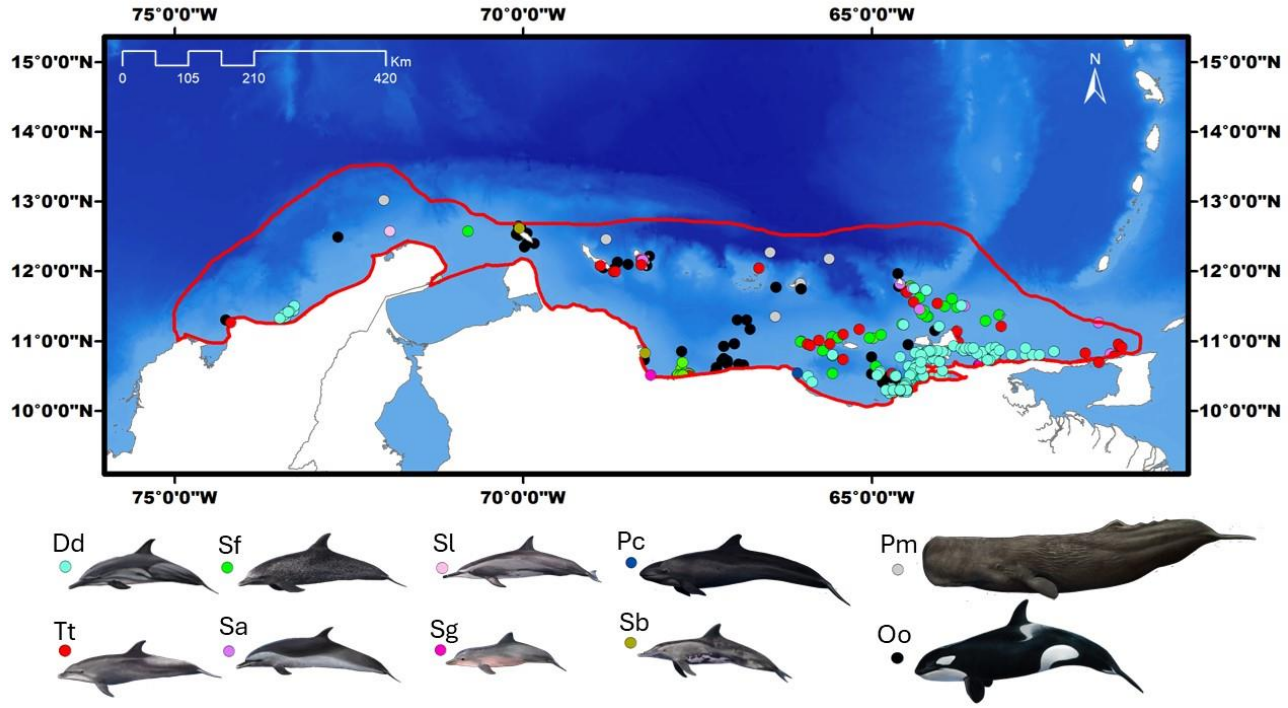
## Criterion B: Distribution and Abundance Sub-criterion B1: Small and Resident Populations

There are resident and semi-resident populations of bottlenose dolphins (*Tursiops truncatus*) and Atlantic spotted dolphins (*Stenella frontalis*) off the central coast of Venezuela, specifically along the Aragua State coast (Bolaños-Jiménez et al., 1998; Bolaños-Jiménez, 2017; Sifontes, 2013). At least 25% of the bottlenose dolphins recorded (14 individuals) are considered resident (4-8 individuals with resightings over periods of between 198-344 days; Cobarrubia-Russo et al., 2021). One individual of Atlantic spotted dolphin has been resighted over a period of at least 15 years (1996-2009) (Bolaños-Jiménez et al., 1998; Bolaños-Jiménez, unpublished data; González-Fernández, 2000).

Figure 1: Atlantic spotted dolphin (*Stenella frontalis*) leaping out of the water in Venezuela. Photo credit: Jaime Bolaños-Jiménez.

Figure 2: Atlantic spotted dolphins (*Stenella frontalis*) leaping out of the water in this IMMA. Photo credit: Caribbean Cetacean Society.

## Map 1 – Odontocetes (toothed whales and dolphins)




**Dd** = *Delphinus delphis* – Common dolphin (light blue), **Sf** = *Stenella frontalis* – Atlantic spotted dolphin (green)
**Sl** = *Stenella longirostris* – Spinner dolphin (pink), **Pc** = *Pseudorca crassidens* – False killer whale (blue)
**Pm** = *Physeter macrocephalus* – Sperm whale (gray), **Oo** = *Orcinus orca* – Killer whale (black)
**Tt** = *Tursiops truncatus* – Bottlenose dolphin (red), **Sa** = *Stenella attenuata* – Pantropical spotted dolphin (purple)
**Sg** = *Sotalia guianensis* – Guiana dolphin (magenta), **Sb** = *Steno bredanensis* – Rough-toothed dolphin (brown)

**Red line**: Boundaries of the Important Marine Mammal Area (IMMA)
**Coloured dots**: Sightings of different odontocete species

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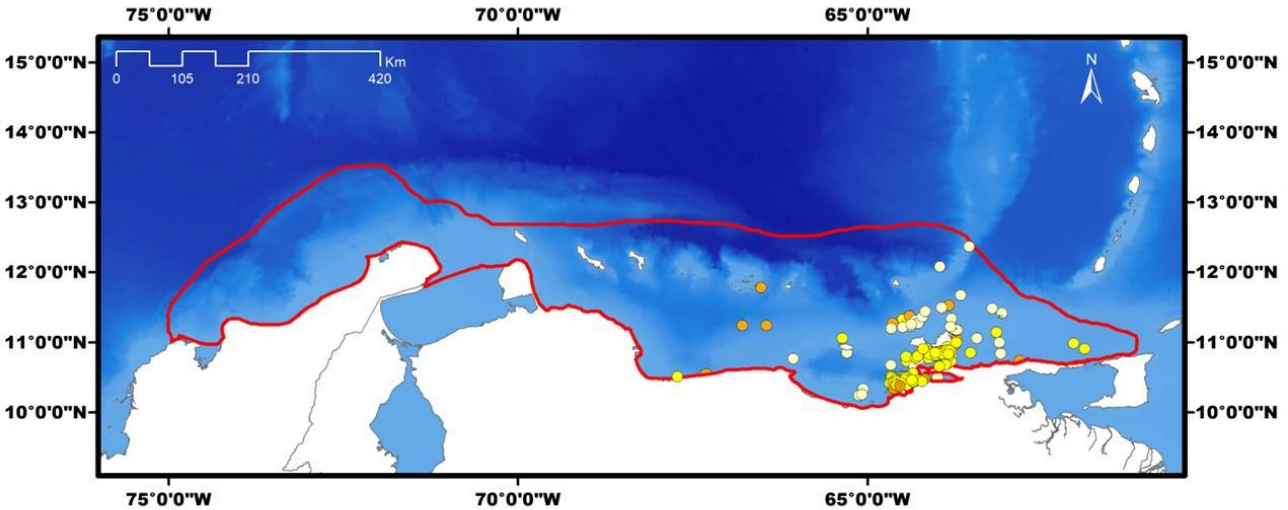
## Map 2 – Mysticetes (baleen whales)




*Balaenoptera edeni* – Bryde's whale
*Balaenoptera borealis* – Sei whale
*Megaptera novaeangliae* – Humpback whale


**Red line**: Boundaries of the Important Marine Mammal Area (IMMA)
**Coloured dots**: Sightings of different mysticete species

Figure 3: Maps of Odontocetes and Mysticetes. Map design by Lenin Oviedo based on records selected from Obis Sea Map (Updated to 22/09/2025), iNaturalist, and sightings from Proyecto Delphinus research database base .

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

Humpback whales (*Megaptera novaeangliae*) are the second most encountered baleen whale species in the IMMA (Acevedo et al., 2007, 2008; Bolaños-Jiménez et al., 2021; Silva et al., 2006). Mother and calf groups have been recorded along the eastern coast of Venezuela, specifically in Los Frailes Archipelago (Acevedo et al., 2007, 2008; Swartz et al., 2003), corresponding with the boreal winter season (January–March). Additionally, a few reports of humpback whales have been documented in Venezuela during the austral winter and spring (June–November), suggesting that the whales are coming from the Southern Hemisphere (Bolaños-Jiménez et al., 2015, 2021).

## Sub-criterion C2: Feeding Areas

The main environmental feature of the Southern Caribbean Upwelling System IMMA is the wind-driven coastal upwelling that results in remarkable productivity, supporting extensive foraging habitat for local species of marine mammals (Andrade et al., 2003; Andrade & Barton, 2005; Arévalo-Martínez & Franco-Herrera, 2008; Criales-Hernández et al., 2006; Lonin et al., 2010; Müller-Karger et al., 1989; Paramo et al., 2011). Atlantic spotted dolphins (*Stenella frontalis*), common bottlenose dolphins (*Tursiops truncatus*), pantropical spotted dolphins (*Stenella attenuata*), and rough-toothed dolphins (*Steno bredanensis*) have been regularly observed feeding across the IMMA, including in coastal waters along the mouth of the Magdalena River and La Guajira Peninsula in Colombia (Barragán-Barrera et al., 2019a; Combatt & González, 2007; Farías-Curtidor & Ayala, 2015; Farías-Curtidor & Barragán-Barrera, 2017). Feeding habitats in La Guajira Peninsula have been confirmed through isotopic analyses, which suggest delphinids share the same isotopic niche, consuming the same prey along this region (Barragán-Barrera et al., 2019a; Farías-Curtidor et al., In Prep.). Around the (A) Aruba – (B) Bonaire – (C) Curaçao (ABC) Islands, foraging behavior has also been observed for the previously mentioned delphinids as well as Gray's spinner dolphins (*Stenella longirostris longirostris*) (CCS, 2024; Luksenburg, 2013). In the state of Aragua, central Venezuela, Atlantic spotted dolphins and resident common bottlenose dolphins are regularly observed preying upon unknown prey species (Bolaños-Jiménez et al., 1998, 2007).

Common dolphins (*Delphinus delphis*) are associated with upwelling-modified habitats (Au & Perryman, 1985). They are distributed along the extension of the Southern Caribbean Upwelling System from Colombia along the coast of La Guajira Peninsula (Farías-Curtidor et al., 2017), through the Venezuelan Gulf (Bolaños-Jiménez et al., 2013; Ramírez-Carroz & Gonzalez-Hernandez, 2004), the Aruba-Bonaire-Curaçao Islands (Luksenburg, 2013), the Central Caribbean Coast of Venezuela (Bolaños-Jimenez et al., 2013), the Cariaco Basin off eastern Venezuela (Oviedo, 2008; Oviedo et al., 2010; Oviedo, 2012; Molero Lizarraga et al., 2021) and to the north of the island of Trinidad. Their distribution overlaps with the upwelling foci located off the eastern coast of Venezuela, where the Spanish sardine (*Sardinella aurita*), which is the main prey of common dolphins, is found (Naveira, 1996; Oviedo, 2009, 2011, 2012). Behavioral observations corresponding to foraging and travel have been documented by direct observation in the eastern portion of this IMMA (Oviedo, 2008; Oviedo et al., 2010; Oviedo, 2012; Molero-Lizarraga et al., 2021).

Bryde's whales (*Balaenoptera edeni*) in the Southern Caribbean Upwelling System, appear to be closely associated with the most active upwelling in this area, from Colombia (Pardo & Palacios, 2006), the Aruba-Bonaire-Curaçao Islands (Barros & Debrot, 2006; CCS,

Figure 4: Humpback whales (*Megaptera novaeangliae*) mother and calf in this IMMA. Photo credit: Caribbean Cetacean Society.


Figure 5: Atlantic spotted dolphins (*Stenella frontalis*) leaping out of the water in fornt of tour boat. Photo credit: Manuel (Alex) Bolaños.

2024; Luksenburg, 2013, 2015; Scheidat et al., 2015), off La Guaira Bank in Central Venezuela (Briceño & Sanchez, unpublished data) and overlapping with areas of high concentration of common dolphins in eastern Venezuela (Acevedo, 2007; Acevedo et al., 2007; Silva-Schwarzberg et al., 2010, Notarbartolo di Sciara, 2013). As the most frequently observed whale in this IMMA (Acevedo, 2007; Acevedo et al., 2007), the majority of these records report foraging in shelf waters within the 200 m isobath, frequently in multi-predator aggregations preying on bait balls of small pelagic fish (Acevedo, 2007; Acevedo et al., 2007; Naveira, 1996). The relative abundance of Bryde's whales in the eastern portion of this IMMA appears to increase in the northern hemisphere autumn months (Notarbartolo di Sciara, 1983), possibly in response to the availability of small pelagic fish within the first 10 km of upwelling foci during the weakest upwelling season in September–October (Rueda-Roa et al., 2013, 2018).

The upwellings associated with this IMMA provide suitable feeding habitat for sperm whales (*Physeter macrocephalus*) (Rueda-Díaz et al., 2023). Sperm whales are regularly sighted near the edges of the shelves and canyon system within the IMMA (Avila et al., 2022; CCS, 2024; Smultea et al., 2013). Acoustic data from the Caribbean Cetacean Society (CCS, 2024) and Heenehan et al. (2019) reported feeding behavior (echolocation clicks) of sperm whales north of Bonaire and Curaçao.

## Criterion D: Special Attributes
## Sub-criterion D1: Distinctiveness

Common dolphins along this IMMA appear to be a distinctive morphotype associated with the upwelling habitat of the area. Genetic analysis using skin biopsies gathered from wild dolphins sighted off La Guajira Peninsula (Colombian waters) suggest that they are genetically closer to short beaked common dolphin, even though morphologically there is a resemblance with the long beak form (Farías-Curtidor et al., 2017). Skull morphometric analysis using samples from Margarita Island in the eastern portion of the Southern Caribbean Upwelling Area, also found important intermediate features between the short and long beak form, suggesting again a different morphotype (Esteves & Oviedo, 2007). Additionally, genetic findings based on mitochondrial DNA (mtDNA) shows common dolphins sampled in Colombia and Venezuela form a population unit highly differentiated from individuals in Brazil and Northeast Atlantic Ocean (Chávez, 2015).

## Sub-criterion D2: Diversity

A total of 22 species of cetaceans (20 odontocetes and 2 mysticetes), approaching 25% of the world's total number of cetacean species (Committee on Taxonomy, 2021), have been confirmed to occur in the IMMA. Among these species, 11 have been regularly observed throughout the year across the area and are associated with the productive and diverse seascape and the many critical habitats in this IMMA. These species include: 1) Common dolphin (Acevedo, 2001, 2007; Molero-Lizarraga et al., 2021; Oviedo, 2008, 2009, 2011; Oviedo et al., 2010), 2) Guiana dolphin, (*Sotalia guianensis*) (Acevedo, 2001, 2007; Oviedo, 2008, 2009, 2011, 2012), 3) common bottlenose dolphin (Acevedo, 2001, 2007; Bolaños-Jiménez et al., 2007; Combatt & González, 2007; CCS 2024; Debrot et al., 2011; Oviedo & Silva, 2005; Oviedo et al., 2005), 4) Atlantic spotted dolphin (Acevedo, 2001, 2007; CCS, 2024; Debrot et al., 2011; Oviedo, 2009), 5) Bryde's whale (Acevedo, 2001, 2007; Acevedo et al., 2007, Debrot et al., 2011; Silva-Schwarzberg et al., 2010), 6) killer whale (*Orcinus orca*) (Bolaños-Jiménez et al., 2014, 2023a; Luksenburg, 2013), 7) sperm whale (Avila et al., 2022; CCS, 2024; Heenehan, 2019; Smultea et al., 2013), 8) pantropical spotted dolphins (Barragán-Barrera et al., 2019b; CCS,

2024; Debrot et al., 2011), 9) Gray's spinner dolphins (Barragán-Barrera et al.. 2019b; CCS, 2024; Debrot et al., 2011), 10) short-finned pilot whales (*Globicephala macrorhynchus*) (CCS, 2024; Debrot et al., 2011; Luksenburg, 2013), 11) rough-toothed dolphins (Debrot et al., 2011; Luksenburg, 2013); and humpback whales (Acevedo *et al.,* 2007, 2008; Bolaños-Jiménez *et al.,* 2021; Silva et al., 2006).

Around Aruba stranded neonates have been recorded for Atlantic spotted dolphins, Gray's spinner dolphins, common bottlenose dolphins, pantropical spotted, striped dolphins, and rough-toothed dolphins and calving, sheltering and nursing behavior have been observed there (Henriquez, 2024; Luksenburg, 2013). Several species of small-sized delphinids (e.g., Atlantic spotted dolphin, common bottlenose dolphin, and pantropical spotted dolphin) have been observed with calves and juveniles around Aruba-Bonaire-Curaçao Islands (Barros & Debrot, 2006; CCS, 2024), the coast of Aragua in Venezuela (Bolaños-Jiménez et al., 1998), and along La Guajira Peninsula in Colombia (Farías-Curtidor & Ayala, 2015; Farías-Curtidor & Barragán-Barrera, 2017).

An additional 11 aquatic mammal species, which include Risso' dolphins (*Grampus griseus*), dwarf sperm whales (*Kogia sima*), Gervais' beaked whales (*Mesoplodon europaeus*), melon headed whales (*Peponocephala electra*), pigmy killer whales (*Feresa attenuata*), false killer whales (*Pseudorca crassidens*), Antillean manatees (*Trichechus manatus manatus*), Clymene dolphins (*Stenella clymene*), Striped dolphins (*Stenella coeruleoalba*), and Cuvier's beaked whales (*Ziphius cavirostris*) have been included as Supporting Species within the IMMA. These species have been less well studied. Beaked whales have mostly been reported as strandings, they likely also occur but are hard to detect (Acevedo et al., 2008; Bolaños-Jiménez et al., 2023b; Caicedo-Herrera et al., 2005; Chávez-Andrade et al., 2023; Debrot, 1998; Debrot et al., 1998; Debrot et al., 2011; Fraija et al., 2009; Geelhoed et al., 2014; Mutis-Martinezguerra & Polanco, 2019; Palacios et al., 2013; Pardo & Palacios, 2006; Scheidat et al., 2015; Smultea et al., 2013).

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