



Area Size

118 006 km²

Qualifying Species and Criteria

Bryde's whale – *Balaenoptera edeni*

Criterion C (2)

Atlantic spotted dolphin – *Stenella frontalis*

Criterion C (2)

Sei Whale – *Balaenoptera borealis*

Criterion A; B (2)

Humpback whale – *Megaptera novaeangliae*

Criterion C (1)

Sperm whale – *Physeter macrocephalus*

Criterion A

Blue whale – *Balaenoptera musculus*

Criterion A

Fin whale – *Balaenoptera physalus*

Criterion A

Marine Mammal Diversity

Criterion D (2)

Balaenoptera edeni, *Stenella frontalis*,

Tursiops truncatus, *Delphinus delphis*,

Orcinus orca, *Balaenoptera borealis*,

Megaptera novaeangliae,

Physeter macrocephalus,

Balaenoptera musculus, *Balaenoptera physalus*,

Balaenoptera bonaerensis, *Balaenoptera*

acutorostrata, *Eubalaena australis*, *Stenella*

South Brazil Bight IMMA

Marine Mammal Diversity, continued.

longirostris, *Stenella attenuata*, *Steno bredanensis*, *Stenella clymene*, *Sotalia guianensis*, *Feresa attenuata*, *Peponocephala electra*, *Pseudorca crassidens*, *Globicephala macrorhynchus*, *Grampus griseus*, *Kogia sima*, *Ziphius cavirostris*

Summary:

The South Brazil Bight (23–28.5°S) is the most productive portion of Brazil's continental shelf. The IMMA extends to the 2,000 m contour line and is characterised by the confluence between recurrent upwelling of nutrient-rich South Atlantic Central Waters and temperate and tropical waters. The IMMA encompasses marine habitats on both the continental shelf and slope, both of which are of particular importance for species such as the Bryde's whale (*Balaenoptera edeni*), the only resident baleen whale of Brazil, the Atlantic spotted dolphin (*Stenella frontalis*), the humpback whale (*Megaptera novaeangliae*) and the sei whale (*Balaenoptera borealis*). The IMMA hosts a minimum of 25 cetacean species, comprising at least 60% of all marine cetacean species in Brazil. The IMMA also encompasses areas of regular occurrence of four species that are threatened on the IUCN Red List: the sperm whale (*Physeter macrocephalus*), the blue whale (*Balaenoptera musculus*), the fin whale (*Balaenoptera physalus*) and the sei whale.



Figure 1: Bryde's whale (*Balaenoptera edeni*) sighted in South Brazil Bight. Photo credit: Julio Cardoso - ProBaV (Projeto Baleia a Vista)

Description:

The South Brazil Bight (SBB) is the most productive shelf region of Brazil (MPA, 2011), stretching from Cape of Santa Marta to Cabo Frio, on the south and south-eastern coast of Brazil (23–28.5°S). The slope of the South Brazil Bight IMMA includes two submarine canyons, and close to the coast numerous islands, bays and estuaries may be found. It is a typical western boundary system, characterised by the recurrent upwelling of the nutrient-rich South Atlantic Central Water (SACW) (Brandini et al., 2018). Wind-driven upwelling occurs around Cabo Frio, creating an upwelling front that spreads southwards along the coast, shelf and slope. This wind-driven upwelling is enhanced by the intense activity of vortices of the warm and oligotrophic Brazil Current, that cause shelf-break upwelling and intrusion of the SACW towards the shelf. In addition, the southern portion of the SBB has a wider and flatter shelf and is seasonally washed by a cold front of the Malvinas Current. These waters travelling from the south are enriched by continental inputs from the vast La Plata

River plume (Marta-Almeida et al., 2021). The Southern Brazil Bight may also be regarded as part of a transitional zone between subtropical and temperate realms, spanning from south to south-eastern Brazil.

The highly dynamic and productive environment of the Southern Brazil Bight supports high marine biodiversity and intense fishing activity. The main target species is the Brazilian sardine (*Sardinella brasiliensis*), but the region also hosts other fishes (such as scianids) and invertebrates of economic relevance (MPA, 2011). The region is also subject to intense human activity, such as ports and their related marine traffic, oil/gas exploration and urban encroachment, since it is contiguous to the most populated region of Brazil. Many marine protected areas exist along the coastal and inner shelf waters, but still many gaps of conservation exist in the outer shelf, slope and oceanic waters.

The boundaries of this IMMA were based primarily on the combined habitat suitability models of 18 taxa of



Figure 2: The ENC printscreen shows the Area to be Avoided (red line); Avoid the area around the Southwestern shore of São Sebastião Island (off Ponta da Sela). This will exclude the area with the highest whale records around the island. Coordinates of the area to be avoided: a. 23°53.2'S – 045°27.7'W (Ponta da Sela), b. 23°56.0'S – 045°30.5'W, c. 24°03.6'S – 045°30.5'W, d. 24°03.6'S – 045°15.1'W and e. 23°58.0'S – 045°15.1'W (Ponta do Boi). With the help of GWC (Great Whale Conservancy), IBJ (Instituto Baleia Jubarte) and ProBaV (Projeto Baleia à Vista) together with Tebar Oil Terminal (Petrobras) and São Sebastião Port Authority, a protocol of recommended route, speed and areas to be avoided for all ships (tankers and cargo) demanding São Sebastião Port and Terminal was implemented in order to avoid/reduce risk of collision between whales and ships. This is first in Brazil and is having excellent results.

Excerpt from 'Recommended routing guidelines for São Sebastião, Brasil' – (Great Whale Conservancy, 2021)

cetaceans. A combined habitat suitability index higher than 0,60 was the criteria adopted for defining the inner boundaries. The outer boundary was limited by the 2,000 metres isobath, encompassing the slope region with high cetacean diversity, and where features such as submarine canyons are found. The southern and northern limits were defined by the limits of the Santos sedimentary basin.

Criterion A: Species and Population Vulnerability

Four species that occur regularly in the South Brazil Bight (SBB) and contiguous continental slope are classified as having some degree of extinction risk globally (IUCN Red List) and/or nationally (Ministry of Environment of Brazil): the sperm whale (*Physeter macrocephalus*) is assessed as "Vulnerable" on the

IUCN Red List of Threatened Species (Taylor et al., 2019) and nationally (MMA, 2022); the blue whale (*Balaenoptera musculus*) listed as "Endangered" on the IUCN Red List (Cooke, 2018a) and "Critically Endangered" nationally (MMA, 2022); the fin whale (*Balaenoptera physalus*) listed as "Vulnerable" by the IUCN (Cooke, 2018b) and "Endangered" nationally (MMA, 2022); and the sei whale (*Balaenoptera borealis*) listed as "Endangered" by the IUCN (Cooke, 2018c) and nationally (MMA, 2022).

Criterion B: Distribution and Abundance Sub-Criterion B2: Aggregations

Sei whales were observed in the Santos Basin relatively often in winter months from 2015 to 2021 (n = 80 groups) during a systematic monitoring program (Petrobras, 2021). They occurred mainly along the

continental slope, but were concentrated in the northern portion of the IMMA and around a submarine canyon, with group size varying from 1 to 32 whales. Groups with more than 10 whales were observed on 9 occasions (11.3% of the groups). The aggregations in this subtropical region are most likely for breeding purposes, since a recent migration event was recorded between this IMMA, which has characteristics of a tropical/subtropical breeding ground, and the Falkland Islands (Malvinas), a known sei whale feeding ground (Weir et al., 2020).



Figure 3: Bryde's whale (*Balaenoptera edeni*) spotted in South Brazil Bight; the only resident baleen whale of Brazil. Photo credit: Julio Cardoso - ProBaV (Projeto Baleia a Vista)

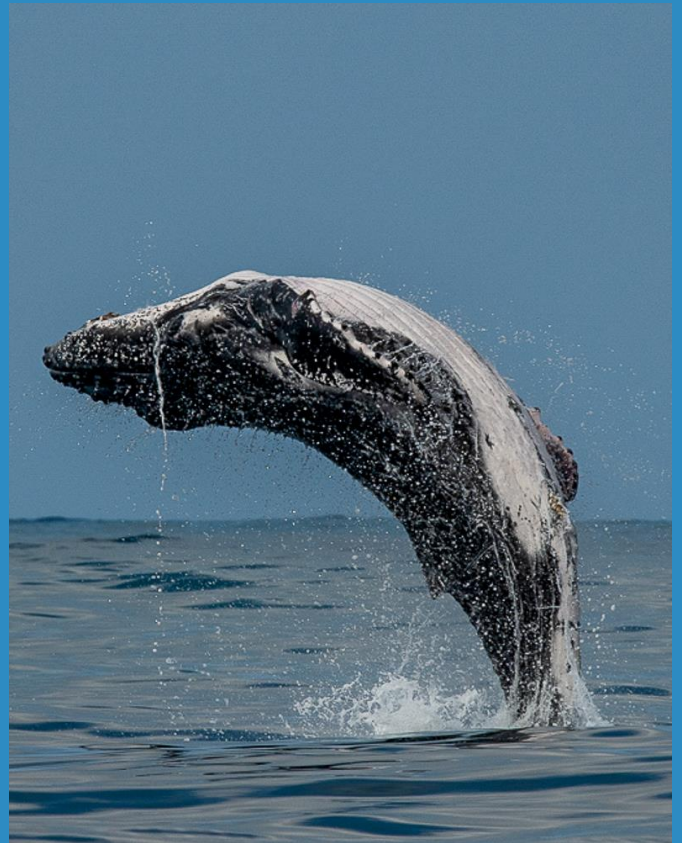


Figure 4: Humpback whale (*Megaptera novaeangliae*). Photo credit: Julio Cardoso - ProBaV (Projeto Baleia a Vista)



Figure 5: Humpback whale (*Megaptera novaeangliae*) fluke. Photo credit: Julio Cardoso - ProBaV (Projeto Baleia a Vista)



Figure 6: Humpback whale (*Megaptera novaeangliae*) fluke with barnacles sighted in South Brazil Bight.

Photo credit: Julio Cardoso - ProBaV (Projeto Baleia a Vista)



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Figure 7: Humpback whale (*Megaptera novaeangliae*) breaching in South Brazil Bight.
Photo credit: Julio Cardoso - ProBaV (Projeto Baleia a Vista)

Criterion C: Key Life Cycle Activities

Sub-Criterion C1: Reproductive Areas

Humpback whales (*Megaptera novaeangliae*) observed in the IMMA are reported to engage in typical reproduction-related behaviour, including the formation of competitive groups and male singing (Reiter, 2021; Morete et al., 2022). Six percent (n = 34) of all humpback whale observations (n = 566 groups) recorded during winter boat-based surveys in the region were groups with calves (Petrobras, 2021).

Criterion C2: Feeding Areas

There is strong evidence that the oceanographic processes occurring in the Southern Brazil Bight IMMA, especially those associated with the Cabo Frio and shelf-break upwellings, are responsible for high

productivity in the region, which sustains large stocks of fish consumed by Bryde's whales (*Balaenoptera edeni*), and possibly other species as well (see also Brandini et al., 2018).

The Bryde's whale (*Balaenoptera edeni*) is the only baleen whale that remains all year long in the waters of Brazil (Zerbini et al., 1997; Milmann et al., 2020). Records are common in the South Brazil Bight, especially near Cabo Frio, State of Rio de Janeiro, and Ilhabela, State of São Paulo (Siciliano et al., 2004; Gonçalves et al., 2016). Photo-identification studies reveal numerous resightings of identified individuals in Cabo Frio region and along the coastal areas of the Southern Brazil Bight IMMA, with individuals showing some degree of site fidelity (Figueiredo et al., 2014). Surface feeding events on Brazilian sardines (*Sardinella braziliensis*) were often observed in the



GOLFINHO-PINTADO-DO-ATLÂNTICO *Stenella frontalis*

- Tamanho: entre 1,90-2,30 metros. Peso: entre 120-143kg.
 - Características: Possuem o corpo pintado, principalmente os adultos, que dá o nome à espécie. Os indivíduos são identificados por marcas e cicatrizes na nadadeira dorsal.
 - Ocorrência: Vivem entre o Rio Grande do Sul e o Nordeste brasileiro, são comuns no Litoral de São Paulo.
 - Alimentação: peixes e lulas.
- Foto: Julio Cardoso



Figure 8: Atlantic spotted dolphin (*Stenella frontalis*) leaping out of the water. Photo credit: Julio Cardoso - ProBaV (Projeto Baleia a Vista)

area (Siciliano et al., 2004; Mello-Neto et al., 2017).

This species of sardine is a major fishing resource in South Brazil Bight and its life cycle is connected to oceanographic processes of the Bight, such as the Cabo Frio upwelling (Bakun & Parrish, 1990). Moreover, higher encounter rates of Bryde's whales and other non-migratory cetaceans of the Cabo Frio region were associated with peaks of Chlorophyll a concentration on the shelf and low SSTs (Tardin et al., 2019), conditions that are typical of upwelling environments.

Atlantic spotted dolphin (*Stenella frontalis*) sightings are common in the Brazilian Bight, occurring in waters ranging from 20 to almost 1,000 m of depth (Moreno et al., 2005). Niche modelling analyses show

that the SBB is a core region for the distribution of an isolated southern population of these dolphins (Amaral et al., 2015). The species feeds on a variety of fishes, cephalopods and crustaceans in the South Brazil Bight IMMA (Melo et al., 2010; Lopes et al., 2012). Their prey includes pelagic and demersal organisms from inshore and offshore habitats. Among the most common items of the diet are regionally abundant fishes, such as *Porichthys porosissimus*, and squid such as *Loligo plei*. This squid is dominant on the continental shelf of the South Brazil Bight and may be regarded a keystone species in this marine ecosystem (Gasalla et al., 2010). Stable isotope analyses show that Atlantic spotted dolphins feed on prey associated with the SACW (Bisi et al., 2013).

Globally the taxonomy and systematics of the Bryde's whale species complex is unclear, and until multiple issues are clarified, the Society for Marine Mammalogy's Committee on Taxonomy provisionally classifies all Bryde's whales globally as *B. edeni* (see Committee on Taxonomy 2023 for details). Bryde's whales off South America have been commonly classified in the past as *B. edeni*, but a genetics study published in 2015 suggests that only individuals of *B. brydei* occur on the South American coast, including in this IMMA (Pastene et al., 2015; Milmann et al., 2020).

Criterion D: Special Attributes

Sub-Criterion D2: Diversity

The South Brazil Bight IMMA is a highly dynamic environment in which the convergence of subtropical and temperate water masses and two submarine canyons combine to enhance regional productivity and promote high cetacean diversity (Di Tullio et al., 2016). Recent systematic survey effort in the Santos Basin encompassing intensive sampling effort from both coastal and oceanic waters over six years has significantly improved the level of knowledge about cetacean ecology in this region, (see Dalpaz et al., 2021; Petrobras, 2021). The surveys resulted in the documentation of 25 species within the IMMA's boundaries. The diversity might be even higher if strandings and other species that probably occur in the region are taken into account. It is noteworthy that the slope of the SBB has two submarine canyons with known occurrence and concentration of diverse species of cetaceans (Petrobras, 2021). The recently documented cetacean diversity in the IMMA represents approximately 60% of all the species that have ever been documented in Brazilian waters.

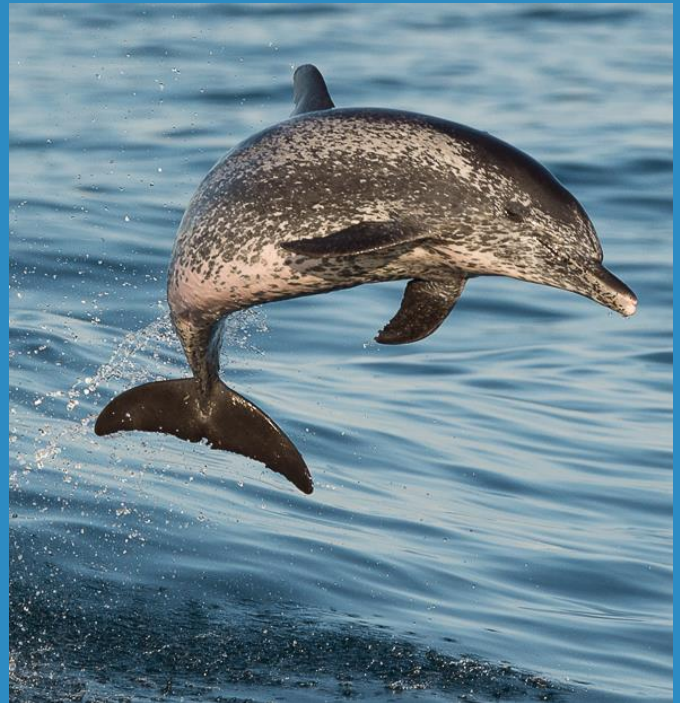


Figure 9: Atlantic spotted dolphin (*Stenella frontalis*).
Photo credit: Julio Cardoso - ProBaV (Projeto Baleia a Vista)

Supporting Information

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