

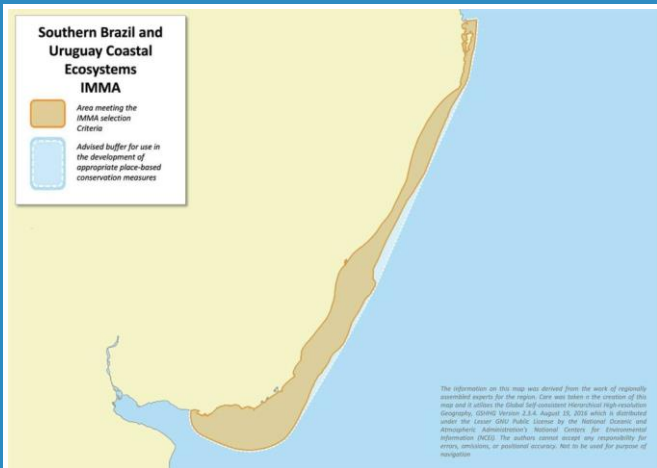
Southern Brazil and Uruguay Coastal Ecosystems IMMA

Summary, continued.

subpopulation of Lahille's bottlenose dolphin and Franciscana Management Area III. The IMMA also includes the second most important breeding ground for southern right whales in the Southwest Atlantic, as well as five main breeding colonies of South American fur seals and sea lions and associated feeding area of the latter over the continental shelf in one of the most productive oceanic regions of the world.

Description:

The Southern Brazil and Uruguay Coastal Ecosystems IMMA covers uninterrupted coastal ecosystems from the coastline to the 50 m isobath between Florianópolis Island, Brazil, and the middle of the Rio de la Plata at the south where it extends westward up to Santa Lucia River mouth (west of Montevideo), Uruguay. The IMMA encompasses a mosaic of features such as bays, long sand beaches, rocky shores, the inner waters of estuaries and rivers as well as islands, islets and rookeries that host breeding and haulout colonies of the South American sea lions (*Otaria byronia*) and South American fur seals (*Arctocephalus australis*). Particularly it includes the biggest pinniped breeding colony of South American fur seal (Lobos' Island and islet, 35° 01' S, 54° 52' W; Franco-Trecu et al., 2019) and the northernmost haulout area of both species in the Southwest Atlantic (Wildlife Refuge of Ilha dos Lobos (WRIL), 29° 20' S; 49° 42' W; Procksch et al., 2020). The north latitudinal limit was based on the main distributional area of the Southern Brazil-Uruguay



Area Size

66 550 km²

Qualifying Species and Criteria

Lahille's bottlenose dolphins –

Tursiops truncatus gephyreus

Criterion A; B (1)

Franciscana dolphin – *Pontoporia blainvillei*

Criterion A; D (1)

Southern right whale – *Eubalaena australis*

Criterion B (2); C (1)

South American sea lions – *Otaria byronia*

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

South American fur seals –

Arctocephalus australis

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

Summary

The Southern Brazil and Uruguay Coastal Ecosystems IMMA comprises a mosaic of coastal habitats (from the shoreline out to the 50 m isobath, including inner estuaries, islands, rookeries and coastal bays) between Florianópolis, Brazil, in the north and the middle of the Rio de la Plata (political border) in the south where it extends westward up to the Santa Lucia river, Uruguay. It fully covers key habitats for two threatened cetaceans: the entire distributional range of Southern Brazil-Uruguay

Lahille's bottlenose dolphins' population (*Tursiops truncatus geophyreus*), which is genetically distinct from the adjacent Argentine population (Fruet et al., 2014), while the south-western limit (middle of Rio de la Plata up to Santa Lucia river, Uruguay) and the isobath of 50 m as the offshore limit were defined as the distributional range of Franciscana (*Pontoporia blainvillei*), particularly encompassing Franciscana Management Area III (sensu Secchi et al., 2003) based on aerial surveys and fishing bycatch data (Danilewicz et al., 2009, 2010; Szephegyi, 2012; Secchi et al., 2021; Sucunza et al., 2020, Uruguay, unpublished data). The coastal zone has a gentle slope and wide continental shelf. Circulation and water mass patterns are complex as it is part of a transitional environment and the region is dominated by two mesoscale features: the warm and salty Brazil Current transporting tropical oligotrophic water over the slope (Stramma et al., 1990) and South Atlantic Central Water flowing over the continental shelf until the coast. The Falkland/Malvinas Current meets the Brazil Current at the latitude of the La Plata River, off Argentina, at the Brazil-Falkland/ Malvinas Confluence creating further mixing and transition (Piola & Matano, 2001).

The shelf of Uruguay and the region around the southern border of Brazil is characterized by the presence of fresh waters from the La Plata River which extends northward in late fall, and retracts during the spring/summer months with the wind as the main forcing mechanism (Palma et al., 2004; Piola, 2005; Soares et al., 2007b; Burrage et al., 2008; Möller et al., 2008; Pezzi et al., 2016). The freshwater from Patos Lagoon and intrusions of Subantarctic Shelf waters exhibit the same seasonal pattern (Palma et al., 2008). The La Plata River plume extends from 28°S to 38°S (very close to Florianópolis), reaching up to 1200 km in length (Palma et al., 2008). These coastal geography and oceanography dynamics make the region highly productive, suitable for the

reproduction and development of many invertebrates and fish species. It provides fundamental conditions to sustain multiple populations of marine mammal species but is critical for three (including two endangered) species of cetaceans and two species of pinnipeds. The coastal bays in the Santa Catarina State provide sheltered and calm waters for the single contemporary wintering ground of southern right whales (*Eubalaena australis*) in Brazil (Groch et al., 2005; Seyboth et al., 2015; Renault-Braga et al., 2018). Estuaries, rivers mouths and adjacent coastal waters host resident populations of the Lahille's bottlenose dolphins, that use those areas to feed, give birth and rest, while open coast populations of the subspecies move latitudinally across larger areas mediating gene flow (Fruet et al., 2012; Laporta et al., 2016). Franciscana dolphins occur along the entire area (Danilewicz et al., 2010; Prado et al., 2021; Secchi et al., 2021; Sucunza et al., 2020), which consistently provides a wide range of their preferred prey species, such as sciaenid fish (Basso et al., 2020; Botta et al., 2022). The IMMA area is also important to other marine mammals, such as the Common bottlenose dolphins (*Tursiops truncatus truncatus*) and the Guiana dolphin (*Sotalia guianensis*).

This IMMA overlaps with ten Protected Areas of Brazil and Uruguay. In Brazil, it overlaps with Anhatomirim Environmental Protected Area (APA Anhatomirim), Southern Right Whales Environmental Protected Area, Arvoredo Biological Reserve, the Wildlife Refuge of Molhe Leste of São José de Norte, the Wildlife Refuge of Ilha dos Lobos. In Uruguay, it fully covers the marine extent of the Cerro Verde and Islas de la Coronilla's Habitat and/or Species Management Area, Cabo Polonio National Park, Laguna de Rocha's Lagoon Protected Landscape, Laguna Garzón's Habitat and/or Species Management Area, and Santa Lucía Wetlands' Protected Area with Managed Resources Humedales.

Furthermore, this IMMA partially overlaps the Southern Brazilian Sea EBSA, which is characterized for being a region of high productivity and important for deep-sea corals, demersal and pelagic fishes, seabirds, and sea turtles as well as for whales and dolphins (Secretariat of the Convention on Biological Diversity, 2014).

Criterion A: Species or Population Vulnerability

Lahille's bottlenose dolphin (*Tursiops truncatus gephyreus*) – The low abundance of the subspecies, with an estimate of fewer than 600 individuals alive in 2022, led to their classification as Vulnerable on the IUCN Red List (Vermeulen et al., 2019).

Franciscana (*Pontoporia blainvillei*) – As one of the most threatened small cetaceans in the western South Atlantic this species is listed as Vulnerable on the IUCN Red List of Threatened species, due to high bycatch and increasing habitat degradation throughout its range (Zerbini et al., 2017).



Figure 1: Lahille's bottlenose dolphin (*Tursiops truncatus gephyreus*). Photo credit: Robert Pitman



Figure 2: Franciscana dolphins (*Pontoporia blainvillei*). Photo credit: Federico Sucunza

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

Lahille's bottlenose dolphin – The Lahille's bottlenose dolphin subspecies is divided into two geographically isolated subpopulations: Southern Brazil-Uruguay, and Argentina (Fruet et al., 2014). This IMMA covers the entire range of the Southern Brazil-Uruguay subpopulation, which consists of five small management units (Fruet et al., 2014). The Gephyreus Project – an international research initiative coordinating simultaneous photo-identification sampling at seven sites along the distribution range of the subspecies in order to investigate the metapopulation dynamics of the southern Brazil/Uruguay subpopulation – has been generating consistent results. Mark-recapture models in a Robust Design framework were fitted to data collected from the seven sampled sites in southern Brazil and Uruguay, collected during seven sampling periods between 2019 and 2022. These models estimated the number of marked individuals for each area per period. Total abundances, corrected by the mark rate estimation, ranged from 53 (95%CI: 50-57) to 62 (95%CI: 48-76) in Laguna; from 127 (95%CI: 80-174) to 252 (95%CI: 143-361) in Patos Lagoon; from 20

(95%CI: 11-30) to 29 (95%CI: 16-41) in Tramandai; from 4 (95%CI: 3-8) to 47 (95%CI: 37-57) in Torres; from 8 (95%CI: 3-12) to 24 (95%CI: 4-12) in North Bay; from 10 (95%CI: 7-14) to 38 (95%CI: 21-55) in Uruguay.

Combining the estimates from all areas, the total estimate for southern Brazil and Uruguay ranged from 246 (95%CI: 183-309) in the first period to 398 individuals (95%CI: 245-550) in the sixth sampling period, suggesting a total of < 400 individuals for the entire southern Brazil-Uruguay subpopulation (Fruet et al., 2023). High resighting rates of marked animals recorded within and between sampling periods suggests strong residence and site fidelity to estuaries and river mouths. Results from long-term mark-recapture studies with the resident local populations indicates that the region is used for reproduction and caring for young, with most births occurring during spring and summer, in association with increasing water temperature and food supply (see Fruet et al., 2016 for review; Fruet et al., 2015; Bezamat et al., 2019). Inner waters of estuaries and bays are preferred for females to take care of their young. Interbirth-interval estimates are also available (Hoffman, 2004; Fruet et al., 2015; 2016; Bezamat et al., 2019). For Baía Norte and Itajaí river, in southern Brazil, as well as in Uruguay, there are many records of the presence of mother and calf pairs using these areas constantly, but no reproductive rate estimation is available (Flores et al., 2007).



Figure 3: Southern right whale (*Eubalaena australis*) sighted near shore from Punta del Este, Uruguay. Photo credit: Cecilia Passadore

Sub-Criterion B2: Aggregations

Southern right whale (*Eubalaena australis*) – The IMMA area encompasses the main wintering aggregation area of right whales along the Brazilian coast, from the central to southern coast of Santa Catarina state (Renault-Braga et al., 2021), designated by the Federal Government of Brazil as a Marine Protected Area dedicated to the species recovery and conservation (Southern Right Whale Environmental Protected Area). The area is a major wintering ground for a threatened population that was greatly depleted by whaling. The Southwestern Atlantic population is currently estimated to be less than 10% of its original numbers (Romero et al., 2022).

South American fur seals (*Arctocephalus australis*) and sea lions (*Otaria byronia*) – These two species are distributed in the Pacific and the Atlantic Oceans (Vaz-Ferreira, 1982a,b), and just the Uruguayan and Brazilian populations belong to this IMMA. Both species show a patchy distribution of breeding colonies and resting sites in both sides of South America (Tunez et al., 2008; Crespo & Oliveira, 2021; Crespo et al., 2021). Both species occupy five Uruguayan breeding colonies (Franco-Trecu et al., 2019) and two Brazilian marine protected areas (Procksch et al., 2020).

The total (uncorrected) South American fur seal abundance in Uruguay from aerial photos in 2013 was 45,588 (SD = 1,536) individuals, 67% of which were at Punta del Este (Isla – Islote de Lobos). In 2013, the corrected pup abundance estimate was 12,741 for Cabo Polonio islands and 18,419 for Isla – Islote de Lobos (Franco-Trecu et al., 2019). For the southern Brazilian coast, the observed numbers in the last decade for both species of South American pinnipeds in the two wildlife refuges ranged from 300 to 500 individuals per year (Pavanato et al., 2013; Procksch et al., 2020).



Figure 4: Southern right whale (*Eubalaena australis*) mother and calf pair sighted off southern Brazil.
Photo credit: Projeto Franca Austral/Instituto Australis

Criterion C: Key Life Cycle Activities

Sub-Criterion C1: Reproductive Areas

Southern right whales – The southern right whale which underwent a dramatic demographic bottleneck due to whaling, has a historical and contemporary circumpolar distribution from around 12°S to 65°S, albeit with a discontinuity between Chile and New Zealand. In the Atlantic coast of South America, southern right whales aggregate in two main breeding grounds: Peninsula Valdes, Argentina, and the bays of central-southern Santa Catarina State, southern Brazil. The whales use these areas mainly for calving, resting and reproduction. Recent genetic and mark-recapture studies showed connectivity between Brazil and Argentina, exemplified by weak genetic differentiation and the movement of genetically and naturally identified

individuals between the Western South Atlantic grounds (Ott et al 2011, Rowntree et al 2020). In Uruguay, coastal areas such as Punta del Este host congregating sites for whales in breeding seasons, but these are not likely to be calving grounds (Costa et al 2007). Right whales have been monitored since the 1980's along the southern Brazilian coast. Most groups sighted in this region are mother-calf pairs with a few sightings of juveniles, single adults and mating groups (Seyboth et al., 2015, Danilewicz et al., 2016; Renault-Braga et al., 2018, 2021a). In this area, female right whales aggregate for about five months of the winter (from July to November), and the early spring breeding season. The area has bays which protect the species from strong winds and waves, important for animals to give birth, and/or care for young during their first months of life (e.g., Groch et al., 2005; Seyboth et al., 2015; Renault-Braga et al.,



Figure 5: Southern right whale (*Eubalaena australis*) blow sighted off southern Brazil. Photo credit: Projeto Franca Austral/Instituto Australis

2018). As the population increases there is increasing occurrence of the species south of Santa Catarina (Danilewicz et al., 2016), in an area likely used for mating (Renault-Braga et al., 2021b, 2022). The Brazilian Right Whale Catalogue includes more than 1000 photo-identified whales. The most recent estimate of population growth rate in Brazil was 4.8%/year with an abundance estimate of 569 mature females (Renault-Braga et al., 2021b).

South American fur seals – Reproductive areas for fur seals within this IMMA were reported for the Uruguayan coastline. The breeding colonies for South American fur seals are: Lobos' Island and islet (35° 01' S, 54° 52' W), Torres group Islands (34° 21' S, 53° 44' W) which includes Rasa (0.03 km²), Encantada (0.02 km²), and Islote (0.02 km²), together with Del Marco Island (0.08 km²) (34° 25' S, 53° 46' W) which is located ca. 2 km offshore and within the Cabo

Polonio National Park that was established in 2009 (Franco-Trecu et al., 2019). The biggest breeding colony of South American fur seals is Isla de Lobos, Uruguay (Franco-Trecu et al., 2019).

South American sea lions – Reproductive areas for sea lions within this IMMA were reported for the Uruguayan coastline only. Their main breeding colonies are two groups of rookeries: Lobos' Island and islet and the group of islands of Torres-Del Marco. The northernmost breeding colony of this species in the Atlantic is also located in Uruguay, at the Verde Island and Coronilla Island (33°56'S 53°29'W; Vaz-Ferreira, 1975), where the reproductive activity is low with a few numbers of births recorded (Szteren, 2015). The latter are part of the Isla Verde and Islas de la Coronilla's Habitat and/or Species Management Area.



Figure 6: South American fur seals (*Arctocephalus australis*) and sea lions (*Otaria byronia*) in Uruguay at Punta del Este (Lobos Islet).
Photo credit: Cecilia Passadore



Figure 7: South American fur seals (*Arctocephalus australis*) and sea lions (*Otaria byronia*) in Uruguay at Punta del Este (Lobos Island).
Photo credit: Cecilia Passadore

Sub-Criterion C2: Feeding Areas

South American sea lions – The South American sea lions have a very broad diet within the Atlantic Ocean. The foraging habitat specially covers an extensive area in the Río de la Plata estuary and its plume, with a clear center of activity around Lobos' Island and a significant overlap between subadults and adults (Rodríguez et al., 2013). Moreover, in waters of Río de la Plata and the adjacent Atlantic Ocean, two important prey items of sea lions' diet, the striped weakfish (*Cynoscion guatucupa*) and the whitemouth croaker (*Micropogonias furnieri*) are also targeted by both the artisanal fisheries and the coastal bottom trawl fisheries operating in the area, and interactions between fisheries and sea lions' have been reported (Szteren & Paez, 2002; Franco-Trecu et al., 2019).

Lactating South American sea lions are central place-foragers (Orians & Pearson, 1977) that make foraging trips at sea and return to their rookeries or colony (central place) to nurse their young (Thompson et al., 1998). As a consequence, the latter behaviour and foraging are separated in time and space (Bonner, 1984); therefore, it is crucial that foraging areas be close to the rookeries since travelling to these sites can incur high energy cost. This is particularly important for lactating pinniped females that must forage during lactation (Boness et al., 1994).

Based on foraging behaviour-satellite-tracking data from individuals tagged in Lobos' Island breeding colony (35°01'S; 54°52'W), it was shown that lactating South American sea lions are benthic divers and that they forage in shallow waters within the continental shelf (Riet-Sapirza et al., 2013). Most of the tracked dives (70%) occurred between 15 and 25 m depth, followed by the depth range of 5 – 10 m (23%), and a few dives (7%) between the 30 and 55 m depth (Riet-Sapirza et al., 2013). The maximum distance travelled on a foraging trip from Lobos' Island ranged between



Figure 8: South American fur seals (*Arctocephalus australis*) giving birth to a pup at Lobos Island. Photo credit: Cecilia Passadore



Figure 9: South American fur seals (*Arctocephalus australis*) breastfeeding at Lobos Island. Photo credit: Cecilia Passadore



Figure 10: Lahille's bottlenose dolphin (*Tursiops truncatus gephyreus*) mother and calf pair. Photo credit: Robert Pitman

37.8 and 135.5 km.

Sub-Criterion C3: Migration Routes

South American fur seals and sea lions – Every year hundreds of pinnipeds of various species are found along the southern Brazilian coast, most of which are South American fur seals and South American sea lions (Pinedo, 1990; Rosas et al., 1994; Simões-Lopes et al., 1995; Oliveira, 2013). Brazil has no breeding colonies for any species of pinniped and only two haulout sites that are within marine protected areas (MPAs): the Wildlife Refuge of Molhe Leste of São José de Norte (WRML) (32° 10' S; 52° 06' W), and the Wildlife Refuge of Ilha dos Lobos (WRIL) (29° 20' S; 49° 42' W), both on the coast of the Rio Grande do Sul, southern Brazil (Oliveira, 2013). The arrival of these species in southern Brazil usually corresponds to the dispersal period after the breeding season, which occurs from December to February, and may be assisted by the cold, northwards following Malvinas Current (Pinedo, 1990; Rosas et al., 1994;

Simões-Lopes, 1995; Oliveira, 2013). This dispersal period towards Brazilian waters is one of the least understood periods of the life-cycle of South American pinnipeds (Bastida & Rodríguez, 1994; Sanfelice et al., 1999). Recent tagging (Giardino et al., 2014) and genetic studies (Oliveira et al., 2008a, 2017) have confirmed that South American fur seals and South American sea lions from Argentina and Uruguayan colonies disperse northwards to Brazil.

Criterion D: Special Attributes

Sub-Criterion D1: Distinctiveness

Lahille's bottlenose dolphin – Fruet et al. (2014) performed an analysis combining 16 microsatellite loci and mitochondrial DNA (mtDNA) control region sequences in 124 biopsy samples collected over six local populations of photographically identified Lahille's bottlenose dolphins in southern Brazil, Uruguay and central Argentina. Results revealed remarkably low levels of genetic diversity and strong genetic differentiation between dolphins from

southern Brazil–Uruguay (SB–U) and Bahía San Antonio (BSA), Argentina. Negligible contemporary gene flow between units was estimated based on Bayesian analysis, suggesting they should be considered two distinct evolutionarily significant units. Results of this paper were discussed during the *Second International Workshop on Research and Conservation of Tursiops in the Southwest Atlantic Ocean*", held in Cassino Beach, Rio Grande, Brazil, from 6 to 8 April 2017. Participants recognized the two main units proposed by Fruet et al. (2014): Southern Brazil–Uruguay (SB–U) and Argentina. After discussion, participants agreed that they are genetically and ecologically different.

In addition, it is also important to consider the cooperative fishing behavior between the Lahille's bottlenose dolphins and the castnet fishers. This unique feeding behavioural tactic is restricted to a few local populations of Lahille's bottlenose dolphins in southern Brazil – considered intangible natural heritage (Simões-Lopes et al., 2016). Specific studies on such behavior support evidence in favor of the cultural transmission of the cooperative foraging tactic among dolphins: stereotyped and synchronized behaviors, which are shared among subsets of the population and maintained across generations via social learning, primarily from mothers to calves (Simões-Lopes et al., 2016; van der Wal et al., 2022).

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