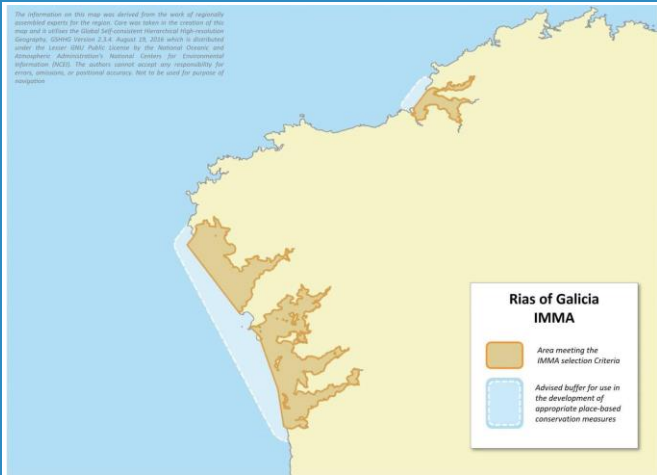


# Rias of Galicia IMMA

## Description:

The Rias of Galicia, situated along the northwest coast of Spain, encompass a network of unique and ecologically rich inlets. The Rias of Galicia, also referred to as 'ría,' are ancient drowned tectonic valleys taken over by the sea (Evans & Prego, 2003). These semi-enclosed coastal embayments are characterized by their complex topography, with a distinctive mixture of estuarine, freshwater, and marine influences. They exhibit a complex and dynamic topography, which includes a combination of shallow, sandy shores, deep channels, submerged reefs, and rocky coastlines. The Rias of Galicia have a long history of human presence and activity, including fisheries, aquaculture, and recreational boating (Surís-Regueiro & Santiago, 2014). What truly sets the Galician Rias apart is their extraordinary ecological significance. These inlets offer a unique combination of factors that make them of paramount importance to marine ecosystems. The tidal mixing of freshwater and seawater, the interaction of terrestrial and marine nutrient inputs, and the diverse substrates create a fertile and productive habitat. Moreover, the waters of these inlets are influenced by wind-driven seasonal coastal upwelling events, a phenomenon that carries deep, cold, and nutrient-rich waters to the photic layer, substantially enhancing primary production (Alvarez et al., 2012). Complementing these events, terrestrial runoff plays a significant role, particularly during winter when rainfall is more pronounced, leading to higher river discharge (Alvarez et al., 2012). This infusion of nutrients from the land augments the region's overall productivity. This productivity cascades through the food web, supporting a wide range of prey species that are essential for coastal bottlenose dolphins (*Tursiops truncatus*) feeding requirements (Santos et



## Area Size

1 346 km<sup>2</sup>

## Qualifying Species and Criteria

Common bottlenose dolphin – *Tursiops truncatus*  
Criterion B (1)

## Summary

The Galician Rias in northwest Spain are of exceptional ecological significance for common bottlenose dolphins (*Tursiops truncatus*). The Galician Rias host one resident coastal bottlenose dolphin population, with strong group associations, unusually large aggregations, and seasonal patterns reflecting the population's dependency on the unique habitats provided by these inlets and coastal embayments. The Galician Rias serve as essential areas for reproduction, confirmed by observed newborn dolphins and lactating females. At the same time, the Rias offer highly productive feeding grounds year-round, where dolphins display adaptable foraging strategies. The bottlenose dolphins in these areas display unique behaviours and low genetic diversity, while also being exposed to significant threats, including bycatch, overfishing, marine pollution, and aquaculture impacts, necessitating urgent conservation efforts.



Figure 1: Bottlenose dolphins (*Tursiops truncatus*) swimming between mussel rafts, a symbol of the link between this top predator and aquaculture practices in the IMMA - RIAS OF GALICIA. Photo credit: Séverine Methion - BDRI

al., 2007; Methion & Díaz López, 2019, 2020; Methion et al., 2023). The Galician Rias are vulnerable to a range of human-induced threats that directly impact the bottlenose dolphin population resident in these waters. These threats include:

**Bycatch:** Bottlenose dolphins are at risk of incidental capture in fishing gear, particularly bottom set gillnets. Incidental captures have been reported in these waters, with evidence of bycatch mortality (López et al., 2002, 2003; Goetz et al., 2014). Studies suggest that between 53 and 136 bottlenose dolphins are incidentally caught each year in these waters (in fixed gillnets and trawl fisheries) (López et al., 2003; Goetz et al., 2014) and around 14% of stranded bottlenose dolphins recorded in Galicia show evidence of bycatch mortality (López et al., 2002, 2003).

**Overfishing:** Overfishing practices in the Rias can disrupt the prey base of the dolphins (Giralt Paradell et al., 2021).

**Marine Pollution:** Marine pollution in the Rias, with documented evidence of pollutants exceeding health effect thresholds, compounds the vulnerability of the bottlenose dolphin resident population (Vieites et al., 2004). Studies have identified elevated levels of pollutants such as PCBs, mercury, and cadmium in stranded individuals, exceeding the toxic threshold for health effects in marine mammals (Méndez Fernández et al., 2014a, b). The potential for excessive eutrophication, as indicated in the Galician Rias, is a further concern (Bridge et al., 2023). Eutrophication can have significant impacts on bottlenose dolphins prey availability and abundance.

**Aquaculture Industry:** The aquaculture industry poses potential risks to the dolphins and their habitat (Díaz López & Methion, 2017; Methion & Díaz López, 2018). The vulnerability of the species in this region necessitates immediate and focused conservation efforts.

## Criterion B: Distribution and Abundance

### Sub-criterion B1: Small and Resident Populations

The Galician Rias IMMA hosts one resident population of coastal bottlenose dolphins, as extensively documented by various studies (López et al., 2002; Díaz López et al., 2008; Pierce et al., 2010; Díaz López & Methion, 2017; Díaz López & Methion, 2018; López et al., 2019; Methion & Díaz López, 2018; Methion & Díaz López, 2019a; Methion & Díaz López, 2019b; Methion & Díaz López, 2021; Methion et al., 2023). Through long-term photo-identification and mark-recapture methods spanning over two decades, these studies have provided a wealth of insights into the characteristics of this resident population. Individual characteristics, including age and sex, as well as ecological and social preferences, may explain the movement of individuals across the Galician rias (Methion & Díaz López, 2018, 2019b). Notably, the presence of photo-identified bottlenose dolphins in the Galician Rias for periods exceeding 20 years underscores the enduring nature of their residency.

Bottlenose dolphins are present in the Galician Rias throughout the entire year, and there are no substantial seasonal fluctuations in their presence. Research has consistently shown that the largest Galician Rias, including Arousa, Vigo, Pontevedra, Ares-Betanzos, and Muros-Noia serve as primary aggregation sites for most of the individuals of the resident population (López et al., 2004; Díaz López et al., 2008; Methion & Díaz López, 2018, 2020; López et al., 2019). Studies reveal that the movement of individuals between Rias within the IMMA may vary seasonally, with lower movement during the winter months (Methion & Díaz López, 2018). The data collected from various surveys and transects in the largest and most productive Galician ria (Ria of Arousa) reveal an average of 1.4 sightings per hour. In

contrast, outside the rias, the presence of bottlenose dolphins is less frequent. The surveys and transects conducted outside the rias report an average of 0.1 sightings per hour. These few observations are characterized by the movement of groups between Rias or the presence of transient bottlenose dolphins with a more pelagic behaviour. In a comprehensive study conducted by the Bottlenose Dolphin Research Institute between 2014 and 2022, it was observed that 94% of the bottlenose dolphin groups were located within the Rias, reaffirming their strong association with these inlets (Díaz López et al., 2023). Moreover, photo-identification studies carried out to date have further confirmed the regular movement of individuals between the Rias and their preferences for these habitats (Díaz López et al., 2008; López et al., 2019; Díaz López et al., 2023). A recent ongoing study conducted by researchers at the BDRI Institute for the Spanish government between 2023 and 2025, in its first year of observations, indicated that the estimates of abundance, based on mark-recapture techniques (photo-identification) using the robust Pollock method, were  $391 \pm 25$  bottlenose dolphins for the whole Galician Rias system.

Ecological and genetic distinctions are evident between bottlenose dolphins stranded within the Galician Rias (suggested as a coastal ecotype) and those stranded outside the Rias (Fernández et al., 2011a, b). The existence of these two ecotypes is further substantiated by the high variability in isotopic values ( $\delta^{13}\text{C}$ ) observed in bottlenose dolphins along the Galician coast (Méndez-Fernández et al., 2012, 2013). The low levels of genetic diversity observed in bottlenose dolphins stranded in the Galician Rias suggest potential restrictions on gene flow with adjacent sites, despite the absence of physical barriers (Fernández, 2011b).

The interplay between social and oceanographic conditions, both on a small and large scale, directly



Figure 2: Bottlenose dolphin (*Tursiops truncatus*) leaps in front of traditional fishing vessels, illustrating the coexistence between marine life and local communities in the IMMA - RÍAS OF GALICIA. Photo credit: Bruno Díaz López - BDRI.

shapes the spatio-temporal aggregation patterns of common bottlenose dolphins within the Galician Rias (Methion et al., 2023). Abundance estimates of bottlenose dolphins in Galician waters are subject to fluctuations influenced by oceanographic variables. Water oxygenation, chlorophyll-a concentration, and the North Atlantic Oscillation (NAO) index play pivotal roles in determining the spatio-temporal aggregation patterns of these dolphins (Methion et al., 2023). The observed aggregations in the Galician Rias, with an average group size of  $10.7 \pm SE 0.3$ , are larger than the average group size in several other coastal bottlenose dolphin populations in different regions (e.g., California, Shannon Estuary, Kvarneric Bay, Sarasota, Sardinia Island). Notably, the group size in the Galician Rias is comparable to or even exceeds that of some other populations with large average group sizes (e.g., Moray Firth, Golfo San José, Doubtful Sound).

Bottlenose dolphins utilize Galician rias as a nursery area, and evidence of newborn dolphins has been observed from June to September (Díaz López et al., 2018; Methion, 2021; Methion et al., 2023). This observation indicates that the Galician rias are a critical location for calving, with the majority of calving events occurring during the summer (Methion, 2021). Evidence of infanticides during the summer months (July-September), supported by post-mortem examinations, further substantiates the significance of these estuaries as calving and nursery areas (Díaz López et al., 2018). Evidence from stranded pregnant and/or lactating females, as well as stranded neonates and juveniles, confirms that bottlenose dolphins give birth and provide care for their young in Galician rias. This nurturing process continues until the calves are weaned (Fernández et al., 2011b; Read, 2014; Díaz López et al., 2017). Dependent calves, including both immature and



Figure 3: A group of bottlenose dolphins (*Tursiops truncatus*), including a mother and her newborn calf, elegantly traverse the waters of the IMMA - RIAS OF GALICIA. Photo credit: Bruno Díaz López - BDRl

newborn dolphins, are present in 55% of the observed groups (Methion, 2019; Methion et al., 2023a).

The productive waters of the Galician Rias serve as vital foraging grounds for common bottlenose dolphins, offering an abundance of high-quality food resources. The Galician Rias are recognized for their rich food resources, both in terms of quality and quantity. Studies have documented the importance of these productive waters in supporting the dietary needs of bottlenose dolphins, indicating that the region provides a reliable source of high-quality prey species (Díaz López et al., 2008; Díaz López & Methion, 2017; Methion & Díaz López, 2019; Methion et al., 2023a). The Galician Rias not only offer a bountiful and diverse array of food resources for common bottlenose dolphins but also highlight their adaptability in navigating human-altered

environments. The interactions with shellfish aquaculture areas and the application of specific foraging strategies underscore the resourcefulness of these dolphins within their feeding grounds.

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Studies in Galician rias have revealed that bottlenose dolphins employ various foraging techniques, including cooperative feeding. These techniques involve a high degree of social organization and behavioural adaptation, emphasizing the adaptability of these dolphins in obtaining their food resources (Methion and Díaz López, 2019, 2020). Shellfish aquaculture within the Rias has introduced spatial habitat complexity. This complexity has led to variations in resource distribution and abundance, effectively fragmenting the habitat of bottlenose dolphins (Díaz López & Methion, 2017). Some individual bottlenose dolphins have adapted to these changes, frequently utilizing shellfish farm areas as foraging grounds. They employ specific foraging strategies to catch prey within the floating rafts, benefiting from a reliable and easily located food source. This results in lower energetic and time expenditure during foraging and potentially increases their energy intake (Methion, 2019; Methion & Díaz López, 2019). Ongoing interactions with shellfish aquaculture may have endowed specific individuals with an intimate understanding of the characteristics of these human-altered areas. This knowledge enables them to efficiently obtain the food resources concentrated within these structures.

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The image displays a collection of logos for the Marine Mammal Protected Areas Task Force and its partners. At the top left is a large blue logo of a whale's head. To its right is the text "MARINE MAMMAL PROTECTED AREAS TASK FORCE". Below this are the logos for IUCN, SSC (Specialist Species Commission), and WCPA (World Conservation Union). In the middle row, there is the TETHYS logo (since 1986), the ocean care logo, and the WDC (Whale and Dolphin Conservation) logo. At the bottom is the Water Revolution Foundation logo.

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