

SENTINELS OF THE OCEAN

DISTRIBUTION AND ENVIRONMENTAL STATUS OF
SEABIRDS AND COASTAL WADERS OF PORTUGAL



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1. Foreword

Portugal is, almost by definition, an oceanic country. With an Exclusive Economic Zone (EEZ) of around 1.7 million km², it ranks 20th globally, 5th in Europe and 3rd in the European Union. Its geographical position and the extent of the maritime area under its jurisdiction directly confer upon it the responsibility to protect global marine biodiversity, but also the opportunity to enjoy this heritage in a sustainable manner, ensuring its preservation for future generations.

At the start of this century, I had the immense privilege of publishing, alongside an extraordinary team of professionals, some of the first national marine studies produced on a global scale. In 2008, SPEA BirLife published the book *Important Areas for Seabirds in Portugal*. This work, the result of thousands of hours of work on board vessels, as well as the first studies involving the individual tracking of birds — at a time when GPS devices for animal tracking were still extremely large and expensive — paved the way for similar publications in other countries across Europe and the world. Portugal was already establishing itself as a leading nation. In 2014, in a further demonstration of ambition and national coordination, the first *Atlas of Seabirds of Portugal* was published. Once again, its launch represented a significant milestone: it combined a traditional printed publication with a fully digital atlas, allowing open access to all the information collected and amplifying its impact exponentially.

Now, just 12 years after that publication, I am thrilled and deeply honoured to be able to present a new update of the *Atlas*, in both its printed and digital versions. The technological advances made in recent years allow us to significantly improve, deepen and expand our knowledge of seabird movements. Better still, the inclusion of new data on their environmental status and the threats they face will enable us to refine the conservation and management tools needed to protect and safeguard them.

I am convinced that *Sentinels of the Ocean* will once again become an example to be followed by many countries around the world. Protecting seabirds, both resident and migratory, means protecting our marine resources, whilst promoting the sustainable development of local communities, fishers, the tourism sector and renewable energy developers, amongst others. Protecting seabirds also means positively reaffirming Portugal's maritime character and demonstrating that it is possible to make progress simultaneously in scientific knowledge, economic development and nature conservation.



F. Iván Ramírez

Head of Avian Species Team
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Migratory Species of Wild Animals
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2. LIFE PanPuffinus!

The LIFE PanPuffinus! project (LIFE19 NAT/MT/000982; 2019 – 2026) aimed to address the urgent conservation needs of two threatened endemic Mediterranean seabird species: the Yelkouan Shearwater *Puffinus yelkouan* and the Balearic Shearwater *Puffinus mauretanicus*. Through unprecedented cross-border collaboration between Malta, Greece, Spain, France and Portugal, the partners implemented a series of conservation actions over five years aimed at mitigating the two main threats to these species: accidental capture in fishing gear (bycatch) and predation by invasive mammal species on land. The project was coordinated by BirdLife Malta in partnership with Aquatic Resources Malta (ARM), Hellenic Ornithological Society (HOS), Natural Environment & Climate Change Agency (NECCA), Sociedad Española de Ornitología (SEO/BirdLife), the Ligue pour la Protection des Oiseaux (LPO) and Sociedade Portuguesa para o Estudo das Aves (SPEA BirdLife).

SPEA BirdLife was responsible for implementing the project in Portugal, within the Aveiro-Nazaré Special Protection Area, the country's most important area for the Balearic Shearwater. We worked alongside fishers, gathering new data on bycatch and testing mitigation measures and solutions to reduce it.

The LIFE PanPuffinus! project was co-funded by the European Union's LIFE Programme, which supports climate and environmental action initiatives to protect Europe's biodiversity and natural habitats. The project also received support from: the Maltese Ministry of Agriculture and Fisheries, Food and Animal Rights, A. G. Leventis Foundation, The Green Fund, French Biodiversity Agency (OFB), Food4good, MAVA, Sathoan, Fondation Nature et Découverte, Oceanário de Lisboa and Fundo Ambiental.

3. Partners

SPEA BirdLife

At the Portuguese Society for the Study of Birds (SPEA BirdLife), we work every day to protect wild birds and the unique habitats on which they depend on. With the support of our members, volunteers and partners, we monitor the status of birds, build nests, remove invasive species, advocate for fair and sustainable environmental legislation, combat environmental crimes and raise awareness among different audiences of the importance of nature conservation.

SPEA BirdLife was founded on the 25th of November 1993. We began as a small organisation dedicated primarily to birdwatching and the study of birds, but over the years have grown and evolved. We are now one of the largest environmental non-governmental organisations in Portugal, with a strong commitment to nature conservation and a drive to make a difference. We have been the Portuguese partner of BirdLife International since 1999, we are acknowledged as a National Environmental Non-Governmental Organisation (registration no. 108/N) since July 2012 recognised as a Public Interest Entity since July 2012 and as a Development Non-Governmental Organisation since July 2021. SPEA BirdLife is also a member of the C7 Coalition, which brings together the seven largest environmental organisations in Portugal in the defence of the environment and the pursuit of sustainable policies.

CE3C

CE3C - Centre for Ecology, Evolution and Environmental Changes is an interdisciplinary research centre in ecology, evolution, environmental change, planetary health and related fields. It is a national and international reference in science, producing knowledge that supports and informs policy makers, NGOs, businesses and society. It is based at the Faculty of Sciences of the University of Lisbon, the National Museum of Natural History and Science in Lisbon and the University of the Azores, and is also part of the Associate Laboratory CHANGE.

Estación Biológica de Doñana (EBD-CSIC)

The Estación Biológica de Doñana (EBD-CSIC), founded in 1964, is a Public Research Institute of the Consejo Superior de Investigaciones Científicas (CSIC), part of the Global Life area and the Natural Resources sub-area. Its mission is to develop excellent scientific research in the fields of ecology, evolution and biodiversity conservation, analysing the processes that explain its origin, persistence and deterioration, as well as the consequences of its loss and the opportunities for its conservation and restoration. The EBD promotes a multidisciplinary approach to understanding how biodiversity responds to global environmental change, contributing to the development of evidence-based management strategies and fostering the transfer of knowledge to society and public administrations. Although it initially focused its work on the Doñana territory, it has progressively expanded its research to other ecosystems, both within and beyond Spain. It has its main headquarters in Seville and field stations at the Reserva Biológica de Doñana (Almonte, Huelva) and in Parque Natural de las Sierras de Cazorla, Segura y Las Villas (Jaén).

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Organisations and projects

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Marta Cruz | Marta Monteiro | Marta Nunes | Marylou Feat | Mateo Bohringer | Michael Posh | Miguel Abada | Miguel Cabral | Miguel Cardoso |
Miguel Fontes | Miguel Gaspar | Miguel Lecoq | Miguel Mendes | Miguel Rodrigues | Miguel Tapadas | Mike Davis | Nélia Penteado | Nelson Braga Moura |
Nélson Pereira | Nicola Pestana | Nina Crofton | Noelia Lanchas | Nuno Barros | Nuno Bikudo | Nuno Faria | Nuno Gonçalves | Nuno Oliveira |
Nuno Paulino | Nuno Rodrigues | Nuno Vieira | Olivier Coucelos | Patrícia Candelas | Patrícia Chaves | Patrícia Guedes | Patrícia Guimil | Paul Foster |
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A group of Cory's Shearwater | Luís Ferreira

5. Introduction

This publication, *Sentinels of the Ocean*, follows on from the *Atlas of Seabirds of Portugal* (Meirinho *et al.* 2014) and serves as its thematic and methodological update, supplemented with new content. This work compiles the most recent information on the distribution, abundance and environmental status of seabird populations using Portuguese waters, integrating data obtained through individual tracking using electronic devices (e.g., GPS), as well as long-term monitoring time series.

The main aim of this publication is to update knowledge on seabird populations in Portugal, assess their environmental status, and identify threats and conservation priorities at a national level. To this end, it presents data on the distribution of breeding areas, the abundance of breeding and non-breeding populations, productivity of breeding populations, and population trends observed over recent decades.

Technological advances in recent years, particularly in the development of remote tracking devices, have provided unprecedented insights into the movements, feeding grounds and use of marine space by these species. The growing use of these methodologies has made it timely to gather and systematise the available information on the species found in Portugal, ensuring a robust scientific source for their conservation.

As top predators, seabirds reflect changes in marine ecosystems and serve as indicators of the ocean's conservation status. Thus, assessing the status of their populations is an essential tool for gauging the health of the marine environment. In this work, historical and current data on the abundance of breeding populations were compiled. For some species, it was also possible to incorporate information on productivity, enabling demographic analysis and the prediction of future trends. With regard to non-breeding species, the long time series of over 20 years of scientific surveys obtained from marine censuses has enabled the assessment of species occurring in a sub-area of Portugal's Continental Exclusive Economic Zone (EEZ). In addition, the annual counts of wintering coastal birds carried out since 2009 along the non-estuarine coast, as part of the *Arenaria* Project, have enabled the assessment of the environmental status of the most common coastal species.

Sentinels of the Ocean comprises a first section containing a series of introductory chapters devoted to the status of seabird populations, their ecology and evolution, movement patterns of residents and migrants within the Portuguese EEZ, as well as the main threats they face. This is followed by methodological chapters that describe in detail the different approaches used, depending on the nature and origin of the data analysed. Finally, the main knowledge gaps that still exist are presented and discussed, particularly those related to the monitoring and conservation of these species. Strategic priorities for the future are also outlined, both to address these gaps and to anticipate emerging threats, such as the development of renewable energy in the marine environment and the growing effects of climate change.

The second part of this publication comprises chapters devoted to 66 species that utilise the marine component of the national territory. In total, more than 160 distribution maps are presented, organised by phenological period (breeding and non-breeding) and by region (Mainland, Azores and Madeira), as well as 81 charts summarising the environmental status assessment. For each species, a general overview on a global level is also provided, including information on distribution, movements, phenology, abundance, population trends, ecology, habitat, threats and conservation measures.

Portugal is a country with a vast maritime territory whose ecological importance is crucial on both an Atlantic and European scale. This work demonstrates the fundamental role that the Portuguese EEZ plays in the life cycle of numerous seabird species. Such importance entails an increased responsibility to promote the conservation of the marine environment and the natural values that depend on it.

6. Seabirds as bioindicators of ocean health

Today, the oceans face a growing range of anthropogenic pressures that profoundly affect their ecological integrity and all living beings that depend on them. Marine litter, overfishing and climate change, amongst other threats, act cumulatively,

altering physical, chemical and biological processes and modifying the food web structures and the resilience of marine ecosystems.

6.1. Bioindicators

The complexity and high connectivity of the oceans make monitoring particularly challenging. Seabirds are generally considered as good environmental indicators, true sentinels of the ocean, which allow us to gain insight into everything that is happening beneath the water column. The fact that they are relatively accessible and congregate in breeding colonies facilitates their monitoring (e.g., censuses and monitoring of breeding success), as well as the collection of biological samples and individual tracking. Furthermore, they occupy higher trophic niches, have a long lifespan and show site fidelity to their nesting sites, which generally makes them good candidates for use as bioindicators, as they not only reflect what is happening in the lower trophic levels but also allow for the assessment of cumulative effects. Changes in their ecology, physiology or breeding success may signal variations in food availability, exposure to pollution or changes in environmental dynamics. As such, they are widely recognised as key bioindicators for assessing the health of the oceans (Croxall *et al.* 2012).

Monitoring seabirds enables the collection of a wide range of data, including physiological, behavioural and demographic indicators which, when analysed together, provide an assessment of the environmental state of marine ecosystems.

This multidisciplinary approach has proved fundamental for detecting impacts, particularly in situations and regions where the effects of human activities are diffuse and difficult to quantify directly (Donald *et al.* 2019). Changes in demographic parameters (namely population abundance, breeding success and individual survival) may indicate variations in food availability, climate change impacts or direct human pressures, and the timely combination of this data with marine pollution metrics enables the development of environmental assessments and the possibility to anticipate trends before they result in population declines (Furness & Camphuysen 1997), providing important information for decision-making and nature conservation.

The impact of various threats on ecosystems increasingly requires a joint assessment of species, the status of their populations, and their response to the external environment. For example, quantifying bycatch in fishing gear allows seabirds to be used as bioindicators of fishing pressure in certain areas, helping to identify areas, seasons and fleet types where the risk of capture is highest and where mitigation measures are urgently needed. Furthermore, a decline in breeding success, malnourished offspring or changes in diet may signal that fish stocks or



Lesser Black-backed Gull feeding | Luís Ferreira

other key prey are in decline or shifting, acting as an early warning of problems at the base of the food chain. This change is, in many cases, only noticed later, in the harvest results of commercial fisheries, using, for example, fisheries statistics (Furness & Camphuysen 1997; Parsons *et al.* 2008).

Ocean pollution caused by plastic and other types of waste is one of the most evident and persistent pressures on marine life (Wilcox *et al.* 2015). Among the groups most affected are seabirds, for which the ingestion of or entanglement in plastic fragments has significant consequences for their physical condition and survival. The study of these materials allows us to estimate the quantity and characteristics of the waste present in the areas frequented by birds (Lavers *et al.* 2014). Another important aspect of environmental monitoring is the

bioaccumulation of chemical contaminants. The analysis of tissues—such as feathers, blood or the oil secreted by the uropygial gland—offers an effective way to assess birds' exposure to pollutants over time; these methods can reveal subtle trends and patterns that are often not detected by more traditional approaches (Furness & Camphuysen 1997; Philpot *et al.* 2019).

Coastal surveys are a form of monitoring that enables the study of the temporal and spatial patterns of seabird stranding and the identification of causes of mortality, including interactions with fishing or pollution. Mass stranding of seabirds can, for example, serve as a warning sign of a serious environmental problem, such as an oil spill or extreme environmental conditions.

6.2. Sentinel Species

The selection of sentinel species is key to the success of monitoring. Some species tend to interact with vessels and fishing gear, thereby providing a good indication of the incidence of bycatch, as is the case with the Balearic Shearwater or the Northern Gannet *Morus bassanus*. Others can reveal declines in fish stocks, such as the Atlantic Puffin *Fratercula arctica* or the Razorbill *Alca torda*. Certain birds are also more likely to interact with debris or accumulate contaminants, making them particularly suitable as bioindicators. The Northern Fulmar *Fulmarus glacialis*, the Cory's Shearwater *Calonectris borealis*, the Black-legged Kittiwake *Rissa tridactyla*, the Northern Gannet and the Great Cormorant *Phalacrocorax carbo*, amongst others, stand out given their ecology, broad distribution and demonstrated susceptibility to plastic and chemical pollutants (Provencher *et al.* 2019; Sobrino-Monteliu *et al.* 2025; van Franeker *et al.* 2022). Species that build nests using materials gathered from the surrounding area or that frequent coastal areas with high levels of human activity are particularly indicative of local pollution levels. Monitoring these individuals requires robust and standardised protocols, including consistent methods of analysis, sample sorting and rigorous control of contamination, especially in the case of microplastics (Provencher *et al.* 2019).



Balearic Shearwater | Luís Ferreira

6.3. Limitations and future perspectives

Despite their enormous potential, the use of seabirds as bioindicators faces significant limitations: monitoring colonies in remote locations entails high costs; data collection almost always relies on specialist teams; and the continuity of long-term studies requires ongoing funding and commitment (Croxall *et al.* 2012). The definition of environmental impact thresholds - such as thresholds for ingested plastics or critical concentrations of contaminants, for example - continues to prove complex due to regional variability and a lack of consistent data across colonies and species (Provencher *et al.* 2017).

The need for integrated approaches and collaboration between countries is now widely recognised. The harmonisation of methodologies, the development of common protocols, and the sharing of data and resources across Atlantic regions are essential steps towards establishing effective programmes for monitoring the health of the oceans (Donald *et al.* 2019; ICES 2023). In a context of rapid change and increasing pressures, seabirds emerge as indispensable partners in monitoring and in understanding the ocean ecosystems. Their ability to integrate environmental signals makes them vital tools for guiding conservation policies, informing management programmes and improving knowledge of the cumulative impacts of human activities on marine ecosystems.

7. Breeding ecology and evolution of seabirds

Seabirds represent a convergent group of species that have adapted to life in coastal and oceanic environments. Despite their great taxonomic diversity, they share ecological adaptations typical of marine predators: long lifespans, low

breeding productivity, high levels of parental care and fidelity to nesting sites (Schreiber & Burger 2002; Weimerskirch 2002).

7.1. Breeding ecology

Seabirds exhibit a wide variety of nesting strategies: dense colonies on cliffs or oceanic islands with nests in cavities and hidden locations (as is the case with shearwaters) or open nests on beaches and dunes (such as those of terns). Their breeding seasonality has evolved to synchronise with peaks in local food availability, in order to maximise productivity and offspring growth. However, in some species this has been changing in response to oceanographic and climatic changes, with interannual variations and trends towards earlier or later breeding (Frederiksen *et al.* 2004). These phenological changes have a direct impact on success, particularly when they cause a mismatch between the peak needs of the young and the peak abundance of prey.

Most species exhibit an equal division of parental care between parents, taking turns during the breeding, from incubating eggs to feeding and defending the nest. The duration of offspring dependence varies between species: some produce relatively independent juveniles shortly after their first flight, whilst others exhibit prolonged periods of parental feeding. Seabirds also display strategies adapted to food variability, adjusting their parental effort - they adopt a strategy of reduced egg laying in years with low food availability and increased investment in breeding when conditions are favourable (Weimerskirch 2002).

7.2. Adaptations to marine life

The transition to a marine lifestyle has led to a range of morphological, physiological and behavioural adaptations. Some species have wings and body shapes optimised for long flights or deep dives. Physiologically, seabirds have developed osmoregulation via salt glands and a high capacity for energy storage. Behaviourally, many species have adopted long-distance migration, social monogamy and site fidelity to nesting sites (Schreiber & Burger 2002; Weimerskirch 2002).

The islands where many seabirds nest are true natural laboratories for evolution. Nesting in large clusters or colonies has provided effective protection against predators. Philopatry — the behaviour of returning to one's place of birth to breed — is another adaptation that has brought advantages to seabirds. Returning to the same location results in the accumulation of knowledge about the surrounding environment, such as food sources, competitors and threats from predators. Species that persist in a particular area ensure a greater likelihood of occupying an area of good quality for their breeding (Coulson 2016). All these adaptations have thus given rise to the various lineages of seabirds we know today.



Bulwer's Petrel | Martin Loftus



European Shag in the nest, incubating | Elisabete Silva

8. The migration and wintering of seabirds



A flock of Northern Gannets flying | Edwyn Anderton

Seabirds are among the most mobile groups of vertebrates on the planet, travelling thousands of kilometres between breeding colonies and wintering grounds via migratory flyways, routes or corridors (Newton 2007; Shaffer *et al.* 2006). These seasonal movements are essential for the survival of individuals and the breeding success of the species. Throughout these journeys, birds face complex challenges, including the need to meticulously manage energy expenditure, find food in highly variable environments and adapt to unpredictable weather conditions; consequently, migration is a central component of their ecology (Shaffer *et al.* 2006; Amélineau *et al.* 2018), during which they are often exposed to various threats.

Migration is a dynamic and flexible strategy, shaped by physical pressures and individual behavioural decisions. Individual consistency in migratory routes is another important aspect of seabird ecology. Many individuals maintain repetitive migration patterns, including routes, departure dates and wintering grounds, year after year. At the same time, there is variation between individuals and populations, which provides adaptive variability and flexibility in the face of environmental and climatic changes, contributing to population resilience by allowing different strategies to be explored (Phillips *et al.* 2016).

In this way, seabirds link different oceanic regions, transporting energy, nutrients and, potentially, contaminants along their migratory routes. Migration cannot be viewed as a mere seasonal movement, but as a factor that shapes the ecology of seabirds, determines population trends and influences the evolution of populations.

During migration periods, seabirds significantly increase the intensity and duration of their flights, often covering vast stretches of ocean without stopping to rest or feed. These journeys require the efficient use of prevailing winds and ocean currents to minimise energy expenditure, requiring a balance between travel speed and the maintenance of body condition. Behavioural decisions involve not only route planning but also the selection of favourable flight altitudes and the choice between continuous flight and strategic stopovers, amongst many other factors (Amélineau *et al.* 2018; Fayet *et al.* 2016).

Coastal routes may offer more predictable feeding opportunities, but involve longer journeys and greater exposure to threats and human activities, whilst ocean crossings reduce these risks and often also the distance travelled, but increase the risk of exhaustion and dependence on previously accumulated energy reserves (Amélineau *et al.* 2018). Body morphology and individual experience are crucial factors in the choice of these strategies.

After migration, the birds arrive at their wintering grounds, where they face challenges that differ from those encountered in their breeding colonies. During winter, they tend to reduce their expenditure on high-intensity flight and concentrate on relatively stable, food-rich habitats, which allow them to replenish their reserves and prepare for the following breeding season. Wintering areas are often characterised by the presence of major ocean fronts, upwelling zones and complex currents, the productivity of which can directly affect the birds' body condition and survival, generating carry-over effects on future breeding performance (Newton 2007; Fayet *et al.* 2016).



9. Seabirds in the Portuguese EEZ

9.1. Oceanographic and ecological context

Portugal has one of the largest Exclusive Economic Zones (EEZ) in the European Union and the twentieth largest in the world, covering approximately 1.7 million km² (Figure 1). The Portuguese EEZ is of exceptional importance for marine biodiversity due to its geographical location, diversity of habitats and ecological processes that support a wide variety of species. This area is influenced by the large-scale circulation of the North Atlantic, in which the Gulf Stream feeds the North Atlantic Current and the Azores Current, which in turn influence the Portugal Current, establishing a link with the Canary Current along the eastern margin of the Atlantic (Barton 2001). These systems regulate the horizontal transport of heat, salt and biogeochemical characteristics of the water, promoting connectivity between the Portuguese EEZ, the Bay of Biscay and the remaining areas of Macaronesia and the North Atlantic.

The Portuguese Mainland coast lies within a biogeographical transition zone between temperate and subtropical waters, where the distribution ranges of numerous species overlap. It exhibits marked hydrographic and sedimentary variation: the north, which is colder and influenced by coastal upwelling and high rainfall, contrasts with the south, which is warmer and under Mediterranean influence. These differences strongly influence the composition and structure of marine communities, which vary between the north-west and the central and southern regions (Cardoso *et al.* 2019). Coastal upwelling occurs along the entire Portuguese coast, being particularly intense and frequent on the west coast (Ferreira *et al.* 2022). This process brings cold, nutrient-rich waters to the surface, stimulating the development of phytoplankton and zooplankton, which form the basis of the marine food chain. Productivity is further enhanced by coastal lagoons and kelp forests, which contribute to significant amounts of nutrients (Falcão & Vale 2003; Pinho *et al.* 2015). This high influx of nutrients sustains a rich piscivorous biodiversity, which in turn supports commercial fisheries and top predators, such as cetaceans and seabirds (Veiga-Malta *et al.* 2019).

The Azores, situated on the Mid-Atlantic Ridge, form a region characterised by seamounts and oceanic ridges that promote localised upwelling, increasing productivity and generating high concentrations of prey in the open deep ocean. This biogeographical configuration favours a mix of cold-water, temperate and tropical species, resulting in high marine diversity (Borges *et al.* 2010). The area is home to unique cold-water coral communities and vulnerable deep-sea benthic ecosystems (Morato *et al.* 2021), supporting important fish communities, which include demersal species and large migratory pelagics, such as tuna and silver scabbardfish *Lepidopus caudatus* (Morato *et al.* 2002; Menezes *et al.* 2006). Furthermore, the Azores have one of the world's highest diversities of cetaceans, with around 24 species of whales and dolphins regularly observed, including resident species and seasonal visitors (Silva *et al.* 2014).

The Madeira region also lies in a transition zone between temperate and subtropical waters, and is strongly influenced by the Canary Current and the coastal current system of North-West Africa. It is characterised by a very narrow insular shelf, steep submarine slopes, and the presence of underwater elevations and seamounts (Hermida & Delgado 2016). Its waters are oligotrophic and low in productivity, which influences the availability of habitats and the ecological dynamics of the region (Hermida & Delgado 2016). Marine diversity reflects this biogeographical position, hosting coastal communities dominated by subtropical fish, but also temperate species. Various top predators and other megafauna utilise these waters seasonally or throughout their entire life cycle, including tuna, swordfish, sharks, seabirds, cetaceans, seals and sea turtles (Alves *et al.* 2018; Romero *et al.* 2024).

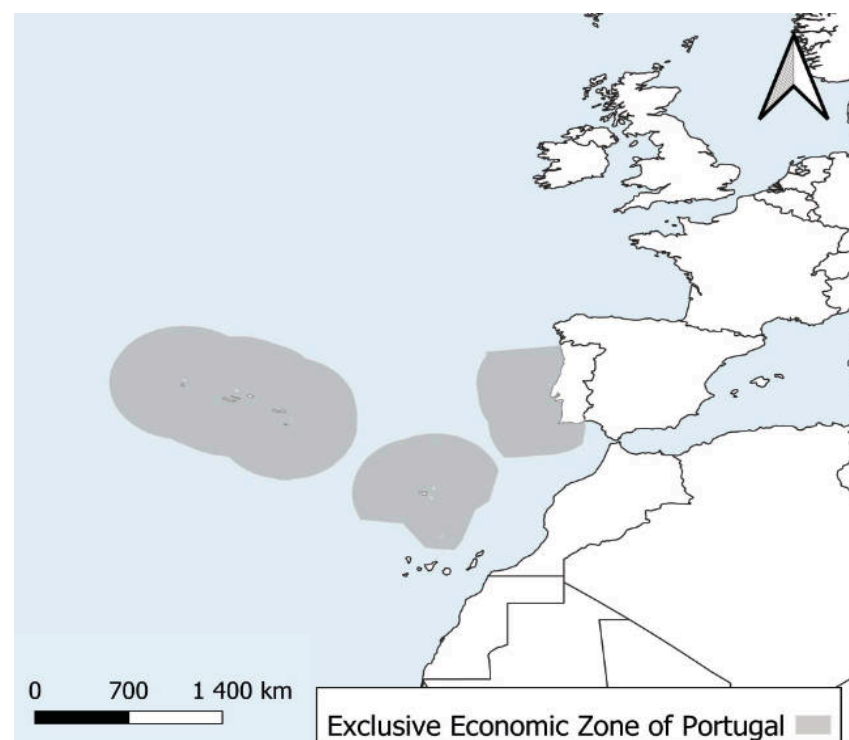


FIGURE 1: Boundaries of Portugal's Exclusive Economic Zone

9.2. The importance of the Portuguese EEZ for seabirds

The high productivity of the Portuguese EEZ plays a crucial role as a feeding ground for numerous marine species, including birds, ranking among the 20 Exclusive Economic Zones worldwide that support 50 or more species of seabirds (Croxall *et al.* 2012). The diversity and availability of food resources provide favourable conditions for both resident and migratory species that use these waters for resting, feeding or during migration. The location and vast extent of the EEZ make Portuguese waters a refuge and a key stopover point. It also functions as an important migratory corridor for many seabirds, forming part of the East Atlantic Flyway, and is used by birds moving between northern Europe, the Mediterranean, the South Atlantic and the African coast (Meirinho *et al.* 2014; Morten *et al.* 2025). Furthermore, for many species, the Portuguese EEZ constitutes a significant wintering area, with high diversity and abundance during the non-breeding season (Ramírez *et al.* 2008; Fagundes *et al.* 2024). In fact, the communities of migratory and wintering birds are considerably richer than the breeding communities, and several species occur here in numbers of global significance, notably the Balearic Shearwater, the Lesser Black-backed Gull *Larus fuscus*, the Northern Gannet, the Mediterranean Gull *Larus melanocephalus* and the Common Scoter *Melanitta nigra* (Meirinho *et al.* 2014).

Portugal is also of great importance as a breeding area for seabirds, with the Azores and Madeira archipelagos being particularly significant, as they are home to the largest number of pelagic species. In total, 22 species of seabirds breed within the country, of which nine belong to the order Procellariiformes, two to the Suliformes and eleven to the Charadriiformes (Equipa Atlas 2022).

Nevertheless, such importance brings with it great responsibilities, and Portugal has often failed to live up to this significant role. One of the main examples was the sharp decline in the breeding population of the Common Murre *Uria aalge* in the Berlengas archipelago, with no evidence of breeding since 2002 (Equipa Atlas 2022). Another alarming situation is the high number of migratory populations in the country that are in decline (Fagundes *et al.* 2024) or in poor environmental condition (see Chapter 11).



A group of Northern Gannets feeding | Elisabete Silva

9.3. The global importance of breeding seabirds

Portugal plays a prominent role in the North-East Atlantic, hosting some of the region's most significant seabird colonies, both due to the presence of endemic species and because it is home to populations of significant size on a global scale.

Of the 22 seabird species that breed in Portugal, three are endemic: one to the Azores and two to Madeira.

- The Monteiro's Storm-petrel *Hydrobates montei*, endemic to the Azores, has an estimated population of fewer than 400 breeding pairs, with confirmed nesting on the islets of Praia and Baixo, off the coast of Graciosa Island, on the island of Flores (Equipa Atlas 2022), and more recently, on the islet of Topo, located on the island of São Jorge (Pipa *et al.* 2024). Due to its small population size, the species is classified as Vulnerable at a global level (BirdLife International 2025).
- The Desertas Petrel *Pterodroma deserta*, endemic to the Desertas Islands (Madeira), has an estimated population of around 180 breeding pairs and a global conservation status of Vulnerable (BirdLife International 2025).
- The Zino's Petrel *Pterodroma madeira*, endemic to the island of Madeira, nests on the eastern slopes of the central mountain range, with an estimated population of around 80 breeding pairs. Due to its restricted range and small population size, it is classified as Endangered at a global level (BirdLife International 2025).

Other marine species also have populations of significant importance within the Portuguese EEZ, accounting for a substantial proportion of global or European populations. The White-faced Storm-petrel *Pelagodroma marina*, although widely distributed across the Northern and Southern Hemispheres, has the vast majority of its European subspecies - *P. m. hypoleuca* - concentrated in the Selvagens Islands (Madeira), with an estimated population of up to 110,000 pairs (Campos & Granadeiro 1999; Equipa Atlas 2022), and is classified as Endangered in Europe (BirdLife International 2021). In the case of the Cory's Shearwater, Portugal is home to around 85% of the global population, with the largest colonies in the Azores (up to 188,000 pairs), followed by Madeira (up to 43,000 pairs) and the Mainland coast, where fewer than 800 breeding pairs are estimated (Equipa Atlas 2022; BirdLife International, 2025). The Barolo Shearwater *Puffinus baroli* has populations estimated at fewer than 4,000 pairs in Madeira and around 1,700

pairs in the Azores, thus constituting almost the entire population of this species, with the exception of a few hundred pairs in the Canary Islands (Equipa Atlas 2022; BirdLife International 2025). The Bulwer's Petrel *Bulweria bulwerii* has a pantropical distribution, nesting in various oceanic regions. In Europe, its breeding population is restricted to Macaronesia, where it is estimated that there are around 100,000 pairs, with the main colonies located on the Desertas and Selvagens Islands (Madeira) (Equipa Atlas 2022). On the Mainland coast, the Audouin's Gull *Larus audouinii* stands out, with its breeding population concentrated in the Algarve, specifically on the islands of Deserta and Culatra in the Ria Formosa Natural Park, with an estimated population of over 7,000 pairs. This represents the largest colony of the species worldwide, accounting for around 36% of the global population, which has a Vulnerable conservation status (Oliveira *et al.* 2025b; BirdLife International 2025).



Monteiro's Storm-petrel | Tânia Pipa



Desertas Petrel | Pedro Geraldès



Zino's Petrel | Martin Loftus



Barolo Shearwater | Ana Isabel Fagundes



White-faced Storm-petrel | Martin Loftus



Audouin's Gull | Pedro Geraldès

9.4. Main migratory and wintering species

Among the main species of migratory and wintering seabirds that use the Portuguese EEZ is the Balearic Shearwater, which breeds exclusively in the Balearic Islands and is currently classified as Critically Endangered (BirdLife International 2025). The vast majority of the global population uses the Iberian coastal waters as a migratory corridor (De la Cruz *et al.* 2025). The north-central coast of Portugal, more specifically the Aveiro-Nazaré Special Protection Area, is of particular importance during the wintering period, hosting over 50% of the global population of this species (Araújo *et al.* 2022a).

Similarly, the Northern Gannet, which breeds in the North Atlantic, is one of the most abundant species along the Portuguese Mainland coast, particularly during the pre-breeding (January - February) and post-breeding (September - November) migrations (Catry *et al.* 2010a). Despite interannual fluctuations, it is estimated that at least 9% of the global population may use Portuguese waters, corresponding to more than 120,000 individuals (Araújo *et al.* 2022a).

The Lesser Black-backed Gull is a migratory species of the North Atlantic, with breeding populations mainly in Central and Northern Europe, and a breeding population in Mainland Portugal of fewer than 50 pairs (Equipa Atlas 2022). During

winter, a large proportion of the breeding birds in Central Europe move to the North-East Atlantic, including the coastal waters of Mainland Portugal, which serve as feeding and resting areas. Although no concrete and recent figures are available, wintering birds number in the tens of thousands along the coast, and are also found in large numbers within major estuaries and even in some inland reservoirs.

Also breeding in northern Europe, the Common Scoter winters in Mainland Portugal, being most common along the north coast, where it is found mainly in shallow coastal waters with sandy bottoms. The number of individuals can reach around 20,000 birds (Jesus 2018), corresponding to approximately 1–2% of the global population.

The Mediterranean Gull is another common winter visitor to Mainland Portugal, with breeding ranges scattered along the coasts of the Black Sea, the Mediterranean and northern Europe, including the Netherlands, England, Belgium and Germany. Between October and March, numbers exceed 7,000 individuals along the Portuguese coast, concentrated mainly south of the River Tagus (Poot & Flamant 2006).



Balearic Shearwater | Luís Ferreira



Northern Gannet | Thys Valkenburg



Mediterranean Gull | Pedro Geraldès

9.5. Migratory routes and connectivity

Most seabird species are highly mobile, travelling hundreds or thousands of kilometres, particularly during their migrations, but some also undertake such journeys while foraging. In Portugal, there are some extreme examples of these large-scale movements - such as the Zino's Petrels, which are endemic to Madeira and can travel 12,000 km on their foraging trips (Ventura *et al.* 2020). The famous Arctic Terns *Sterna paradisaea*, record-holders for long-distance migration, also pass through Portugal's waters (Egevang *et al.* 2010). It is because of these journeys that seabirds play a fundamental role, on a global scale, in the transport of nutrients not only between geographical regions, but also between different marine and terrestrial ecosystems (Otero *et al.* 2018) - i.e., in ecological connectivity.

Migratory seabirds found along the Portuguese coast mainly use two major migratory routes: the East Atlantic Flyway and the Atlantic Ocean Marine Flyway (Figure 2). The East Atlantic Flyway is a coastal migratory route used by many terns, gulls, jaegers, gannets and also by most migratory waders. The Atlantic Ocean Marine Flyway, recently described by BirdLife International (Morten *et al.* 2025), is used by more pelagic species, such as shearwaters, but also some gulls (such as Sabine's Gull *Xema sabini*), terns and jaegers. It

is important to clarify that the definition of these major migratory routes is based on very general patterns. In reality, each species has its own route, often more than one, depending on the population in question (Catry *et al.* 2011a). In some species, such as shearwaters, this variability is even reflected at the individual level, with a single bird potentially changing its route from one year to the next (Dias *et al.* 2011). Consequently, many seabird species use both of the aforementioned routes, in most cases only part of these routes, depending on the population of origin and the destination of the journey.

Knowledge of seabird migration has increased exponentially in recent decades, thanks to advances in individual tracking technology, particularly the use of GLS geolocation devices (Carneiro *et al.* 2024). Species from the Atlantic Ocean - including those found in Portugal - are relatively well studied compared to other oceans (Bernard *et al.* 2021; Michel *et al.* 2026), particularly shearwaters and some gulls. In contrast, smaller species such as storm-petrels are comparatively less studied, due to limitations on the weight of the tracking devices. The significant investment in research into the movements of seabirds (particularly advanced in the case of shearwaters, which are by far the most closely tracked seabirds in the Atlantic) (Carneiro *et al.* 2024) has enabled a



FIGURE 2: Main migratory routes used by pelagic (orange shaded area) and coastal birds (purple line) found in Portugal: the Atlantic Ocean Marine Flyway and the East Atlantic Flyway, respectively. Adapted from <https://www.seabirdtracking.org/special/marine-flyways/> and <https://qsr.waddensea-worldheritage.org/reports/east-atlantic-flyway>.

detailed understanding of various aspects of their migratory ecology and behaviour: where and via which routes they migrate (i.e., their destinations and routes), when they migrate (dates of departure and arrival, both at colonies and wintering sites), where they stop along the way, and how they migrate (activity patterns throughout the migratory journey). The data obtained from these studies have also provided insights into the threats faced by seabirds during their journeys, such as bycatch in fishing gear, climate change, pollution and the expansion of offshore wind farms (Ramos *et al.* 2012; Clark *et al.* 2023; Garthe *et al.* 2023). Nevertheless, given the high number of species found in Portuguese waters and the variability of their movements, it is still far from clear how the various threats encountered by seabirds throughout the annual cycle may impact - cumulatively or synergistically - their demographic patterns and, ultimately, their role in ecological connectivity and marine productivity (Graham *et al.* 2018).

Not all developments are cause for concern, however, as the understanding of the migratory routes of seabirds has also been a key factor in their conservation. The compilation of data from various studies across different colonies has enabled significant progress in identifying the most important areas for their conservation (Carneiro *et al.* 2024), as well as identifying the countries with the greatest responsibility for their conservation (Beal *et al.*

2021), thereby facilitating the implementation of concrete conservation measures in the most relevant regions (Figure 3). This is the case of the North Atlantic Current and Evlanov Sea Basin Marine Protected Area (NACES) (Davies *et al.* 2021), designated in 2021 with the specific aim of conserving migratory seabirds. NACES is located in the centre of the North Atlantic, between the Azores, the United Kingdom, Canada and Greenland, where ocean currents converge in an area between 200 m and 1,000 m deep (Figure 4). These unique oceanographic conditions make this area rich in fish and squid, which rise to the surface at night, in turn attracting millions of seabirds of a wide variety of species.

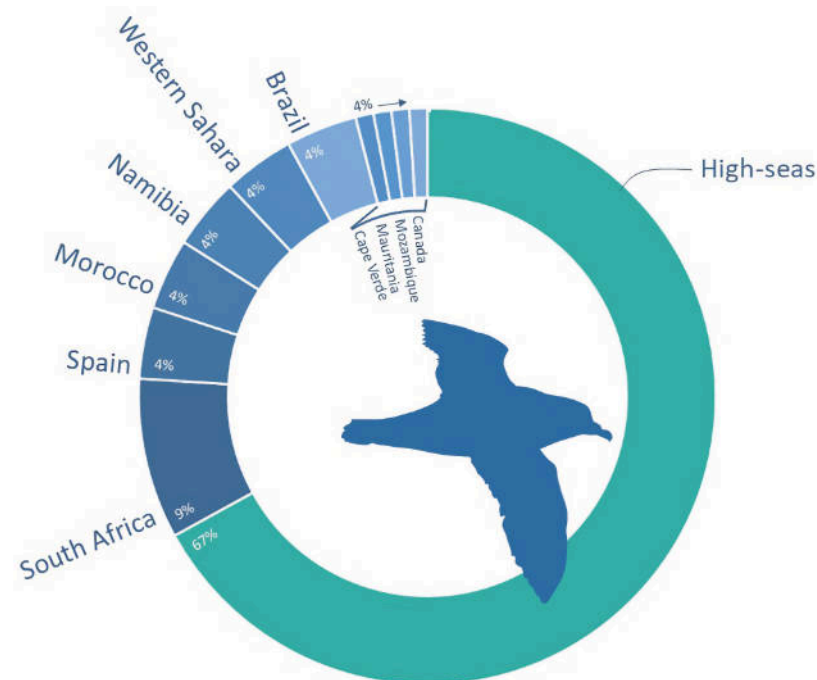


FIGURE 3: The shearwaters that breed in Portugal visit many other marine areas. When they are not in Portuguese waters, shearwaters spend around two-thirds of their time outside the jurisdiction of any country (on the high seas). Based on information available at <https://birdlifeseabirds.shinyapps.io/seabird-connections/>.

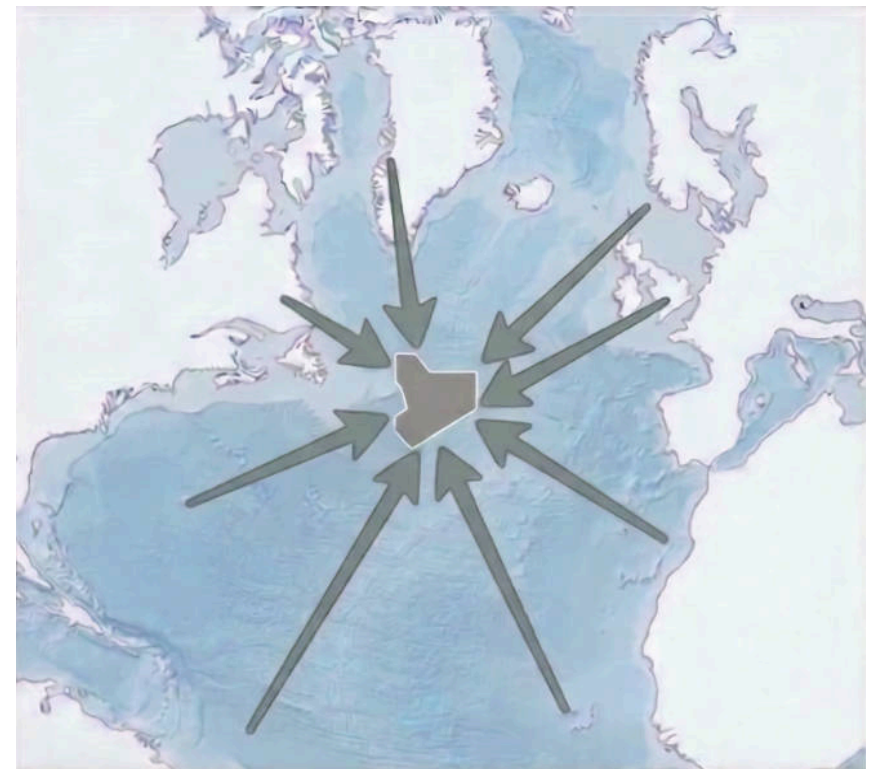


FIGURE 4: Location of the North Atlantic Current and Evlanov Sea Basin Marine Protected Area (NACES). The seabird populations origins that use this area are highlighted.

10. Threats to seabirds

Seabirds are among the most threatened groups of birds (Croxall *et al.* 2012; Vulcano *et al.* 2024), with 29% of species classified as globally threatened (Phillips & Dias 2023). The main threats identified are invasive species, bycatch in fishing gear and climate change, alongside other significant pressures such as overfishing, hunting/capture and disturbance (Dias *et al.* 2019). Most species (c. 70%) face multiple threats, requiring integrated management strategies that simultaneously address terrestrial and marine factors.

Anthropogenic impacts primarily affect long-lived birds that feed at the surface in the open sea and depend on specific habitats. Birds with restricted habitats, short breeding seasons and diverse diets are particularly vulnerable to threats that alter their habitat, such as pollution or changes to natural systems. Pelagic

species, on the other hand, with slow breeding, show greater sensitivity to pressures that directly affect survival and breeding success, including invasive species, resource exploitation and climate change. In contrast, non-threatened species tend to be coastal, have diets based on invertebrates and exhibit high rates (Richards *et al.* 2021).

As excellent indicators of the state of marine ecosystems, the decline in seabirds reflects the global crisis facing the oceans. It is therefore urgent to implement practical actions that balance priority and feasibility, both at the species level and in key areas for their conservation (Dias *et al.* 2019).



Corvo Island | Pedro Geraldès

10.1. Threats on land

Invasive species

Invasive alien species are among the main threats to seabirds, and constitute the threat affecting the largest number of species: 165 in total, of which 73 are globally threatened (Dias *et al.* 2019). Introduced predatory mammals have a particularly severe impact, being implicated in 58% of extinctions of birds, mammals and reptiles (Doherty *et al.* 2016). The problem is particularly acute on islands, where many birds nest on the ground and lack natural defences against introduced predators (Doherty *et al.* 2016; Oliveira *et al.* 2022b). Rats *Rattus spp.* and cats *Felis catus* are the species that affect the greatest number of seabird species, followed by smaller rodents (house mouse *Mus musculus* and eastern deer mouse *Peromyscus maniculatus*) (Dias *et al.* 2019). Other predators with significant impacts include dogs *Canis lupus familiaris*, pigs *Sus scrofa domesticus*, foxes *Vulpes vulpes*, mustelids and mongooses (Doherty *et al.* 2016; Oliveira *et al.* 2022b). In the case of seabirds, the main effects observed are direct predation and reduced habitat quality caused, in this instance, by introduced herbivores.

Three species of rat (Polynesian rat *Rattus exulans*, brown rat *R. norvegicus* and black rat *R. rattus*) are responsible for the local extinction or decline of at least 75 species of seabirds on islands, primarily through the predation of eggs, chicks and adults, affecting mainly those that nest in burrows (Jones *et al.* 2008). Other rodents, such as the house mouse, have an impact on vegetation and habitat, and may also prey on eggs and chicks, including those of large species, causing severe population declines. Cats, meanwhile, introduced to numerous archipelagos, are associated with 14% of insular vertebrate extinctions and constitute a significant threat to many endangered seabirds (Medina *et al.* 2011). Introduced herbivores (such as the European rabbit *Oryctolagus cuniculus* and the domestic goat *Capra aegagrus hircus*) degrade vegetation, promote soil erosion, reduce nesting habitat and increase species' vulnerability to predation (Courchamp *et al.* 2003). In some cases, they may also occupy burrows or destroy nests, leading to the abandonment of nesting areas (Courchamp *et al.* 2003).

On European islands, around 39% of native species affected by invasive vertebrates are seabirds, with rats being the most common and damaging invaders, accounting for around 77% of cases (Hulme 2007). The eradication and control of invasive mammals has thus become an urgent priority and a key tool in the restoration of nesting habitats, with the first programmes carried out in New Zealand in the 1980s and, ten years later, in Europe, in the archipelagos of Madeira and the Selvagens (Oliveira *et al.* 2022b). Many other eradication projects followed in Portugal (Table 1). In addition to these eradication programmes, complementary programmes for the control of cats and rodents were implemented in the archipelagos of the Azores and Madeira, as well as on the Mainland, improving habitat conditions and survival rates for various seabird populations such as the Zino's Petrel, Desertas Petrel, Bulwer's Petrel, Cory's Shearwater, Barolo Shearwater, White-faced Storm-petrel, Monteiro's Storm-petrel, Band-rumped Storm-petrel *Hydrobates castro*, Audouin's Gull, Sooty Tern *Onychoprion fuscatus*, Little Tern *Sternula albifrons*, Roseate Tern *Sterna dougallii* and Common Tern *Sterna hirundo*. These projects have also enabled the restoration of island ecosystems, although legal barriers, lack of resources and public opposition persist, limiting the success of eradication programmes (Oliveira *et al.* 2022b).



Black rat | Miguel Lecoq



Cat | Tânia Nascimento



Rabbit | Luís Ferreira

Location		Species			
		House mouse	Black rat	Rabbit	Goat
Mainland	Berlenga Islands		x	x	
	Barreta Island				x
Azores	Feno Islet		x		
	Praia Islet			x	
Madeira	Madeira Island				x
	Selvagem Grande	x		x	
	Deserta Grande			x	
	Bugio			x	x
	Cal Islet	x		x	
	Desembarcadouro Islet	x	x		x
	Chão Islet	x			
	Cima Islet			x	

TABLE 1: Mammal species introduced in Portugal and targeted for eradication (sources: Bried *et al.* 2009a; Amaral *et al.* 2010; Oliveira *et al.* 2022b; Nascimento *et al.* 2023a; Oliveira *et al.* 2025a).

Hunting, capture and egg collection

The capture of seabirds poses a threat that varies significantly between regions and over time. Historically, many species have been heavily exploited for their meat, eggs, fat and feathers, particularly in areas with dense colonies (Baldwin 2009). This pressure has led to sharp declines and, in some cases, local and global extinctions, as occurred with the Great Auk *Pinguinus impennis* and the Spectacled Cormorant *Urile perspicillatus*, both of which became extinct in the 19th century due to hunting for human consumption (BirdLife International 2025). In addition to this direct action, the collection of eggs, often on a large scale and repeated over several breeding seasons, has compromised the breeding success of several species of seabirds (Baldwin 2009).

The capture of seabirds, as well as the collection of eggs and chicks, continues to take place in over 160 countries, occurring within a variety of socio-cultural contexts, ranging from the subsistence needs of local and indigenous communities

to recreational and commercial uses. Nevertheless, many populations are now so depleted that they cannot support even low levels of exploitation sustainably (Naves & Rothe 2023; Inch *et al.* 2024). In Europe, the strengthening of conservation legislation and the creation of protected areas have contributed to the widespread ban on direct harvesting for consumption. In Portugal, although the hunting or collection of seabirds no longer constitutes a widespread threat, episodes of illegal and/or opportunistic capture continue to occur. Historically, the practice of catching juvenile Cory's Shearwaters for consumption was locally common on some islands in Madeira and the Azores. On the Mainland, there are historical records of adult Cory's Shearwaters and their eggs, and Yellow-legged Gull *Larus michahellis* eggs, being collected by fishermen on the island of Berlenga, along with eggs from Little Tern colonies for consumption (Lockley 1952; Teixeira 1984).

Light pollution

The expansion of artificial lighting generates light pollution, posing a threat to biodiversity (Hölker *et al.* 2010). Artificial light at night profoundly alters natural light-dark cycles, disrupting circadian rhythms and affecting reproduction, feeding, sleep and increases the risk of predation in many living beings (Gaston *et al.* 2017). For birds, the disruption of natural light cycles can disorient their movements, delay reproduction and hinder feeding and nesting (Gouveia 2022). Pelagic seabirds, especially the Procellariiformes, are particularly vulnerable, as they rely on stellar navigation to guide themselves visually at night, locating colonies and undertaking long journeys (Telfer *et al.* 1987). Vision develops gradually over time and, as a result, juveniles have limited visual capacity, making them particularly sensitive to artificial night-time lighting and more vulnerable to the effects of light pollution (Rodríguez *et al.* 2017; Atchoi *et al.* 2020).

Light pollution acts as a powerful attractant during night-time flights, disorienting birds and causing many to crash to the ground (Gouveia 2022). The causes of this attraction may include mistaking light for food, an association between light

and feeding during the nestling phase, or interference with natural navigation systems (Rodríguez *et al.* 2017). Disoriented birds may suffer severe injuries following collisions with structures, be preyed upon, or die from starvation or dehydration. These events can occur on a large scale, particularly on dark or foggy nights. Light pollution can also increase predation within colonies, reduce the frequency of adults at the nests, and affect population dynamics. At sea, lights from vessels, oil platforms and other human activities also cause attraction and mortality, impacting various species around the world (Glass & Ryan 2013; Ronconi *et al.* 2015).

Reducing the impact of light pollution on seabirds involves social, economic and environmental challenges (Gouveia 2022). Mitigating light pollution to protect seabirds requires research, appropriate lighting planning, rescue campaigns and active community involvement.



Light pollution | Elisa Teixeira

In Portugal, in the most affected regions of Madeira and the Azores, rescue campaigns for grounded birds have been carried out over recent decades, targeting priority and/or endangered species (Luminaves 2020). Despite this, it is estimated that up to 14% of birds attracted to the ground by light pollution ultimately die, although the actual figures are likely to be even higher, as not all birds are found (Rodríguez *et al.* 2017). In addition to bird rescue, these campaigns aim to monitor

Diseases and parasites

Diseases are emerging as a growing threat to the conservation of seabirds, particularly in the event of outbreaks, as they can cause sharp and rapid declines in populations, even when they appear to be stable. Seabirds can be affected by a variety of pathogens, including viruses, bacteria, fungi, protozoa, helminths and ectoparasites (Woods *et al.* 2009).

Among viruses, highly pathogenic avian influenza (HPAI) has emerged as one of the main recent concerns, with outbreaks recorded in various seabird populations across Europe since 2021, causing significant mortality, particularly in gregarious species such as gulls, jaegers, terns and gannets (Tremlett *et al.* 2024). In addition to direct mortality, HPAI can reduce breeding success or lead to the abandonment of colonies (Careen *et al.* 2024). Similarly, bacterial infections such as avian cholera, caused by the bacterium *Pasteurella multocida*, pose a serious threat, causing significant mortality in albatrosses and large shearwaters on sub-Antarctic islands (Uhart *et al.* 2018).

Dense colonies and degraded areas facilitate the transmission of pathogens, and the presence of synanthropic species (such as gulls) can also facilitate the circulation and spread of infectious agents between coastal, urban and marine environments (Navarro *et al.* 2019). Exposure to chemical pollutants (e.g. metals and plastics), which weaken immune systems, can also further exacerbate susceptibility to infections (Sebastiano *et al.* 2022). Finally, climate change may also alter the geographical distribution of many pathogens and vectors, favouring the introduction and persistence of diseases in regions where they were previously absent (Grimaldi *et al.* 2011).



Cory's Shearwater collected during rescue campaigns | Beatriz Martins

populations, identify the most problematic locations and explore different lines of research, typically related to species ecology, the effect of light pollution, marine productivity and breeding success (Rodríguez *et al.* 2017). Maintaining and improving these campaigns, creating rescue protocols, establishing rehabilitation centres and combining these data with rigorous scientific methods is essential to reduce mortality caused by light pollution and guide mitigation actions.

In Portugal, there are not many studies on the prevalence of diseases in seabirds; however, cases of avian influenza have been reported on the Mainland and in Madeira in breeding gulls, specifically the Yellow-legged Gull and the Audouin's Gull (European Food Safety Authority 2024).



Northern Gannets at a rehabilitation centre | RIAS

10.2. Threats at sea

Bycatch in fishing gear

Seabirds typically feed in the most productive areas of the oceans, which are also the preferred areas for commercial fishing. This spatial and trophic overlap can lead to negative interactions between birds and fishing vessels/gear, often resulting in injury and mortality of birds. This phenomenon is known as bycatch and constitutes one of the main threats to seabirds, resulting in high direct mortality (Dias *et al.* 2019). Bycatch can occur in various types of fishing gear, particularly longlines and static nets, but also in trawling, purse seining, traps and recreational fishing (Oliveira *et al.* 2022a). Bird bycatch can occur through various mechanisms, such as entanglement in nets or fishing lines, hooking or hook ingestion, entrapment in purse seines, or collisions with nets and cables (Oliveira *et al.* 2022a).

It is estimated that around 60% of seabird species have interacted with some type of fishing gear (Pott & Wiedenfeld 2017). Large-scale fisheries affect more threatened species than small-scale fisheries, although average impacts are similar (Dias *et al.* 2019). Among the different types of fishing gear, gillnets are responsible for the highest number of species affected, whilst longlines and trawls have more severe and widespread impacts.

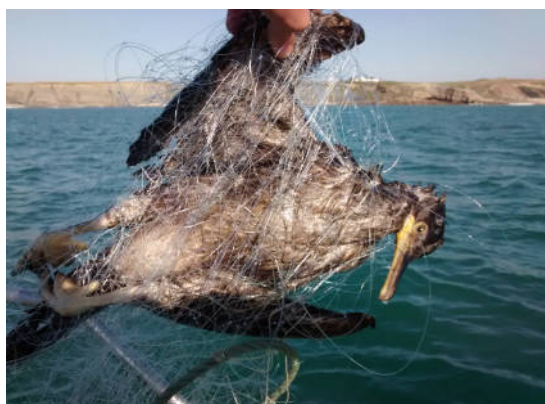
Globally, it is estimated that 160,000–320,000 seabirds are killed each year in longline fisheries (Anderson *et al.* 2011) and around 400,000 in gillnets (Żydelis *et al.* 2013); no overall estimates are available for other types of fishing gear. In Europe, it is estimated that at least 195,000 seabirds are caught annually. The most critical region is the North-East Atlantic, with over 115,000 birds caught annually, mainly in gillnet fisheries, followed by longline fisheries. The Common Murre is the most affected species, with over 31,000 individuals killed per year (Ramírez *et al.* 2024).

In Portugal, the highest rates of bycatch are associated with multi-gear vessels, particularly in gillnets and demersal longlines (Oliveira *et al.* 2015). Although bycatch may be frequent in some fisheries, it often occurs sporadically, with occasional events capturing dozens or hundreds of birds at a time, particularly



Sea | Daniel Santos

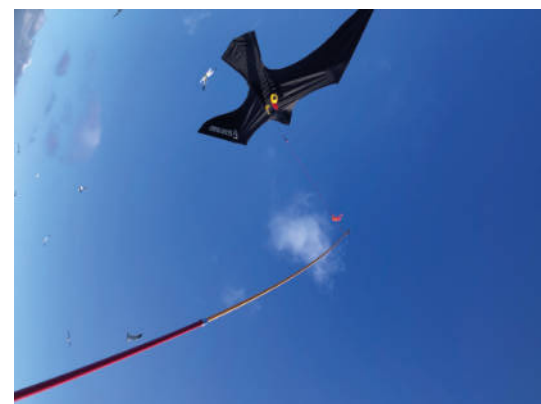
with gregarious species such as shearwaters (Pereira *et al.* 2025a). In the Berlengas Islands SPA and the surrounding waters of Peniche, the most affected species is the Northern Gannet, with an estimated several thousand birds caught annually in demersal longlines and set gillnets. Other affected species include the Cory's Shearwater by demersal longlines, and the European Shag *Gulosus aristotelis* by gillnets, with several hundred and several dozen birds, respectively, being caught every year (Oliveira *et al.* 2021). In the Aveiro-Nazaré SPA, recent findings show that gillnets show alarming bycatch rates of Northern Gannets, Balearic Shearwaters, Yellow-legged Gulls and Lesser Black-backed Gulls, whilst also affecting other species such as the Razorbill, the Common Murre and the Common Scoter (Alves 2024).



European Shag captured in a fishing net | Iván Gutiérrez



Northern Gannet caught on a hook | Iván Gutiérrez



Scarybird kite | Flávia Carvalho

In the eastern Algarve, small-scale fisheries can cause significant mortality among seabirds, particularly at certain times of year and in certain types of fishing gear; the Great Shearwater *Ardenna gravis* is the species most frequently caught as bycatch, followed by Northern Gannet, Great Cormorant, Yellow-legged Gull and Lesser Black-backed Gull (Pereira *et al.* 2025a).

Reducing bycatch of seabirds remains a significant challenge, as there are still limitations to the effectiveness of currently available technical solutions and compliance with mitigation measures remains insufficient. These circumstances make the implementation of independent electronic monitoring systems urgent (Dias *et al.* 2019). The combination of systematic data collection and the immediate application of mitigation measures is essential to reduce current mortality, fill knowledge gaps and meet international conservation commitments (Ramírez *et al.* 2024). In Portugal, some technical solutions have already been tested,

including high-contrast panels on gillnets, black hooks on longlines and the use of deterrent devices, such as the scarybird kite, although many of these measures have presented challenges and have not proved particularly effective (Oliveira *et al.* 2021; Almeida *et al.* 2023). Although still at the experimental stage, the use of the scarybird kite along the Portuguese coast has shown promising results as a measure to mitigate the risk of seabird bycatch. In the presence of the device, a reduction in the number of interactions and an increase in the distance between birds and vessels is observed. Furthermore, certain behaviours during fishing operations, such as cleaning nets and discarding fish and offal only outside fishing activity periods, can help reduce the risk of seabird bycatch. These practices highlight the importance of implementing good operational practices and providing ongoing training for professionals (Frade *et al.* 2025).

Competition for resources and overfishing

When fisheries target the same prey species consumed by seabirds, they increase the pressure on fish stocks, and overfishing can significantly reduce the availability of food for these birds (Montevecchi 2001; Furness 2003). Prey depletion can affect adult survival, reduce breeding success, affect feeding efficiency and even alter foraging habits (Furness 2003; Bertrand *et al.* 2012). These effects are particularly evident in species that depend on schools of small pelagic fish (Saraux *et al.* 2021), such as the Pacific sardine *Sardinops sagax* and the European anchovy *Engraulis encrasicolus* in South Africa (Okes *et al.* 2009; Crawford *et al.* 2014), as well as sand eels in the North Atlantic (Frederiksen *et al.* 2004). In addition to reduced food availability, spatial and temporal overlap between birds and fisheries also increases the risk of bycatch in fishing gear, constituting an additional source of mortality (Nascimento *et al.* 2023b).

Competition for resources can be exacerbated when fishing grounds overlap with key feeding sites for birds or with regions that support small or threatened populations, thereby increasing their vulnerability (Pott & Wiedenfeld 2017). However, assessing these impacts remains a challenge, as they often occur simultaneously with other global pressures, such as climate change and pressures on breeding sites, or due to gaps in knowledge, particularly regarding fishing effort and catches, especially in the case of small-scale fisheries (Pott & Wiedenfeld 2017). Nevertheless, it is assumed that such competition is high on a global scale, particularly in the Southern Ocean, the Asian continental shelves, the Mediterranean, the Norwegian Sea and the California coast, contributing to increased pressure on seabird populations in these regions (Grémillet *et al.* 2018).

Along the Portuguese coast, the availability of small pelagic fish, such as the sardine *Sardina pilchardus* and the European anchovy *Engraulis encrasicolus*, plays a crucial role in the diet of various seabirds. The collapse of the stocks of these species is one of the factors that may have contributed to the decline in breeding populations of the Common Murre (Martínez-Abraín *et al.* 2023). In addition to pelagic fish, competition for other commercially valuable species may also affect coastal diving birds. In the case of the European Shag in the



Birds and purse seine fishing | Flávia Carvalho

Berlengas Islands, there is a high degree of spatial and trophic overlap with multi-purpose gear fisheries, particularly nets and longlines that target several of the same prey species (Nascimento *et al.* 2021; Nascimento *et al.* 2023b). This overlap is particularly significant during winter and may constitute an additional pressure during foraging.

Despite the potential of ecosystem-based fisheries management to reduce these impacts, this approach remains largely under-utilised, is virtually non-existent on the high seas, and requires far-reaching reforms of fisheries sector

Pollution and contaminants

Marine pollution and exposure to contaminants pose threats to seabirds, affecting their health, survival and breeding success. Oil spills are one of the best-known examples, with devastating effects, as they compromise the waterproofing of feathers and reduce buoyancy and thermal insulation, resulting in mass mortality (Jenssen 1994; Munilla *et al.* 2011). Surviving birds suffer long-term chronic effects from exposure to and ingestion of the toxic polycyclic aromatic hydrocarbons (PAHs) present in the oil (Troisi *et al.* 2016). PAHs disrupt thyroid homeostasis, which plays a vital role in regulating energy metabolism, resulting in very low survival rates among rehabilitated birds, despite the significant investment of resources (Troisi *et al.* 2016).

Spills mainly occur on oil tankers transporting large quantities of crude oil to refinery terminals. In addition to the regular unloading of refined products from ships, there are also unintentional leaks from oil tankers and drilling platforms, resulting from accidents and negligence (Troisi *et al.* 2016). According to the European Maritime Safety Agency, there was a downward trend in the probability of oil spills occurring in European seas between 2008 and 2022, although oil and other polluting substances remain a persistent problem (European Environment Agency 2025). The North Sea and the Mediterranean Sea have a higher incidence of potential oil spills, mainly due to heavy maritime traffic, intensive oil and gas extraction on offshore platforms, and industrial activities along the Mediterranean coast (European Environment Agency 2025).

Maritime traffic in the Portuguese EEZ is heavy, with hundreds of ships passing through every day. Many of these carry hazardous substances, posing a growing risk of pollution along the Portuguese coast. One of the disasters that caused the highest number of seabird deaths in the Iberian Peninsula involved the oil tanker *Prestige* (2002–03), which sank off the coast of Galicia and affected the area stretching from northern Portugal to France. Consequently, mass deaths of 23,000 seabirds were documented in the days following the spill, with an estimated 115,000 to 230,000 birds affected (García *et al.* 2003). The species most affected were wintering seabirds that dive to catch their prey, particularly the Common Murre, the Razorbill and the Atlantic Puffin. However, a marked mortality of European Shags, a resident species in the region, was also recorded in Galicia. Mortality was higher among females, resulting in a decline in breeding success and an estimated 11% reduction in the adult population (Martínez-Abraín *et al.* 2006).

organisations (Dias *et al.* 2019). Among the solutions currently implemented, the designation of marine protected areas, the establishment of no-take zones and the application of seasonal restrictions that take into account critical breeding or feeding periods stand out (Pichegru *et al.* 2010; Bertrand *et al.* 2012). These measures, when integrated into an ecosystem-based approach, can contribute to the recovery of resources and the resilience of seabird populations.

Another form of pollution threatening seabirds is plastic contamination, which is predicted to continue to rise (Wilcox *et al.* 2015). Seabirds are particularly vulnerable to this type of pollution, often ingesting floating plastic (Wilcox *et al.* 2015). The ingestion of plastic can cause digestive blockages, perforations, reduced ability to feed and death. Microplastics (<5 mm) are also frequently ingested indirectly, via the food chain, increasing the risk of exposure to persistent organic pollutants (POPs). In addition to physical impacts, plastics act as carriers of chemical contaminants, which can be released into the digestive tract and bioaccumulate in tissues, causing toxic, immunological and endocrine effects (Lopes *et al.* 2022). Among seabirds, the Procellariiformes have the highest ingestion rates, with 41% of individuals containing plastic in their bodies, averaging 9.9 particles per bird (Kühn & Van Franeker 2020).

Entanglement in plastic can also cause drowning, injuries and restrict movements, affecting a large number of species; it has been reported in at least 36% of seabird species (Ryan 2018). The vast majority of cases are caused by fishing nets or lines that have been lost or discarded by fishermen, although it is not always possible to distinguish whether the cause lies in passive fishing gear or in active gear associated with bycatch. The incorporation of plastics into nests is another common interaction, linked to the increased availability of plastic waste in coastal areas and island colonies (Jagiello *et al.* 2019). Plastic materials incorporated into nests may increase their structural durability, but they can also result in injuries and entanglement of adult birds or chicks (Votier *et al.* 2011), as well as increasing exposure to toxic compounds associated with this waste (O’Hanlon *et al.* 2017).

Metal contamination in seabirds stems from both natural sources and human activities; these metals enter marine food chains and accumulate progressively within organisms through bioaccumulation and biomagnification, affecting predatory species at the top of the food chain most severely (Lopes *et al.* 2022). Seabirds can thus serve as sensitive bioindicators of environmental health, since their primary route of exposure to metals such as mercury, lead and cadmium is through their diet, although they may also absorb these elements via water, sediments or air (Theron *et al.* 2012). Once inside the body, these metals can interfere with essential physiological processes, affecting the nervous, hormonal, immune and reproductive systems, and often leading to the induction of oxidative stress, characterised by an imbalance between free radical production and antioxidant capacity (Ercal *et al.* 2001;



Oiled Razorbill | Elisabete Silva

Koivula & Eeva 2010). This process results in cellular damage that can manifest as reduced breeding success, smaller or more fragile offspring, behavioural changes, reduced body condition and decreased survival (Goutte *et al.* 2014; Provencher *et al.* 2016; Oudi *et al.* 2019). Although some species exhibit natural tolerance to high concentrations, many suffer adverse effects

Biotoxins

Harmful algal blooms (HABs) can have detrimental effects on various marine species, either through the excessive accumulation of biomass or through the presence of toxic compounds produced during these events (Casero *et al.* 2022). Seabirds, as they feed on filter-feeding fish and crustaceans, are particularly vulnerable to these toxins, which can cause reduced feeding and breeding activity, loss of motor coordination and even mortality (Shumway *et al.* 2003). The occurrence of HABs is associated with the natural dispersal of species by currents or storms, climate change and human activities, particularly the increase in eutrophication resulting from the intensive use of fertilisers and the discharge of agricultural, industrial and domestic effluents into coastal waters (Anderson 2009). Coastal birds, such as gulls, terns, ducks and cormorants, appear to be the most affected, possibly due to their feeding habits near the coast, which increase their exposure to coastal HABs (Gibble & Hoover 2018). Several mass mortality events involving seabirds have been linked to HABs (Shumway *et al.* 2003), although the true extent of the impacts may be underestimated, given the difficulty in establishing a direct causal link between these events and bird deaths (Gibble & Hoover 2018).

Another type of poisoning affecting seabirds is caused by bacteria, notably botulism, which results from the toxin produced by *Clostridium botulinum*. This bacterium thrives in anaerobic environments rich in organic matter,



Northern Gannet with a tangled net | Borgia Braga

when levels exceed physiological limits (Burger & Gochfeld 2000). Monitoring contamination is essential for assessing ecological risks, and is often carried out through the analysis of feathers, blood, liver or eggs, with feathers being particularly useful as they reflect exposure during moulting and allow for a non-invasive sampling method (Monteiro & Furness 1995).



Ria Formosa | Luís Ferreira

conditions frequently found in eutrophicated wetlands and estuaries. As with poisoning caused by HABS, seabirds may be affected by ingesting contaminated invertebrates, fish or water, exhibiting neurological symptoms known as parietic syndrome, which include weakness, paralysis, diarrhoea and dyspnoea (Casero *et al.* 2022). Outbreaks of botulism generally occur during the warmer months (between August and November), when high temperatures favour bacterial proliferation in sediments (Gutiérrez-Arnal & Marín 2024).

In Portugal, parietic syndrome has been recorded with increasing frequency over the last decade, particularly in gulls, and may represent one of the main causes of mortality in the Algarve (Casero *et al.* 2025). It is believed that these birds may ingest botulinum toxin at waste water treatment plants, where conditions are conducive to its formation (Casero *et al.* 2022).

To better assess and mitigate these impacts, it is useful to implement standardised post-mortem protocols and carry out more systematic biotoxin testing in cases of mortality (Gibble & Hoover 2018).

Offshore renewable energy

As the renewable energy industry in coastal and offshore waters develops and expands, the risks to bird populations that depend on these habitats increase (Bray *et al.* 2016). Although marine renewable energy projects contribute to decarbonisation, climate change mitigation, energy security, and the provision of socio-economic benefits, they can have either adverse effects on seabirds, such as collisions and disturbance, or positive effects, such as increased biodiversity and food resources (Drewitt & Langston 2006; Copping *et al.* 2020).

Offshore wind farms can affect birds through the risk of collision with turbines, habitat loss, and disturbance caused by the turbines and maintenance activities (Harwood & King 2022). For migratory species, wind farms can also create barriers along migratory routes, potentially forcing seabirds to alter their flight paths, increasing energy expenditure and reducing feeding efficiency (Exo *et al.* 2003). For underwater devices (e.g. tidal turbines), the species most vulnerable to collision are diving birds such as cormorants and auks, as well as gulls and terns that dive to depths where tidal turbines may be installed, depending on prey distribution and device characteristics (Furness *et al.* 2012; Harwood & King 2022).

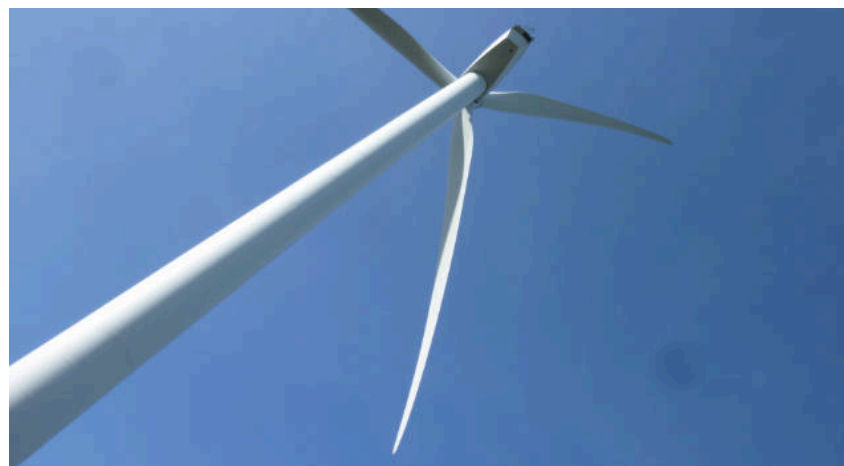
Species such as the Common Scoter, and other species from the Anatidae and Podicipedidae families, are considered particularly sensitive to disturbance and tend to avoid wind farm areas (Furness *et al.* 2013). On the other hand, cormorants, large gulls and terns are often attracted to these structures as resting sites (Harwood & King 2022). The extent of avoidance depends on multiple factors, including species, life stage, location, structure density, visibility, vessel traffic, and the birds' potential acclimation to noise and human activity (Harwood & King 2022).

The availability and distribution of prey may also be altered by marine renewable energy projects, through ecological changes such as noise, the creation or



Dead Audouin's Gull in the colony | Luís Ferreira

destruction of habitat, changes in primary productivity, and alterations in predator–prey interactions (Harwood & King 2022). Conversely, the installation of artificial structures can generate reef-like effects, favouring the development of new communities of invertebrates and fish, which may attract birds and other predators (Degraer *et al.* 2020). Changes in physical and hydrodynamic processes may also displace or reduce important food resources (Harwood & King 2022). These effects are difficult to predict and monitor, as they depend on complex interactions across trophic levels. Some studies show that such impacts can affect birds' feeding success and breeding productivity, and may have significant consequences, particularly when multiple projects occur in the same region or along migratory routes (Perrow *et al.* 2011; Harwood & Kin 2022).



Wind turbine tower | Julieta Costa

To mitigate these impacts, the development of sensitivity maps can guide the planning of offshore renewable energy projects by identifying areas of high ecological importance and helping to optimise the design and location of infrastructures (Christel *et al.* 2013). In Portugal, sensitivity mapping of

seabirds has revealed that the Balearic Shearwater, the Audouin's Gull and the Common Scoter are among the species most vulnerable to the expansion of offshore wind energy (Guilherme *et al.* 2023; Barros *et al.* 2024).

10.3. Cross-cutting threats

Climate change

Climate change poses a growing threat to seabirds, affecting them through rising sea temperatures, changes in ocean currents and marine productivity, the displacement of their prey, and the intensification of extreme weather events. These changes may contribute to the decline of prey essential to some species, resulting in potential food shortages (Häkkinen *et al.* 2023). Rising sea levels also exacerbate the risk of habitat loss, particularly on small islands, atolls and low-lying sandbanks used for nesting and resting.

The increase in the frequency and severity of extreme weather events can have direct effects on breeding populations and their habitats. Severe storms at nesting sites can reduce breeding success and lead to the abandonment and displacement of colonies (Bonter *et al.* 2014). Furthermore, stronger winds increase the energy cost associated with foraging, reducing the efficiency of food search and capture. Heatwaves also pose a particular risk, as high temperatures can cause heat stress and increase mortality among eggs and chicks, particularly when local vegetation is insufficient to provide shade (Häkkinen *et al.* 2023).

In terms of marine productivity, the warming of surface waters and the increase in freshwater resulting from melting ice reduce the upwelling of nutrients from deeper layers, thereby decreasing phytoplankton production, particularly in tropical and polar regions. Since 1999, a global trend of declining oceanic primary productivity has been observed, with negative implications for the entire food chain, including top predators such as seabirds (Grémillet & Boulinier 2009). In the North Sea, for example, the warming of winter waters has altered the abundance and composition of plankton communities, reducing the quantity and quality of prey, such as sand eels, which are essential for various species of seabirds. It is therefore predicted that changes in the availability, composition, energy content and timing of prey may significantly affect the breeding success and distribution of these birds (Daunt & Mitchell 2013).

Climate change may affect the rates of bioaccumulation of contaminants in marine food chains by altering their transport, persistence and exposure (Alava *et al.* 2017). Other factors influencing seabird populations, such as disease, pollution or interactions with fisheries, may be exacerbated in a scenario of global warming. Similarly, collision and displacement impacts associated with the development of offshore renewable energy could become more severe if the quantity and quality of prey decline (Daunt & Mitchell 2013). Although the effects of climate change are difficult to mitigate, they can be alleviated by addressing other threats for which solutions already exist (Dias *et al.* 2019).



Storm | Luís Ferreira



Stranded Atlantic Puffins | Nuno Oliveira

Loss and habitat degradation

The loss and degradation of habitat affects both nesting sites on land and feeding and migration areas at sea. Historically, most of these species nested on islands and in remote areas, but with human expansion these areas have been altered, occupied or fragmented, reducing the space available for colonies and, in some cases, leading to the total disappearance of nesting sites. Coastal urbanisation, port expansion, increased tourism and the transformation of natural vegetation have profoundly altered the landscape of many islands and cliffs, replacing entire habitats with infrastructure, lighting and constant disturbance. In the marine environment, habitat loss is more subtle but equally significant: migratory routes and areas traditionally rich in food may shift due to oceanographic changes, commercial exploitation or increased maritime activity, reducing the predictability with which birds access resources (Croxall *et al.* 2012).

In recent decades, the establishment of protected areas in various regions of the world has made it possible to safeguard both colonies and key foraging areas, contributing to the stabilisation or recovery of some populations (Ramírez *et al.* 2017). Nevertheless, even within these areas, habitat quality may remain compromised by the presence of invasive species that alter vegetation, soil dynamics or the availability of nesting cavities, as well as by insufficient monitoring and the limited implementation of management plans (Dias *et al.* 2019; Di Cintio *et al.* 2023). In the marine environment, the picture is similar. Despite the expansion of marine protected areas, many remain without effective regulation or suffer from insufficient enforcement of existing measures. In several sensitive areas, there remain limited restrictions on commercial and recreational fishing, as well as on other leisure activities. At the same time, these areas remain exposed to pollutants, heavy maritime traffic and noise disturbance (Velando & Munilla 2011; Álvarez-Fernández *et al.* 2017).

In Portugal, the majority of seabirds nest in protected areas, and the network of Marine Protected Areas has been expanded on the Mainland and in the archipelagos of Madeira and the Azores. However, significant challenges remain for species that nest outside these areas, particularly on beaches and coastal zones heavily used by humans, such as the Little Tern, whose nests are vulnerable to trampling, human disturbance (such as recreational activities) and changes to the sandy habitat (Lopes *et al.* 2015). Thus, despite significant progress, loss and degradation of habitat remain a central threat, requiring not only expansion but also effective and connected management between terrestrial and marine areas (Batista & Cabral 2016). At the same time, despite recognised efforts to expand the Network of Marine Protected Areas in Portugal, it should be noted that some areas of recognised importance for birds, identified as marine Important Bird Areas (IBA), still lack protection and official designation, particularly on the Mainland (expansion of the Berlengas and Ria Formosa marine areas) and in the Azores (the vast majority of IBAs identified in the past) (Ramírez *et al.* 2008).

Habitat restoration is also a key tool in mitigating the loss and degradation of habitats essential for seabirds, particularly on oceanic islands and in coastal

areas. At European level, this effort has been reinforced by the adoption of the Nature Restoration Law (Regulation (EU) 2024/1991), which requires Member States to restore at least 20% of terrestrial and marine areas by 2030, and all degraded ecosystems by 2050, including seabird habitats listed in the Habitats Directive (Directive 92/43/EEC) and the Birds Directive (Directive 2009/147/EC). This regulation also requires the establishment of National Restoration Plans with quantifiable targets, monitoring and reporting mechanisms. Restoration should be understood as a continuous process, linked to conservation, with a management plan, community involvement and long-term scientific monitoring.



Nesting area overgrown with an invasive plant | Miguel Lecoq

Disturbance

Disturbance poses a significant threat to seabirds, occurring both within colonies and in the marine areas they use for feeding, resting and migration. On land, particularly during the breeding season, unregulated tourism, uncontrolled birdwatching, the use of drones, the presence of domestic animals, leisure activities on beaches and noise can cause the temporary or permanent abandonment of nests, increasing predation of eggs and chicks and reducing breeding success (Carney & Sydeman 1999; Albores-Barajas *et al.* 2009). The mere movement of people can cause trampling, which may lead to the destruction of nests, the breaking of eggs and even the death of newly hatched chicks, especially in species that nest on the ground, on beaches or in dunes, such as the Little Tern and the Audouin's Gull, which frequently share space with recreational areas (Nascimento *et al.* 2025).

At sea, increased boat traffic, water sports and the associated noise can force birds to abandon foraging areas, increasing energy costs and reducing access to essential resources (Velando & Munilla 2011).

Species that breed in colonies generally tend to tolerate higher levels of human disturbance than solitary-nesting species (Martinez-Abrain *et al.* 2008). However, species that are more shy or sensitive to disturbance incur higher escape costs and are consequently more vulnerable to disturbance (Fliessbach *et al.* 2019).

The management of human access, as well as the ongoing raising of awareness amongst all agents involved, is an essential tool for the conservation of seabirds. This may include the total or partial restriction of access to certain areas, the designation and management of footpaths, the limitation of visitor numbers, or the strict control of specific activities (Batey 2013). At sea, it is also recommended to establish zones with low or no disturbance within protected areas, which serve as refuges for the most sensitive species (Fliessbach *et al.* 2019), or to define minimum approach distances to birds during tourist activities (Chatwin *et al.* 2013). These recommendations are in line with international commitments, notably the target of ensuring that at least 10% of Marine Protected Areas are under strict protection, as set out in the European Union Biodiversity Strategy for 2030, and reinforced by the global conservation targets adopted in the Kunming-Montreal Global Biodiversity Framework.



Disturbance in colonies | SPEA



Signage at Little Tern colony | Tânia Nascimento

11. Assessment of the environmental status of seabird populations

As mentioned earlier, seabirds occupy a high trophic position in marine ecosystems and provide a comprehensive reflection of changes in marine productivity, prey availability and the intensity of anthropogenic pressures. As top predators, long-distance migrants and species that utilise both terrestrial and marine environments, seabirds serve as excellent indicators of ocean health.

In the Portuguese context, the sea plays a central role in the ecology of these species. Waters under national jurisdiction, including Mainland Portugal, the Azores and Madeira, are home to important breeding colonies, critical foraging areas and migratory corridors used by populations that breed in other parts of the Atlantic. Species such as the Cory's Shearwater, the Band-rumped Storm-petrel or the Balearic Shearwater illustrate the ecological diversity and the degree of international responsibility associated with Portuguese marine territory.

Assessing the environmental status of these populations involves answering a key question: are seabirds in Portugal in demographic and ecological conditions that ensure their long-term viability?

This assessment is not limited to quantifying the number of individuals. It requires an integrated analysis of population trends, breeding success, spatial distribution and exposure

to human pressures, such as bycatch in fishing gear, disturbance in colonies or changes in food availability associated with climate change and fisheries exploitation.

In recent decades, evidence of global declines in seabird populations has underscored the need for robust and comparable assessment systems. The latest report from BirdLife Europe and Central Asia (Vulcano *et al.* 2024) highlights that seabirds remain one of the most threatened groups of birds worldwide, frequently subject to cumulative pressures acting simultaneously at sea and on land. In this context, the assessment of the environmental status of seabirds in Portugal is not an isolated exercise, but is part of a harmonised European framework that allows national trends to be interpreted in the light of regional patterns in the North-East Atlantic.

More than just a statistical exercise, this assessment is an essential tool for management and conservation. It enables the identification of populations at risk, the prioritisation of monitoring activities, and the targeting of mitigation measures. In a country with one of the largest EEZs in Europe, understanding the status of its seabirds also means understanding the state of its ocean.

To understand how this assessment is carried out—and the criteria underpinning the classification of environmental status - it is important to outline the framework of the regional indicators used and how they relate to European obligations regarding the protection of the marine environment.

11.1. OSPAR indicators and MSFD criteria

The assessment of the environmental status of seabirds in Portugal is based on indicators developed under the OSPAR Convention, in conjunction with the criteria set out in the Marine Strategy Framework Directive (MSFD; Directive 2008/56/EC).

The MSFD sets the objective of achieving or maintaining Good Environmental Status (GES) for European marine waters. Under Descriptor 1 – Biodiversity, it is stipulated that populations of species must maintain levels of abundance, productivity and distribution that are compatible with their long-term viability.

OSPAR, as a regional convention for the protection of the North-East Atlantic, implements these principles through quantitative indicators that are harmonised across countries.

Mainland

On the Mainland, some populations maintain abundance levels consistent with Good Environmental Status, reflecting stable trends over the last few decades. This is the case for breeding populations of Yellow-legged Gulls, whose abundance has remained relatively stable despite interannual fluctuations, and for other breeding species such as the Cory's Shearwater, the Band-rumped Storm-petrel and the Little Tern. However, some species show less favourable trends (Table 2). Variability in productivity is particularly evident in species dependent on small pelagic fish, such as the Cory's Shearwater, suggesting a possible link to fluctuations in food availability. In the case of the European Shag, the combination of a decline in relative abundance with reduced productivity constitutes a more robust sign of changes in environmental status.

Portugal is part of Regions IV (Bay of Biscay and Iberian Coast) and V (Wider Atlantic), ensuring that the national assessment uses metrics comparable to those applied in the other coastal states of the region.

In this work, two main indicators were used:

- B1 – Marine Bird Abundance
- B3 – Marine Bird Breeding Productivity

A detailed description of the methodology can be found in Section 12.3. The present section outlines the ecological significance of these indicators and how they contribute to the interpretation of the environmental status of the populations.

In the case of non-breeding populations that use the continental shelf, trends are generally more difficult to interpret due to high interannual variability and the influence of large-scale oceanographic factors (Table 3). Nevertheless, indicator B1 points to contrasting situations between species. Some show values consistent with a favourable environmental status, such as the Common Scoter, the Great Shearwater, the Great Cormorant and the Sandwich Tern *Thalasseus sandvicensis*. In contrast, other species show less favourable trends in relative abundance, namely the Manx Shearwater *Puffinus puffinus*, the Balearic Shearwater, the Northern Gannet, the Great Skua *Catharacta skua*, the Razorbill and the Atlantic Puffin, possibly reflecting changes in seasonal distribution or prey availability.

Overall, on the Mainland, the prevailing pattern is one of heterogeneity across species, with some populations stable and others in a less favourable situation.

Species	Abundance			Productivity		
	Mainland	Azores	Madeira	Mainland	Azores	Madeira
Band-rumped Storm-petrel <i>Hydrobates castro</i>	GES	GES		GES	GES	
Monteiro's Storm-petrel <i>Hydrobates montei</i>		GES			nGES	
Desertas Petrel <i>Pterodroma deserta</i>			GES			nGES
Zino's Petrel <i>Pterodroma madeira</i>			GES			nGES
Cory's Shearwater <i>Calonectris borealis</i>	GES	nGES	GES	nGES	nGES	GES
Barolo Shearwater <i>Puffinus baroli</i>		nGES				
Bulwer's Petrel <i>Bulweria bulwerii</i>		GES			GES	
European Shag <i>Gulosus aristotelis</i>	nGES			nGES		
Great Cormorant <i>Phalacrocorax carbo</i>	GES					
Audouin's Gull <i>Larus audouinii</i>	GES					
Lesser Black-backed Gull <i>Larus fuscus</i>	GES					
Yellow-legged Gull <i>Larus michahellis</i>	GES	GES	nGES			
Little Tern <i>Sternula albifrons</i>	GES					
Common Gull-billed Tern <i>Gelochelidon nilotica</i>	GES					
Roseate Tern <i>Sterna dougallii</i>		nGES				
Common Tern <i>Sterna hirundo</i>		GES				

TABLE 2: Summary of the assessment of the Good Environmental Status of breeding populations for the indicators of abundance and productivity, for the three regions: Mainland, Azores and Madeira. Green cells indicate that the population has achieved Good Environmental Status (GES), whilst red cells indicate that it has not (nGES)].

Species	Mainland	Azores	Madeira
Seabirds			
Common Scoter <i>Melanitta nigra</i>	GES		
European Storm-petrel <i>Hydrobates pelagicus</i>	nGES		
Sooty Shearwater <i>Ardenna grisea</i>	GES		
Great Shearwater <i>Ardenna gravis</i>	GES		
Manx Shearwater <i>Puffinus puffinus</i>	GES		
Balearic Shearwater <i>Puffinus mauretanicus</i>	nGES		
Northern Gannet <i>Morus bassanus</i>	nGES		
Great Cormorant <i>Phalacrocorax carbo</i>	GES		
Black-legged Kittiwake <i>Rissa tridactyla</i>	GES		
Black-headed Gull <i>Larus ridibundus</i>	GES	GES	nGES
Mediterranean Gull <i>Larus melanocephalus</i>	nGES		
Lesser Black-backed Gull <i>Larus fuscus</i>	nGES		
Black Tern <i>Chlidonias niger</i>	nGES		
Sandwich Tern <i>Thalasseus sandvicensis</i>	nGES		
Arctic Jaeger <i>Stercorarius parasiticus</i>	nGES		
Pomarine Jaeger <i>Stercorarius pomarinus</i>	nGES		
Great Skua <i>Catharacta skua</i>	nGES		
Atlantic Puffin <i>Fratercula arctica</i>	GES		
Razorbill <i>Alca torda</i>	nGES		
Waders			
Eurasian Oystercatcher <i>Haematopus ostralegus</i>	GES	GES	
Grey Plover <i>Pluvialis squatarola</i>	GES	nGES	nGES
Common Ringed Plover <i>Charadrius hiaticula</i>	GES	GES	nGES
Kentish Plover <i>Charadrius alexandrinus</i>	nGES	nGES	nGES
Whimbrel <i>Numenius phaeopus</i>	GES	nGES	nGES
Ruddy Turnstone <i>Arenaria interpres</i>	nGES	nGES	GES
Red Knot <i>Calidris canutus</i>	nGES	nGES	
Sanderling <i>Calidris alba</i>	GES	nGES	GES
Dunlin <i>Calidris alpina</i>	nGES	nGES	GES
Purple Sandpiper <i>Calidris maritima</i>	GES	nGES	
Common Sandpiper <i>Actitis hypoleucos</i>	GES	nGES	nGES

TABLE 3: Summary of the assessment of the Good Environmental Status of non-breeding populations for the indicator of abundance, for the three regions: Mainland, Azores and Madeira. Green cells indicate that the population has achieved Good Environmental Status (GES), whilst red cells indicate that it has not (nGES)].

Azores

The Azores are home to some of the most important breeding populations of seabirds in the North-East Atlantic, giving the region a heightened international responsibility. Species such as the Cory's Shearwater, the Band-rumped Storm-petrel and the Roseate Tern play a central role in the regional assessment.

With regard to the abundance of breeding populations, several species show values consistent with Good Environmental Status. This is the case for the Band-rumped Storm-petrel, the Monteiro's Storm-petrel, the Yellow-legged Gull and the Common Tern, whose recent trends do not show significant reductions compared to the reference values. In contrast, other species do not meet the thresholds defined for Good Environmental Status. The Barolo Shearwater, the Roseate Tern and the Cory's Shearwater show relative abundance values below the reference levels, suggesting demographic changes that warrant close monitoring.

Madeira

In Madeira, it was only possible to assess the environmental status for a smaller number of species, reflecting the limited size of the breeding populations and the availability of consistent time series. In total, only five species provided sufficient data for the application of the indicators.

With regard to the abundance indicator, the majority of the species assessed show values consistent with Good Environmental Status. The exceptions are the Yellow-legged Gull and the Black-headed Gull *Larus ridibundus*, for which relative abundance values fall below the defined thresholds.

National assessment

A joint analysis of the three regions reveals a varied picture of the environmental status of seabirds in Portugal (Table 4). On the Mainland, there is significant heterogeneity between species, with contrasting situations in both breeding and non-breeding populations, reflecting the high oceanographic variability and the diversity of pressures on the continental shelf. In the Azores, although several species maintain levels consistent with Good Environmental Status, signs of vulnerability are emerging in key species, particularly when considering the productivity indicator. In Madeira, where only four of the 10 breeding species could be assessed, the situation is generally stable for most of the species analysed, but there is particular concern regarding endemic species, for which productivity below the defined thresholds highlights their ecological sensitivity.

Overall, the results reveal a largely stable situation at national level, but one marked by regional contrasts and specific warning signs that justify enhanced monitoring, particularly for species with restricted distribution or those heavily dependent on variable marine resources.

In the case of these species, the decline in abundance may reflect a combination of factors, including variability in food availability, pressures on the open sea and constraints within the colonies.

With regard to productivity, it was only possible to assess three species, with the Band-rumped Storm-petrel showing figures consistent with a stable population trend. The Cory's Shearwater and the Monteiro's Storm-petrel, however, do not meet the defined thresholds, which is a significant indicator, given that persistent declines in breeding success may foreshadow future declines in abundance.

Overall, the Azores present a largely stable picture, but with signs of vulnerability in some key species, reinforcing the importance of maintaining robust time series and continuous monitoring.

Cory's Shearwater shows favourable results for both the abundance and productivity indicators, suggesting an overall stable demographic situation in the region. In contrast, the endemic species, the Desertas Petrel and the Zino's Petrel, do not meet the thresholds defined for the productivity indicator. Given the small size of their populations and their restricted distribution, these results are of particular relevance for regional conservation, highlighting the vulnerability of these species to changes in environmental status and cumulative pressures.

TABLE 4: Percentage of species assessed as being in Good Environmental Status by species group (seabirds or waders), for each indicator (Abundance or Productivity) and in each region. The total number of species assessed is shown in parentheses. Green cells indicate that ≥75% of the assessed populations are in Good Environmental Status, whilst red cells indicate that <75% of the populations have achieved Good Environmental Status].

	Mainland	Azores	Madeira
Breeding seabirds			
Abundance	89% (9)	63% (8)	75% (4)
Productivity	33% (3)	50% (4)	33% (3)
Non-breeding populations – abundance			
Seabirds	42% (19)	100% (1)	0% (1)
Waders	64% (11)	18% (11)	38% (8)

12. Methodology

12.1. Tracking of seabirds

The origins of individual tracking date back to the mid-19th century, with the first systematic studies carried out by scientists and other naturalists (Whitney 2022). In wild birds, this tracking began with individual tagging using metal rings in the early 20th century. As the century progressed and technology exploded, the first electronic devices for individual tracking of wild animals began to appear. In the mid-1950s, the first radio transmitters were used, whereby radio waves made it possible to identify the position of the device and, consequently, the location of the animal. Later, in the 1970s, the Argos satellite system provided a new tool for tracking on a global scale, with the appearance of the first PTT (platform transmitter terminals) devices with satellite location. Since then, technology has developed at great speed, with the emergence of GPS devices (based on the global positioning system), GLS (which record the temporal patterns of sunrise and sunset to estimate geographical position), GPS-GSM (which use the telecommunications network to send the information collected) and GPS devices that communicate with fixed stations connected to the internet. The development of these technologies has also been very noticeable in terms of the size and weight of the devices, with devices currently available that are less than 1 cm in size and weigh less than 1 g. The advent of nano-batteries and the possibility of coupling micro-solar panels has allowed information to be collected over longer periods, some reaching several years. The robustness and waterproofing of these devices has also allowed their application to marine species, such as seabirds. Thus, today it is possible to monitor the movements of large seabird species, such as albatrosses, or to identify the feeding areas of small storm-petrels.

Seabirds are among the best-studied groups of marine animals. This is because they are accessible on land during nesting season. Even species with strictly marine behaviour depend on land for nesting. It is at this stage that the best opportunities arise to study these birds, allowing not only to explore aspects directly related to breeding, but also to collect information on other stages of their life cycle. One of the best examples is the possibility of installing individual tracking devices that allow to obtain spatial and

behavioural information from birds throughout the year, or even over several years.

Individual bird tracking provides information at population, species or even species group level. This methodology has made it possible to identify areas of particular importance to birds during different stages of their life cycle, including breeding, migration and wintering. It has also been possible to identify the main feeding and resting areas for specific populations, as well as those that are common to more than one species. As mentioned before, the North Atlantic Current and Evlanov Sea Basin Marine Protected Area (NACES) is a good example of an area used by a large number of species, identified solely and exclusively through the individual tracking of seabirds (Davies *et al.* 2021). Due to its location, more than 350 km from the nearest land area, it poses numerous limitations on the application of traditional monitoring methodologies, such as censuses on board vessels. On the other hand, this area is equally important for several species during the winter, when weather conditions are very adverse, making it almost impossible for researchers to visit.

Monitoring bird populations over time using individual tracking devices has made it possible to characterise and quantify changes in their behaviour (Carneiro *et al.* 2024). These changes are generally related to anthropogenic pressures, such as the implementation of offshore energy production structures, fishing activity or maritime traffic, but they can also result from natural causes, such as the high and apparent unpredictability of marine resources. Many seabirds feed in vast areas with highly dynamic oceanographic characteristics, both spatially and temporally. Individual tracking helps to understand how birds use environmental characteristics to detect their prey. It has also made it possible to compile evidence on migratory connectivity in the oceans and identify the six main global migratory corridors used by seabirds (Morten *et al.* 2025).



Band-rumped Storm-petrel with GLS | Maria Alho



Band-rumped Storm-petrel with GPS with a solar panel | Tânia Nascimento



Cory's Shearwater with GPS | Nuno Oliveira

Another important milestone achieved by individual tracking was the identification of nesting areas that were completely unknown in the past. A notable example is the case of the New Zealand Storm-petrel *Fregetta maoriana*, rediscovered after more than a century without any evidence of its existence or the location of any nesting areas. In the early 2000s, after observing a few individuals off the coast of New Zealand, researchers placed radio transmitters on birds captured at sea over a period of 10 years, allowing them to confirm nesting areas (Rayner *et al.* 2015).

Temporal and geographical scope

The mapping of species distribution using individual tracking data was restricted to Portugal's EEZ (see example in Figure 5). This exercise was carried out separately for each of the three sub-areas: Mainland Portugal, the Azores and Madeira. In terms of temporal coverage, all available data and those collected by individual tracking devices were included. As this is a relatively recent technology, this resulted in a time series beginning just over two decades ago. In fact, the oldest data analysed relate to the tracking of Balearic Shearwaters with satellite devices used in the year 2000. The most recent data were collected in 2025. Nevertheless, there is great heterogeneity in the coverage of the information compiled for each species, both spatially and temporally.

Data collection and preparation

The compilation of individual tracking data began with consulting three digital platforms specific to this type of information: the Seabird Tracking Database (managed by BirdLife International), Movebank (managed by the Max Planck Institute for Animal Behaviour) (Kolzsch *et al.* 2022) and Seatrack (owned by the Norwegian Polar Institute and the Norwegian Institute for Nature Research, NINA). These three platforms host the vast majority of individual bird tracking information available globally.

The datasets and species occurring within Portugal's EEZ were identified. The species listed in the *Atlas of Seabirds of Portugal* (Meirinho *et al.* 2014), for which little or no information was found, were subjected to a second level of research that included consulting general and specialised search engines for scientific documents. The species names (scientific and common) were used as keywords, associated with various terms, namely tracking, wintering distribution, GPS, GLS and movements. The authors of the identified works were contacted directly to request authorisation to use and access the information.

Of the 336 datasets identified as potentially overlapping with the national EEZ, 224 were made available, with the respective authorisations for use (Figure 6). Each dataset corresponded to a species nesting in a particular colony or location (with the exception of birds captured at sea), monitored with a specific type of device and during a specific period. In the case of species with data from different types of devices (i.e. GPS and GLS), GPS was prioritised due to its lower location error (only a few metres). In cases where the amount of GPS data was limited, or restricted to a small number of individuals, and GLS provided a substantially larger amount of data, the latter was preferred. This was based on the assumption that it better reflected the species' distribution, despite the higher location error



Fitting a Yellow-legged Gull with a GPS-GSM | Margarida Marques

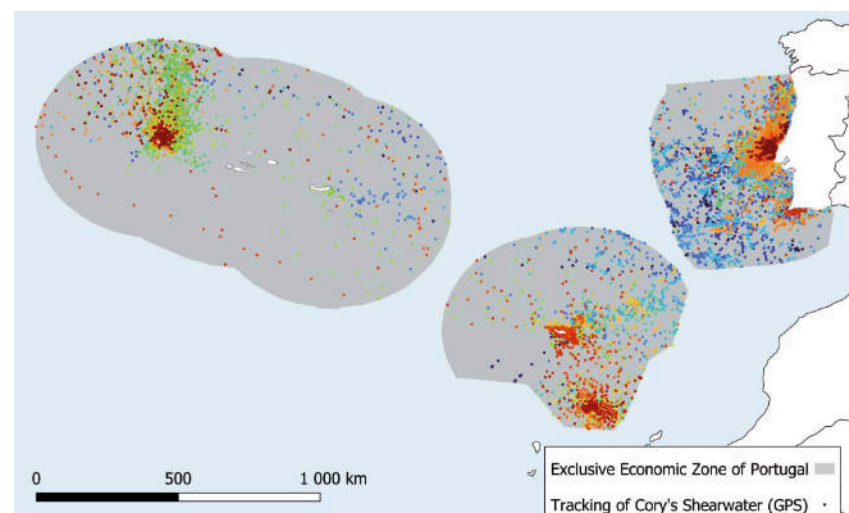


FIGURE 5: Example of the distribution of raw data showing the locations of Cory's Shearwater recorded via GPS devices, for Portugal's EEZ. Each individual has been assigned a different colour.

(100-200 km) (Bennett *et al.* 2025). The data collected by GPS and PTT devices, having similar margins of error, were considered together. The list of data used and their sources can be found in Annex 2.

The distribution of species was mapped separately for the breeding season and the non-breeding season (Figure 7). To this end, a hexagonal grid was created to coincide with the three sub-areas of the Portuguese EEZ - Mainland, Azores and Madeira - chosen for ease of visualisation. The locations were grouped into hexagons with a diameter of 25 km for GPS data and 50 km for GLS. The sum of the number of locations within each hexagon was assigned. This processing was done using a very simple approach in order to avoid interpretations or extrapolations of the data, which would not be the purpose of this study.



European Shag with GPS-GSM device | Ana Marcos Morais

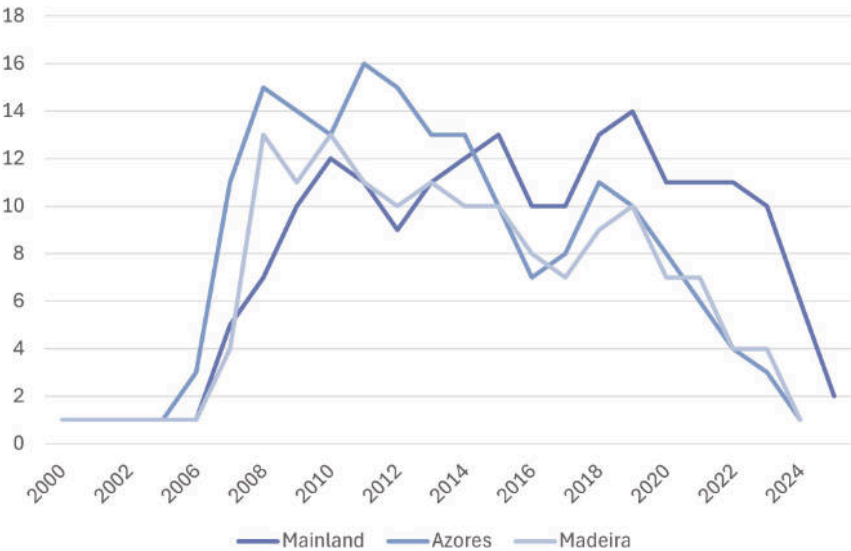


FIGURE 6: Number of species with locations within each region over the years.

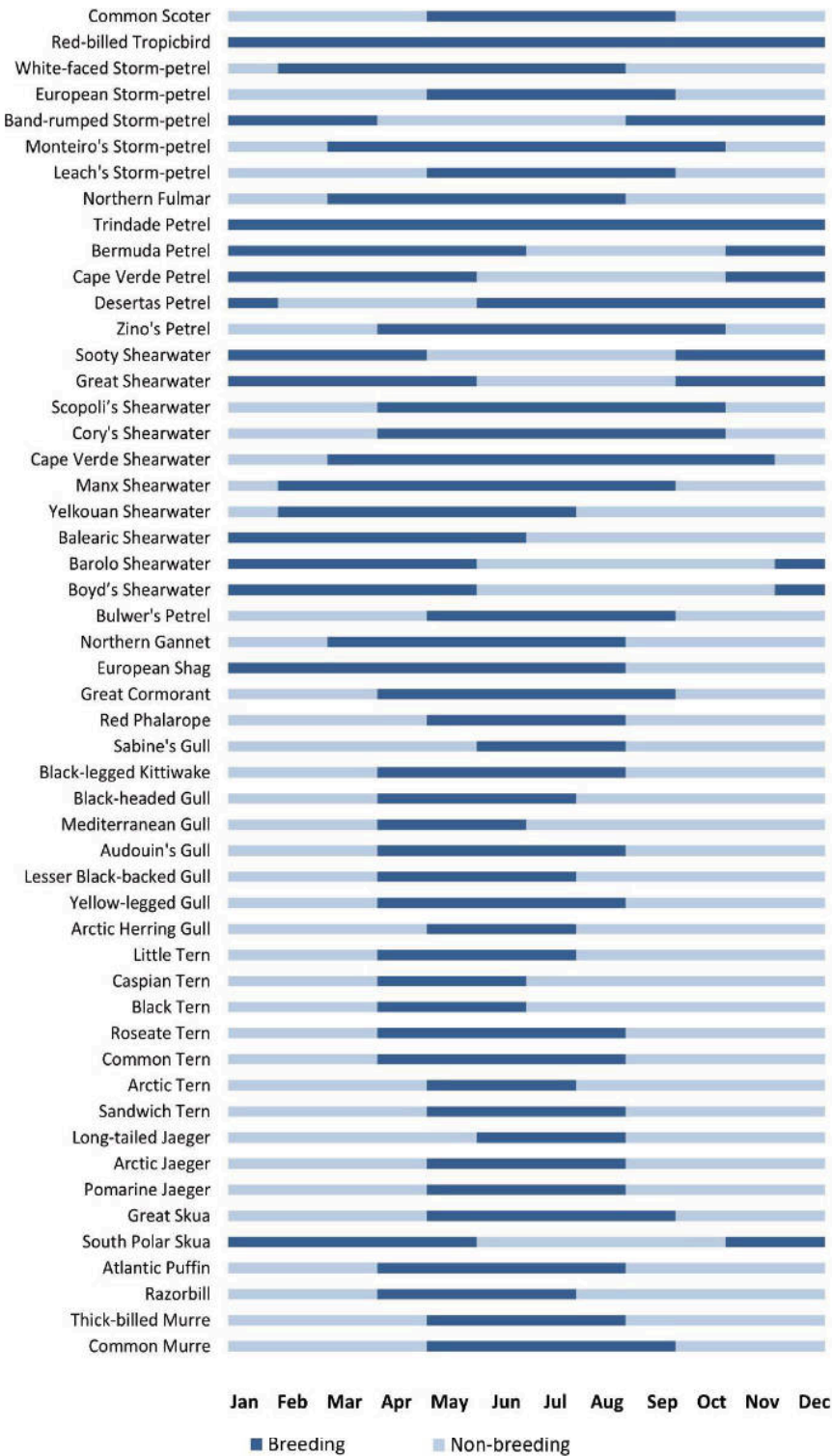


FIGURE 7: Phenological periods (breeding and non-breeding) used to map the distribution of different species based on individual tracking data.

12.2. Abundance and distribution of breeding colonies

Seabirds often breed in colonies - sites where thousands of birds can concentrate during the breeding season. This colonial behaviour, also observed in other groups such as waterbirds, can be explained by several ecological factors. Nesting in groups serves as a strong defence against predators, increasing vigilance and reducing individual predation risk. Furthermore, it is safer to nest on islands or islets that lack (or have been free from, for millenia) terrestrial predators, which has encouraged birds to concentrate in these areas. On the other hand, nesting in these locations is also advantageous for species that rely primarily on the marine environment, as it reduces the distance to feeding grounds. Colonies are also places for socialisation, and for species that range across the vast ocean, travelling hundreds of kilometres in just a few days, nesting in a colony facilitates encounters between birds, supporting the formation and maintenance of pairs. Beyond these factors, different species have specific nesting habitat requirements and behavioural differences that influence colony location. The vast majority of Procellariiformes nesting in Portuguese territory - including various species of shearwaters, petrels, and storm-petrels - nest in cavities, depending on islands and islets with caves, rock crevices, piles of large pebbles, or soil suitable for burrowing. Other species, such as gulls and terns, which nest colonially but on



Audouin's Gull colony | Luís Ferreira



Cory's Shearwater colony | Nuno Oliveira

the ground surface, utilise a greater diversity of habitats. In addition to islands, islets, and coastal cliffs, these species also nest in estuaries, coastal lagoons, and inland reservoirs. Some species, such as the Yellow-legged Gull and the Common Tern, may also nest colonially in urban environments.

With the aim to visually show the distribution of seabird colonies nesting in Portugal and illustrating their relative importance, this publication includes one or more maps for each of these species showing the nesting colonies on the Mainland, Madeira and the Azores. The 21 species considered (Table 5) were chosen based on the information available in the latest *Atlas of Breeding Birds of Portugal* (Equipa Atlas 2022).

The challenge of mapping and quantifying seabird colonies is exacerbated by the lack of information that still persists about some populations, mainly due to the difficulty of surveying inaccessible locations, but also to the nocturnal and elusive behaviour of many of them. Another significant difficulty is the absence of long-term monitoring programmes in many locations and for many species.

TABLE 5: List of species and regions (Mainland, Madeira and Azores) considered for mapping seabird nesting colonies.

*Note: Although the Common Murre is still considered a nesting species, its breeding has not been observed since 2002.

Species	Mainland	Azores	Madeira
White-faced Storm-petrel <i>Pelagodroma marina</i>			x
Band-rumped Storm-petrel <i>Hydrobates castro</i>	x	x	
Monteiro's Storm-petrel <i>Hydrobates montei</i>		x	
Desertas Petrel <i>Pterodroma deserta</i>			x
Zino's Petrel <i>Pterodroma madeira</i>			x
Cory's Shearwater <i>Calonectris borealis</i>	x	x	x
Manx Shearwater <i>Puffinus puffinus</i>		x	x
Barolo Shearwater <i>Puffinus baroli</i>		x	x
Bulwer's Petrel <i>Bulweria bulwerii</i>		x	x
European Shag <i>Gulosus aristotelis</i>	x		
Great Cormorant <i>Phalacrocorax carbo</i>	x		
Black-headed Gull <i>Larus ridibundus</i>	x		
Audouin's Gull <i>Larus audouinii</i>	x		
Lesser Black-backed Gull <i>Larus fuscus</i>	x		
Yellow-legged Gull <i>Larus michahellis</i>	x	x	x
Sooty Tern <i>Onychoprion fuscatus</i>		x	
Little Tern <i>Sternula albifrons</i>	x		
Common Gull-billed Tern <i>Gelochelidon nilotica</i>	x		
Whiskered Tern <i>Chlidonias hybrida</i>	x		
Roseate Tern <i>Sterna dougallii</i>		x	x
Common Tern <i>Sterna hirundo</i>	x	x	x
Common Murre <i>Uria aalge</i>	*		

Temporal and geographical scope

Initially, the aim was to limit the use of information to the most recent data, considering only the last five years (2021–2025). Nevertheless, due to existing information gaps for many species and locations, the temporal coverage was extended for some populations in order to include the best available information. In the case of species whose nesting sites and abundance patterns show high variability, such as terns, due to their behavioural flexibility and the greater exposure of their habitats to human pressures, data from the last 10 years (2016–2025) were included.

In terms of location, the identification of nesting sites on the Mainland included island environments, such as the Berlengas and the Barrier islands, but also the coastal strip, namely cliffs and coastal wetlands, including estuaries and lagoons. Nesting sites in inland reservoirs, such as Alqueva, were also included. Nesting colonies in the archipelagos of Madeira and the Azores were also identified, with the aim of illustrating the colonies in the three regions (Mainland, Azores and Madeira) separately for better visualisation and interpretation of the results.

Data collection

Information on nesting colonies was collected in the following ways:

A. Request for data from researchers and government institutions

Requests for data were made to researchers who are conducting or have conducted monitoring work on seabird colonies, regarding the location and size of breeding colonies. The same type of request for information was sent to government entities, both on the Mainland (*Instituto da Conservação da Natureza e das Florestas*, ICNF) and in the archipelagos (*Instituto das Florestas e Conservação da Natureza*, IFCN, and *Secretaria Regional do Ambiente e Ação Climática*, SRAAC). To facilitate information sharing and standardisation of the data collected, a file template for data sharing was sent in Excel format (Table 6).

B. Bibliographic collection

Reference publications, scientific articles, and technical project reports were consulted to gather information on colony locations and population sizes.

C. Additional data sources

For some species (e.g., Great Cormorant), additional information was also collected from other types of platforms, such as eBird/PortugalAves, on the location of nesting colonies. Additional data were only considered in duly proven cases, i.e., when there was documentary evidence of breeding (e.g., photographic record), and it was possible to determine the corresponding location.

TABLE 6: List and description of parameters included in the request for data on the size and location of breeding colonies of seabirds.

Parameter	Description
Species	Scientific name of the species
Region	Mainland, Madeira Autonomous Region or Azores Autonomous Region
Island	Name of the island
Islet/Colony	Name of the islet or colony
Colony coordinates	Latitude and longitude, in decimal format
Coastal strip coordinates	Where the monitored area corresponds to an extensive coastal strip, the start and end coordinates of that coastal strip should preferably be indicated or, alternatively, the central coordinates of that coastal strip.
Coordinate accuracy	High: 0 - 50 m Medium: 50 - 250 m Low: >250 m
Population estimate	Count or estimate of population size
Interval	Minimum and maximum value of the population estimate
Counting unit	Number of pairs, nests or individuals
Estimation accuracy	A - Estimated margin of error less than 10% B - Estimated margin of error less than 50% C - Estimated margin of error greater than 50% D - Unknown
Census method	1 - Surveying/counting nests/pairs 2 - Listening
Census coverage	Complete – Most of the potential area has been monitored Incomplete – A significant part of the potential area has not been monitored (>25%) Very incomplete – A significant part of the potential area has not been monitored (>50%)
Year	Year or range of years of population count or estimate
Reference	The source and authorship of the data must be indicated, stating whether they are unpublished data or citing a report, book or article, if these data have already been published.
Notes	Further information

Data preparation

The data were organised into individual files, with information on coordinates, population estimates and date of estimate, by species and by region (Mainland, Azores Autonomous Region, and Madeira Autonomous Region). In the case of nearby colonies (<1 km), the information was aggregated in order to optimise the visualisation of the maps. The estimates were also organised by abundance classes in order to facilitate the visualisation and interpretation of the data on the maps and to minimise the impact of less accurate estimates. Where there were several population estimates, the criterion for selection was to use the most recent ones, except in cases where the previous estimates were more complete and/or accurate, in which case these were given priority.

12.3. Population Status Assessment

The assessment of the status of seabird and waders populations occurring in Portugal's marine environment (see Annex 1) was carried out on the basis of indicators developed under the OSPAR Convention to assess the environmental status of the North-East Atlantic. These indicators assess the current status of populations by comparison with a reference condition, establishing quantitative thresholds in order to classify a given functional unit (in this case, a bird population) as being in good or poor environmental status (OSPAR Agreement 2025-05). Some of these indicators have also been adopted by Member States of the European Union, within the scope of the obligations of the MSFD, to assess the good environmental status of marine ecosystem elements. In this work, indicators B1 – Marine Bird Abundance and B3 – Marine Bird Breeding Productivity were used.

Bird abundance, obtained through the number of breeding birds or the number of birds during the non-breeding period, is considered a good indicator because it is widely applicable, relatively easy to measure and good for measuring long-term changes in community structure (OSPAR 2017). Sudden changes in abundance may indicate anthropogenic pressures. Comparison with reference values allows the extent of this variation to be assessed, which may prompt the implementation of management measures.

Productivity is a measure that allows the breeding success of a population in a given year to be assessed (Frederiksen *et al.* 2022). Seabirds, as species with long lifespans and late maturity, tend to reflect changes in the environmental conditions of the habitats they use in their productivity rates. Productivity is a key demographic parameter for population growth rates. The results of the assessment of the seabird productivity

In cases where the species occurs in more than one region, an additional file was prepared with information on the various regions and the aggregate population estimate per island or group of islands (e.g., Desertas, Selvagens). In these cases, the location shown is not the location of the colony, but a central location on the island or the largest island, in the case of a group of islands.

The list of data used and their sources can be found in Annex 3.

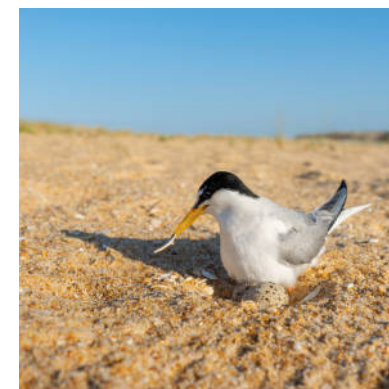
indicator should be interpreted as a sign of changes in the state of the population, complementing the results of the abundance indicator. In addition, productivity is sensitive to changes in the capacity of marine ecosystems to sustain these top predators.

The assessment of the indicators in this publication was carried out separately for each species and region (Mainland, Azores and Madeira). For species with breeding and non-breeding or migratory populations, the assessment focused only on the breeding population (except in the case of the Lesser Black-backed Gull and the Great Cormorant).

The list of data used and their sources can be found in Annex 3.



Northern Gannets feeding | Luís Ferreira



Little Tern incubating | Luís Ferreira

Temporal and geographical scope

The information used to assess the environmental status of nesting seabirds included historical series available in the literature and existing databases, reflecting the most up-to-date information available until 2024. In spatial terms, the assessment was separated by region - Mainland, Azores and Madeira. In the case of the assessment of non-breeding seabird populations, information collected between 2004 and 2024 through marine censuses on board vessels was considered. This assessment was carried out only for Mainland Portugal, restricted to the

coastal zone up to a depth of 200 m, due to the absence of a robust time series that would allow this exercise to be conducted for the Azores and Madeira regions. In the case of the assessment of non-breeding wader populations, the information was collected in winter (December and January) between 2009 and 2025, as part of the Project Arenaria. The coverage of this project included the non-estuarine coast of Mainland Portugal and the entire coast of the Azores and Madeira islands.

Indicator B1 – Marine Bird Abundance (breeding populations)

The assessment of this indicator followed the methodology described by Dierschke et al. (2022b) and adopted by OSPAR (OSPAR Agreement 2016-09). This assessment is based on the construction of time series of annual estimates of the relative abundance of breeding birds. As not all colonies and breeding sites were sampled in every year of the time series, missing values were interpolated from sampled years using generalised additive models (GAM) (Ward et al. 2014). Only colonies or breeding sites with more than two years of observed abundance data were included in this analysis.

In this indicator, relative abundance is presented as the number of adult birds or the number of breeding pairs observed or estimated annually in proportion to a reference value, using the following equation:

$$\text{Relative abundance} = \text{annual abundance} / \text{reference value}$$

The reference value for abundance was established based on the available information, giving priority to the historical reference value (abundance value prior to the start of the time series). In the absence of such a value, it was decided to use the initial period of the time series, i.e. the first 10 years. In this case, the reference value was obtained through predictions based on a generalised linear model to seek an annual trend in that period. The p-values and confidence intervals of the estimates were calculated assuming a 'Quasi-Poisson' distribution in order to take into account the overdispersion of the data. If this regression was significant for the first 10 years (p-value ≤ 0.05), the value estimated by the model for the first year was used as the base value; otherwise, the average abundance for the first 10 years was used, excluding years without counts. The geometric mean abundance over the last six years of the time series (i.e. the most recent period) was evaluated in comparison with the reference value. In the case of species that



Common Tern with chick | Joaquim Teodósio

have recently colonised (<50 years) any of the regions, namely the Lesser Black-backed Gull and Audouin's Gull, the average of the five most recent years of the time series was used.

The assessment values for the relative abundance trend indicator are defined based on the magnitude of change relative to the reference value, pre-established at 1. The threshold for the annual relative abundance of a species to achieve good environmental status of the population was set at a proportion of 0.7 (or 70%) of the reference value for species that lay more than one egg, or 0.8 (or 80%) for species that lay a single egg. The most recent value in the time series was used to assess the current environmental status of the population in each region. It was possible to make this assessment for a group of 16 different species (Table 7; Figure 8).

TABLE 7: List of species considered for the assessment of the Indicator B1 - Marine Bird Abundance (breeding populations) and B3 - Marine Bird Breeding Productivity].

Species	Abundance			Productivity		
	Mainland	Azores	Madeira	Mainland	Azores	Madeira
Band-rumped Storm-petrel <i>Hydrobates castro</i>		X			X	
Monteiro's Storm-petrel <i>Hydrobates montei</i>		X			X	
Desertas Petrel <i>Pterodroma deserta</i>			X			X
Zino's Petrel <i>Pterodroma madeira</i>			X			X
Cory's Shearwater <i>Calonectris borealis</i>	X	X	X	X	X	X
Barolo Shearwater <i>Puffinus baroli</i>		X				
Bulwer's Petrel <i>Bulweria bulwerii</i>		X			X	
European Shag <i>Gulosus aristotelis</i>	X			X		
Great Cormorant <i>Phalacrocorax carbo</i>	X					
Audouin's Gull <i>Larus audouinii</i>	X					
Lesser Black-backed Gull <i>Larus fuscus</i>	X					
Yellow-legged Gull <i>Larus michahellis</i>	X	X	X			
Little Tern <i>Sternula albifrons</i>	X					
Common Gull-billed Tern <i>Gelochelidon nilotica</i>	X					
Roseate Tern <i>Sterna dougallii</i>		X				
Common Tern <i>Sterna hirundo</i>		X				

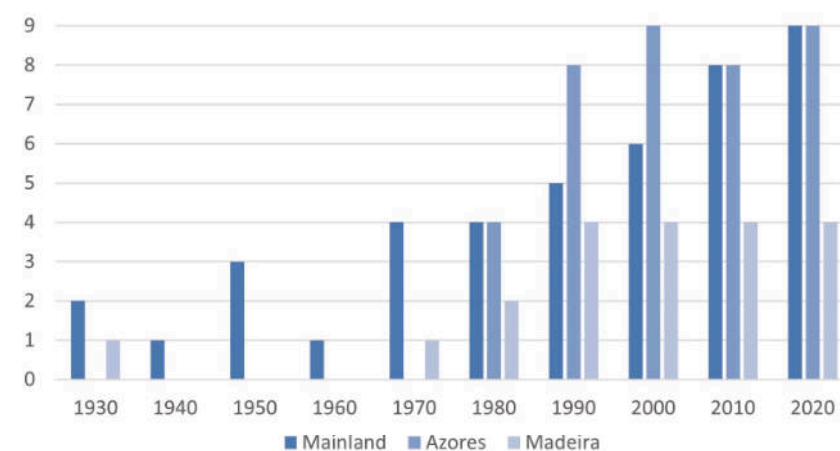


FIGURE 8: Number of breeding seabird species with abundance data for each region over the years, enabling the assessment of indicator B1 - Marine Bird Abundance (breeding populations).

Indicador B1 – Abundance of Non-breeding Seabirds and Waders

The assessment of this indicator followed the methodology described by Dierschke *et al.* (2022a), adopted by OSPAR (OSPAR 2016-09). This indicator was constructed from time series of the relative abundance of seabirds and waders at sea or along the coastal fringe, respectively, during the non-breeding period.

Information about seabirds (except for Common Scoter, Great Cormorant and Black-headed Gull) was obtained through censuses conducted on board vessels. Data were collected in a standardised manner, following the European Seabirds At Sea (ESAS) (Camphuysen & Garthe 2004) methodology. The estimate of the number of birds occurring annually in the region was obtained through trend analysis, based on species distribution generalised additive models (sdGAM) with an appropriate autocorrelation structure (Mercker *et al.* 2021).

In the case of waders, Great Cormorants and Black-headed Gulls, data collection was carried out within the framework of the Project Arenaria, following the methodology described by Lecoq *et al.* (2013). Counts were added up for each grid square in each year (Figure 9), resulting in the estimated number of birds. For the Common Scoter, annual estimates of the wintering population available in the literature were used, obtained from aerial censuses (Rufino & Neves 2004) or coastal surveys (Catry *et al.* 2010a; Jesus 2018).

Similar to the indicator for the abundance of breeding populations, the relative abundance of non-breeding seabirds and waders was presented as the estimated



ESAS survey | Nuno Barros



Great Skua | Thys Valkenburg

TABLE 8: List of species considered for the assessment of Indicator B1 – Marine Bird Abundance (non-breeding populations of seabirds and waders).

Species	Mainland	Azores	Madeira
Seabirds			
Common Scoter <i>Melanitta nigra</i>	X		
European Storm-petrel <i>Hydrobates pelagicus</i>	X		
Sooty Shearwater <i>Ardenna grisea</i>	X		
Great Shearwater <i>Ardenna gravis</i>	X		
Manx Shearwater <i>Puffinus puffinus</i>	X		
Balearic Shearwater <i>Puffinus mauretanicus</i>	X		
Northern Gannet <i>Morus bassanus</i>	X		
Great Cormorant <i>Phalacrocorax carbo</i>	X		
Black-legged Kittiwake <i>Rissa tridactyla</i>	X		
Black-headed Gull <i>Larus ridibundus</i>	X	X	X
Mediterranean Gull <i>Larus melanocephalus</i>	X		
Lesser Black-backed Gull <i>Larus fuscus</i>	X		
Black Tern <i>Chlidonias niger</i>	X		
Sandwich Tern <i>Thalasseus sandvicensis</i>	X		
Arctic Jaeger <i>Stercorarius parasiticus</i>	X		
Pomarine Jaeger <i>Stercorarius pomarinus</i>	X		
Great Skua <i>Catharacta skua</i>	X		
Atlantic Puffin <i>Fratercula arctica</i>	X		
Razorbill <i>Alca torda</i>	X		
Waders			
Eurasian Oystercatcher <i>Haematopus ostralegus</i>	X	X	
Grey Plover <i>Pluvialis squatarola</i>	X	X	X
Common Ringed Plover <i>Charadrius hiaticula</i>	X	X	X
Kentish Plover <i>Charadrius alexandrinus</i>	X	X	X
Whimbrel <i>Numenius phaeopus</i>	X	X	X
Ruddy Turnstone <i>Arenaria interpres</i>	X	X	X
Red Knot <i>Calidris canutus</i>	X	X	
Sanderling <i>Calidris alba</i>	X	X	X
Dunlin <i>Calidris alpina</i>	X	X	X
Purple Sandpiper <i>Calidris maritima</i>	X	X	
Common Sandpiper <i>Actitis hypoleucos</i>	X	X	X



A group of Sanderlings | Don DeBold

number of birds annually in proportion to a reference value. The reference value was established based on the first 10 years of the time series, following the methodology described above (see previous point). The same procedure was used to define the assessment thresholds. It was possible to assess this indicator for a group of 30 different species (Table 8; Figure 9).

Modelling the distribution of non-breeding seabird abundance

In this exercise, data from marine censuses conducted on board vessels were used. Data collection took place between December 2004 and December 2024, following the ESAS methodology (Camphuysen & Garthe 2004). The information was collected mainly in the coastal area of Mainland Portugal, up to a depth of 200 m (Figure 10). All birds on the water were counted along a 300 m wide transect. The snapshot method was used to count birds in flight. Only birds observed within the transect were considered in the following analyses. Along a total of 67,871 km of transects, 87,110 individuals of the 16 target species in this analysis were recorded (Figure 11).

The total number of birds counted each month of each year was added up for each grid square in a 10x10 km grid. This grid was pre-designed based on marine census coverage, including the entire coastal strip of the Mainland region, up to a bathymetric depth of 200 m. To model bird abundance per grid square, spatial, environmental and temporal variables were used that have been shown to have an effect on the distribution and abundance of seabirds in previous studies (Pereira *et al.* 2018; Araújo *et al.* 2022a; De la Cruz *et al.* 2022a). The variables considered were longitude, latitude, year, phenological period, sea state, substrate type, distance from the coast, bathymetry, chlorophyll a, chlorophyll a in the previous month, sea surface temperature, sea surface temperature in the previous month, zooplankton, zooplankton in the previous

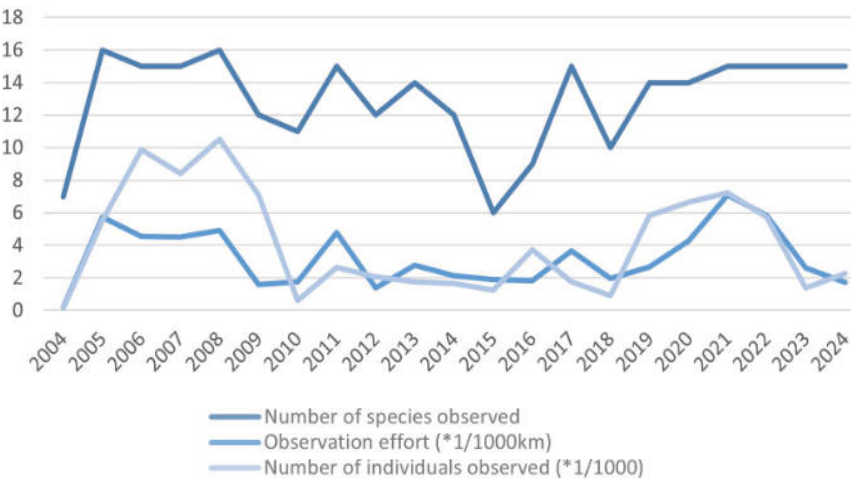


FIGURE 10: Number of covered kilometers, seabird species and total birds recorded during marine censuses between December 2004 and December 2024.

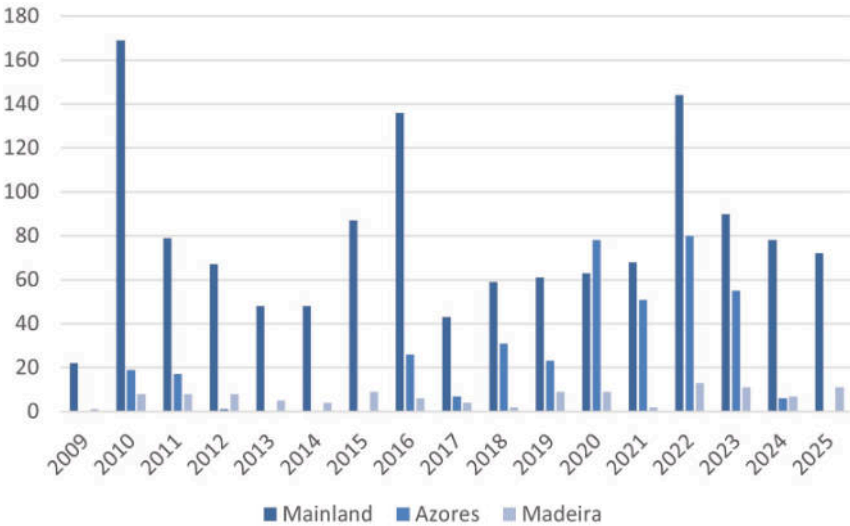


FIGURE 9: Number of Arenaria grid squares sampled per year in each region.

month, sardine *Sardina pilchardus* biomass, horse mackerel *Trachurus trachurus* biomass, and anchovy *Engraulis encrasicolus* biomass (Table 9). The centre of the grid square was used to obtain the value of the spatially distributed variables. Latitude, longitude, year and sea state (on the Beaufort scale) were recorded at sea. The phenological period was defined for each species based on the information available in the literature, with the following categories: breeding, post-breeding migration, wintering and pre-breeding migration (Figure 12).

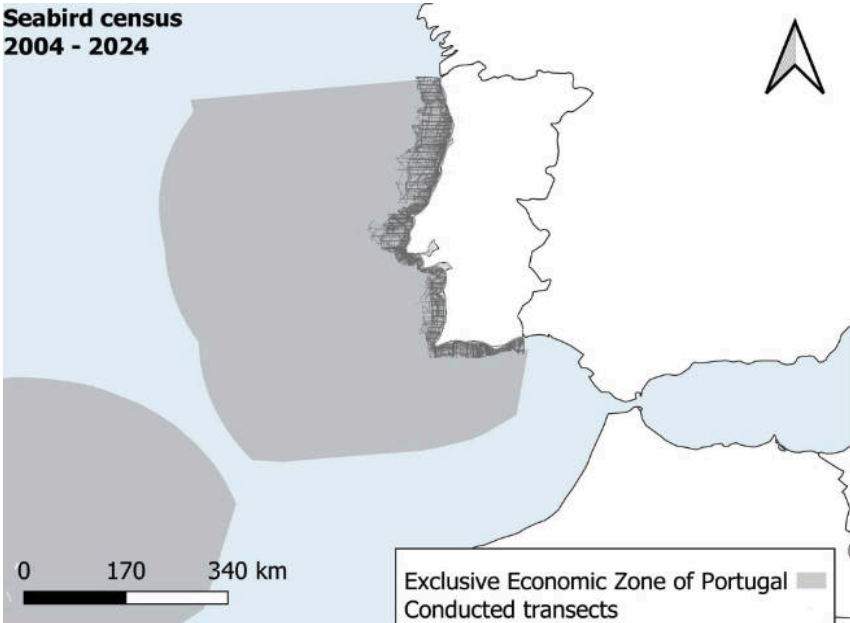


FIGURE 11: Transects conducted between December 2004 and 2024 for seabird censuses in the Mainland subarea, up to a depth of 200m.

The type of seabed substrate was obtained from the European Marine Observation and Data Network (EMODnet) and characterised into five primary categories: mud/silty sand, sand, coarse-grained sediment, mixed sediments and rock/boulders. Bathymetry was also obtained from EMODnet. The distance to the coast was calculated from the georeferenced layer of the European coastline, made available by the European Environment Agency (EEA). Chlorophyll a, sea surface temperature and zooplankton were obtained from the European Union's Copernicus Marine Environment Service (Aznar *et al.* 2016; Jean-Michel *et al.* 2021), at monthly resolution and for a grid of 0.083 degrees (about 9 km). The values of these three variables were also obtained for the month prior to the observations, assuming that there is a time lag between these primary production variables and the response of the upper elements of the food chain, in this case seabirds (Suryan *et al.* 2012). The annual biomass values for sardine, horse mackerel and anchovy were obtained for the Iberian shelf (ICES 2024).

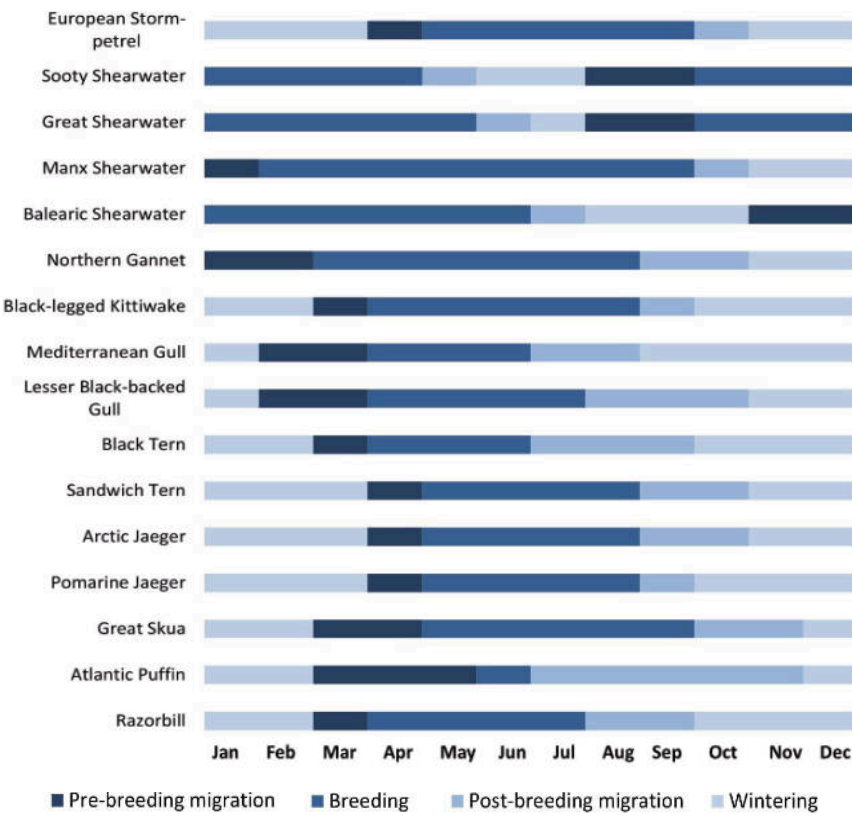


FIGURE 12: Phenological periods used to model bird abundances obtained from marine census data. The periods were defined for each species based on information available in the literature.

The models were adjusted using the number of birds recorded during the observation effort. A stepwise regression selection was implemented based on the explained deviation to select the final model. The restricted maximum likelihood method was used to estimate the smoothing parameters. To avoid overfitting, restrictions were implemented on the maximum degrees of freedom for the smoothing functions of all variables ($k = 4$). Two types of response variable distribution were also considered, negative binomial and Tweedie, in order to take into account the overdispersion of the data. The final predictive values were obtained using the final model selected, specific to each species, for the phenological period and sea state with the highest estimated coefficient values, reflecting the conditions with the highest abundances. The sum of these values for the entire study area resulted in the estimated number of birds, along with the respective 95% confidence intervals.

TABLE 9: Environmental variables used in modelling the abundance of non-breeding seabirds for the Mainland region, between December 2004 and December 2024.

Variable	Data source
Substrate type	EMODnet Geology
Distance to the coast	Coastlines, European Environment Agency
Bathymetry	EMODnet Bathymetry
Chlorophyll a	Copernicus (Aznar <i>et al.</i> 2016)
Chlorophyll a (previous month)	Copernicus (Aznar <i>et al.</i> 2016)
Sea surface temperature	Copernicus (Jean-Michel <i>et al.</i> 2021)
Sea surface temperature (previous month)	Copernicus (Jean-Michel <i>et al.</i> 2021)
Zooplankton	Copernicus (Aznar <i>et al.</i> 2016)
Zooplankton (previous month)	Copernicus (Aznar <i>et al.</i> 2016)
Sardine biomass	ICES
Horse mackerel biomass	ICES
Anchovy biomass	ICES

Indicator B3 – Marine Bird Breeding Productivity

The assessment of the marine bird breeding productivity indicator followed the methodology described by Frederiksen et al. (2022), adopted by OSPAR (OSPAR Agreement 2016-10). In preparing this indicator, time series of annual productivity were used, calculated as the number of fledglings or near-fledglings produced by each pair or nest in a sample of breeding sites. Not all sites were sampled in all years of the time series. The method used was based on the assumption that the missing values had a random temporal distribution, and an annual estimate was calculated using the sample size-weighted average for colonies with available data to reduce the effect of missing data. For a region to be included in the analysis, there had to be at least 10 years of productivity sampling in two distinct colonies or breeding sites. If only one colony or site was sampled, that unit had to be representative of the situation in the region (e.g. cases where data come from the largest known colony in the area).

The metric used in this indicator was the estimated population growth rate, obtained by calculating the arithmetic mean of productivity in the region over the last six years. The six-year average was used to smooth out the population trend. The population trend was defined as the factor by which the population grows each year (the ratio between the population size in a given year and the population size in the previous year). A population with a stable trend has a ratio of 1, a growing population has a ratio greater than 1, and a declining population has a ratio less than 1.

Thresholds were defined for each species within each region to determine that the growth rate, if maintained, would result in a population decline greater than or equal to 30% over the next three generations. This concept is consistent with the IUCN Red List criteria for defining a species as 'Vulnerable' (IUCN 2012). The most recent value in the time series was used to assess the current environmental status of the population in each region. For more details on the methodology used to assess this indicator, see Frederiksen et al. (2022). It was possible to make this assessment for a group of seven different species (Table 7; Figure 13).



Band-rumped Storm-petrel chick | Tânia Nascimento

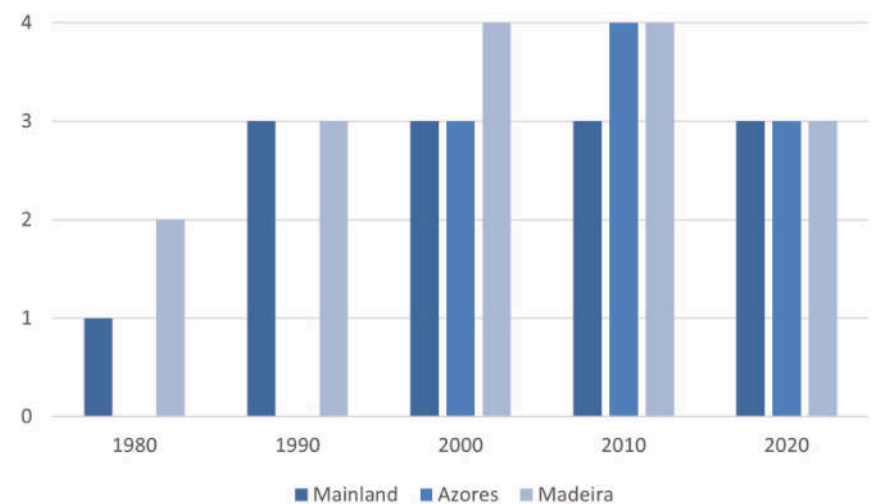


FIGURE 13: Number of breeding seabird species with productivity data for each region over the years, enabling the assessment of indicator B3 - Marine Bird Breeding Productivity].

13. Gaps in knowledge and in the monitoring of seabirds in Portugal

Individual tracking

The rapid development of individual tracking technologies has opened up a new field of knowledge regarding seabirds, enabling us to access detailed information on the distribution and movements of tagged individuals. This type of information has revolutionised studies of the ecology and migration of seabirds, but also the very methodological approach used for the identification and delimitation of marine protected areas (Dias *et al.* 2017; Davies *et al.* 2021).

However, it is important to be aware of the limitations and biases associated with data from individual tracking, which may restrict its use or interpretation. Within a population, there are intrinsic factors (sex, age, condition, status) and extrinsic factors (year, season) that determine differences in bird behaviour. Furthermore, there are variations in spatial ecology between different populations, related to the ecological context, including proximity to foraging areas and intra- and inter-specific competition. Another limitation concerns spatial and temporal resolution, as they are highly dependent on the type of equipment used and the objectives of the monitoring. Finally, there are some species for which the number of individuals monitored is still very small, or where the sample is heavily biased towards specific colonies.

With regard to breeding populations of seabirds in Portugal, there is a substantial amount of individual tracking data available for some species, with the Cory's Shearwater being the prime example, as many hundreds of birds from various colonies have been tracked over the last 25 years (Paiva *et al.* 2010a; Catry *et al.* 2011a; Alonso *et al.* 2018), with a vast body of data available for each of the various stages of the breeding season, as well as on long-distance movements (Dias *et al.* 2011). Other species, such as the Yellow-legged Gull and Audouin's Gull, also have a considerable amount of such information (Mendes *et al.* 2018; Romero *et al.* 2019; Pereira *et al.* 2025b) particularly on the Mainland, where many of the foraging areas of the main colonies have been identified. On the other hand, for smaller species whose breeding colonies may be small and not always accessible, there are significant gaps in knowledge. This is the case with small shearwaters and storm-petrels, such as the Barolo Shearwater, the Manx Shearwater or the Band-rumped Storm-petrel, for which there are no tracking data or for which existing data are limited to a few nesting sites. One of the main limitations has been the size of these species, as it is only recently that technological advances have made it possible to use geolocation devices with sufficiently low weight and sufficient battery life to monitor their movements (e.g., Carreiro *et al.* 2020). This has made it possible to observe in detail the movements of the White-faced Storm-petrels during the incubation and chick-rearing period (Alho *et al.* 2022) or the migratory movements of the Bulwer's Petrels that nest on the Selvagens Islands (Dias *et al.* 2015). However, for most of the islands and islets in the Azores and Madeira archipelagos where Band-rumped Storm-petrels, Bulwer's Petrels, Barolo Shearwaters or Manx Shearwaters nest, there are still no data on the individual tracking of these species.

In the case of species with an endangered status at the global level, such as the Monteiro's Storm-petrel and the Zino's Petrel, or for populations whose numbers are of significant importance at the European level for the species, such as the Roseate Tern in the Azores or the White-faced Storm-petrel in Madeira, it becomes even more important to prioritise this type of monitoring. Although some monitoring data already exist for some of these species, such as the Zino's Petrel and the Desertas Petrel (Ventura *et al.* 2020; Ventura *et al.* 2024), there is a clear need to prioritise the collection of monitoring data on these populations to identify their main foraging areas during the breeding season and their key wintering grounds, thereby contributing to their conservation more effectively. The growing expansion of offshore and coastal wind energy makes it a priority to better understand the local movements of species such as the Roseate Tern in the Azores, as well as the flight heights and the colony entry and exit routes of species such as the petrels and Manx Shearwaters, which nest in very restricted locations, deep inland (and at high altitudes) on the islands of Madeira and Bugio.

Despite the lack of information on breeding species, there are also gaps in knowledge regarding the individual tracking of non-breeding species that are very



Monitoring of Cory's Shearwaters | Luís Ferreira

common throughout Portugal, both during migration and the wintering season, such as the Northern Gannet, the Razorbill, the Balearic Shearwater, the Sandwich Tern and the Mediterranean Gull. The notable exception is the Lesser Black-backed Gull, for which there is already a wealth of tracking data, including high-spatial-resolution data (e.g., Shamoun-Baranes *et al.* 2017; Baert *et al.* 2018). Although some tracking data exist for the group of species mentioned above (e.g., Fort *et al.* 2012; Guilford *et al.* 2012), it is clear that information with fine spatial resolution is still insufficient, does not cover all age groups and seasons (see, however, Bernard *et al.* 2026) and, above all, the existing information relates mainly to a few colonies and may not be representative of the migratory behaviour of the entire population. Similarly, for highly pelagic species that are threatened and poorly recorded in marine censuses, such as the Atlantic Puffin and the Black-legged Kittiwake, individual tracking could be crucial for a better understanding of their distribution within the Portuguese EEZ. The use of spatial data can also help identify threats and risks faced by birds at sea, including interactions with fisheries (Votier *et al.* 2010) or spatial overlap with offshore wind energy areas (Bernard *et al.* 2026); it is therefore essential to invest in this type of monitoring for non-breeding species with an unfavourable conservation status, such as the Balearic

Colonies

Although there are numerous studies and monitoring programmes focusing on seabirds, information on the location and size of colonies in Portugal remains very limited, for a wide variety of reasons. Even scarcer is information on the reproductive parameters of most populations, including productivity, individual survival at various life stages, recruitment rates, age at first breeding, sex ratios, etc.

The first difficulty stems from the elusive and nocturnal behaviour of a large proportion of breeding species, particularly the Procellariiformes. In fact, the overwhelming majority of populations of these species, which include the Cory's Shearwater, the Manx Shearwater, the Barolo Shearwater, the Bulwer's Petrel, the Zino's Petrel, the Desertas Petrel, the White-faced Storm-petrel, the Band-rumped Storm-petrel and the Monteiro's Storm-petrel, visit the nesting colonies exclusively at night and nest in burrows, which limits the survey of nesting sites and counts/estimates of birds present in the colony. There are methodologies that allow population sizes to be estimated from counts of rafts at sea or from the number of vocalisations per hour in the colonies, which is often the only possible way to estimate the number of birds present or the number of pairs. However, the estimated values are often subject to natural variations and external variables, such as weather conditions and the phase of the moon, amongst others. This makes it more difficult to replicate these methods across different locations and years. Capture–recapture through mist nets is an efficient method for estimating population sizes of small Procellariiformes (Oliveira *et al.* 2021), but it is not applicable in all locations and is logistically very demanding. The most efficient method for a good population estimate is direct counting, supplemented by estimates at inaccessible sites. Nevertheless, this methodology can only be implemented in certain locations and for certain species, such as the Cory's Shearwater, whose nests are generally more accessible.

Furthermore, nesting sites are often located in areas that are extremely difficult to access, such as the mountainous interior of some islands (petrels and Manx

Shearwater). It is also a valuable methodology for monitoring species whose opportunistic behaviour around fishing vessels (Oliveira *et al.* 2015) and flight altitudes place them at greater risk, as is the case with the Northern Gannet (Guilherme *et al.* 2023).

In the case of species that are known to use Portuguese waters during their migratory periods, such as the Common Tern, the Manx Shearwater (on the Mainland only), the Great Shearwater, jaegers and other terns, tracking data can be of exceptional importance. In some cases, such as with the Manx Shearwater, the migratory passage can occur within an incredibly short period of time, whilst for other species it may occur at a significant distance from the coast. This can make it difficult to monitor these movements using coastal counts, particularly as for many other species, such as the Northern Gannet, the passage occurs over a very extended period of time (Elmberg *et al.* 2020). Individual tracking can help in these cases, aiding better understanding of the migratory phenology of each species, as well as the distance from the coast during the migratory passage, and may facilitate the estimation of total numbers by cross-referencing the data with coastal counts.

Shearwater), inaccessible coastal cliffs (Cory's Shearwater, Barolo Shearwater and Band-rumped Storm-petrel) and on many islets where it is very difficult to land or carry out regular survey and monitoring work. Obviously, on many of the islands in the archipelagos of Madeira and the Azores, the very topography and size of the islands make surveying potential colonies an enormous challenge. In the specific case of the White-faced Storm-petrel, which nests in colonies on sandy substrates, the challenges differ and are primarily related to estimating occupancy rates and nesting area, as well as minimizing potential damage to nests. For the reasons mentioned above, it is within the Procellariiformes group that we find the greatest gaps in knowledge, particularly regarding the population sizes of most colonies (Band-rumped Storm-petrel, Monteiro's Storm-petrel, Barolo Shearwater and Cory's Shearwater), but also concerning the location of some breeding sites (Band-rumped Storm-petrel, Manx Shearwater and Barolo Shearwater).



Monitoring in hard-to-reach locations | Francisco Félix

When it comes to gulls and terns, the difficulties involved in surveying and counting are much less significant compared to those of the Procellariiformes. However, there are other challenges, such as the regular changes in nesting sites (particularly in the case of terns and Little Terns), which require more frequent surveying efforts to identify new colonies. But for these species too, there is a discrepancy between regions in monitoring efforts. Of particular note is the important long-term monitoring programme for terns in the Azores, and for some gull colonies (Yellow-legged Gull in the Berlengas Islands, Barrier Islands and Pessegueiro Island, and Audouin's Gull, in the Barreira Islands) and terns on the Mainland (Common Gull-billed Tern and Little Tern on Caia, and Little Tern in Ria Formosa), although there is a lack of monitoring in the major estuaries and other wetlands on the Mainland, and also in Madeira, where greater emphasis on tern monitoring would be important. Conversely, it should be noted that the conservation status of the breeding population of the Black-headed Gull on the Mainland has not been assessed recently due to insufficient information (Almeida *et al.* 2022).

The final reason for the gaps in knowledge about the colonies relates to the lack of support and incentives for long-term monitoring programmes. There are, of course, good examples of long-term colony monitoring in various locations, but in other places monitoring is carried out on an *ad hoc* basis, depending on human or financial resources that are not always available, or on projects with a limited duration. In cases where monitoring has been carried out by research teams or NGOs, it is often limited to the duration of the projects, as there are no specific funding streams to support ongoing monitoring programmes. There are also difficulties in sharing and aggregating monitoring data on counts and population estimates, which hinder quick and easy access to this type of information.



Monitoring in hard-to-reach locations | Nuno Oliveira



Monitoring in colonies | Francisco Félix

14. Priorities for future monitoring

Priorities for future monitoring should focus on the systematic collection of data to address the knowledge gaps identified previously and to ensure the continuity and consistency of existing monitoring programmes. Without this information, it is impossible to assess the status of populations, understand the effects of current and emerging pressures, or implement measures to minimise those effects.

In terms of understanding the distribution of seabird populations using Portuguese waters, it is a priority to gather information on species for which data are currently lacking, both regarding breeding and foraging areas. It is particularly important to obtain detailed information on all species that breed within Portugal, particularly those inhabiting the islands. The Barolo Shearwater, the Manx Shearwater, the Roseate Tern and the Common Tern are examples of species whose distribution, particularly their foraging areas at sea, remains poorly understood. These gaps should be addressed through individual tracking initiatives in key colonies. Moreover, for the Barolo Shearwater and the Manx Shearwater, data on the distribution and size of their breeding populations are significantly out of date. On the other hand, there are several non-breeding species for which Portuguese waters play a crucial role during part of their life cycle, but knowledge of their distribution, especially in deep waters far from the coast, remains scarce. Notable among these species are the Wilson's Storm-petrel *Oceanites oceanicus*, the Little Gull *Hydrocoloeus minutus* and the Long-tailed Jaeger *Stercorarius longicaudus*.

The collection of up-to-date information on population sizes is another matter of the highest importance. According to the latest review of bird conservation statuses for Mainland Portugal (Almeida *et al.* 2022), species such as the Black-headed Gull (breeding population) and the Atlantic Puffin are classified as Data Deficient. Furthermore, the classification of bird populations has not been updated for the autonomous regions, with the statuses assigned over two decades ago still in force, despite new classifications and taxonomic revisions having taken place. This lack of updating is problematic, as it can lead to incorrect assessments of conservation status, inadequate monitoring, and the implementation of management and protection measures that do not reflect the actual vulnerability of the populations. In these regions, information on most seabird populations is very scarce or severely out of date, making it urgent to carry out targeted censuses and implement long-term monitoring programmes. Such programmes should cover not only the collection of data on population size, but also other demographic parameters essential to assessing their conservation status, namely breeding success and survival across the various life stages.

The continuation of marine surveys using the standardised ESAS methodology and, along the coastline, the Project Arenaria, are essential for assessing changes in the populations that use Portuguese waters. These surveys have enabled the assessment of the environmental status of various non-breeding species and are also a vital source for understanding population distribution and trends over time. Additionally, the coverage of at-sea censuses using the ESAS methodology should be extended to the entire Portuguese EEZ, including the deeper waters off the Mainland and the waters of the island regions.

Coastal censuses are also a methodology that has proven to be very useful for monitoring certain populations, particularly those that use the Portuguese territory during their migrations and/or wintering. On the one hand, counts using the RAM (Seabird and Marine Mammal Monitoring Network) methodology provide supplementary information for a large number of species (Fagundes *et al.* 2024), and could be improved to obtain information on parameters that are still poorly understood, such as flight height. On the other hand, some species lack targeted coastal censuses, as is the case with the Common Scoter. In this instance, censuses using the double-observer methodology have proved very useful for monitoring the size of the wintering population of Common Scoter (Jesus 2018) and consequently assessing its population trend.

In terms of monitoring threats and pressures, it is a priority to ensure a comprehensive assessment of their effects, including an analysis of cumulative impacts. Some pressures have a long history in Portuguese waters and have been the subject of various initiatives aimed at assessing their impacts and mitigating them. Among the most significant pressures are predation by invasive species, habitat loss due to urban development, bycatch in fishing gear, climate change and extreme weather events, disturbance, marine pollution, overfishing and light pollution (Dias *et al.* 2019). Among the range of emerging threats, the development and implementation of offshore energy production structures, plastic pollution and disease outbreaks stand out. In addition to these emerging pressures, there is still very limited knowledge regarding the impacts of climate change on seabird populations in Portugal. Despite global evidence of changes in distribution, phenology, breeding success and food availability, the quantification of these effects at national level remains limited. It is essential to establish long-term programmes to monitor these effects.



ESAS survey | José Cedeira

[illegible]



15.1. Format of the species accounts

Group and Family

This section indicates the group (seabird or wader) and the taxonomic family to which the species belongs.

Phenology and threat status

Phenological classification was designed to provide readers with a rapid overview of the phenology of each species for mainland Portugal, Madeira, and the Azores. Global and European conservation status were obtained from BirdLife International (2025), while national conservation status was sourced from Cabral *et al.* (2005) and Almeida *et al.* (2022): LC - Least Concern; NT - Near Threatened; VU - Vulnerable; EN - Endangered; CR - Critically Endangered; DD - Data Deficient; NE - Not assessed; NA - Not applicable."

Distribution, movements and phenology

This section presents information on the species' global, national and regional distribution, as well as its movements during the breeding, wintering and/or migration periods.

Abundance and population trends

This section addresses the abundance of the species at global, European, and national levels. In Portugal, the situation is also described at regional or local scales. Population trends over time are also discussed, where such information is available.

Author(s) and data source(s)

Name(s) of the species account author(s) and of the owner(s) or source(s) of the tracking data used in this publication.

Nomenclature and taxonomy

The scientific and English names and the taxonomic order used are based on the BirdLife International taxonomic list (HBW & BirdLife International 2025). The Portuguese names follow the nomenclature used in Svensson *et al.* (2022), which in turn was adapted from Costa *et al.* (2000a).

Ecology and habitat

This section highlights the use of the marine environment by the species, information on diet where known, and selected aspects of its ecology and breeding biology.

Threats and conservation

This section provides information on the main threats affecting the species, conservation measures implemented, and conservation priorities.

Seabirds | Family Phalacrocoracidae

European Shag
Gulosus aristotelis

Phenology

Mainland	Resident and wintering
Madeira	Vagrant
Azores	Absent

Conservation status

Mainland	MADEIRA	AZORES	IUCN Global
EN	NA	NA	LC

Distribution, movements and phenology

The European Shag breeds between February and August, and is found along the European Atlantic coast, in north-west Africa, the Mediterranean and the Black Sea (Billerman *et al.* 2026). It is a predominantly sedentary species, concentrating its distribution around colonies throughout the year (Velando *et al.* 2005; Nascimento *et al.* 2023b). However, some birds undertake short-distance migrations during winter and juveniles exhibit some dispersive movements.

In Portugal, it breeds exclusively on the Mainland, in the Berlengas archipelago and on the rocky coast between Cape Carvoeiro and Albufeira (del Moral & Oliveira 2019). Individual tracking confirmed the localised distribution around breeding colonies. Juveniles undertook more extensive dispersal movements, with one reaching the coastal area between Matosinhos and Caminha during its first winter. Previous records in this part of the country were attributed to individuals originating from Galician colonies (Catry *et al.* 2010a). There are no known records of the European Shag in the Azores (Meirinho *et al.* 2014; Birding Azores 2022) and although the species is recognised as occasional in the Madeira archipelago (Correia-Fagundes *et al.* 2021), only one record of an individual was confirmed in the 1990s (Zino *et al.* 1995a).

Abundance and population trends

The global population has been estimated at 230,000 to 240,000 individuals (Wetlands International 2025), with a declining trend (BirdLife International 2025). In Portugal, it is a scarce species. In 2017, 101 breeding pairs were recorded along the Portuguese Mainland coast (del Moral & Oliveira 2019). The largest colony, comprising 62 pairs, was located in the Berlengas archipelago, followed by the Arrábida/Cape Espichel area, where 20 pairs were recorded. No substantial change in the species' distribution has been recorded since the last census, carried out in 2002 (Equipa Atlas 2022). However, a considerable decline in the population size of the Berlengas archipelago and the south-west coast should be noted. The assessment of environmental status is consistent with this trend, with the population failing to achieve Good Environmental Status for either indicator, abundance or productivity.

Author(s) and data source(s)

Author: Tânia Nascimento
Owners/sources of tracking data: SPEA BirdLife

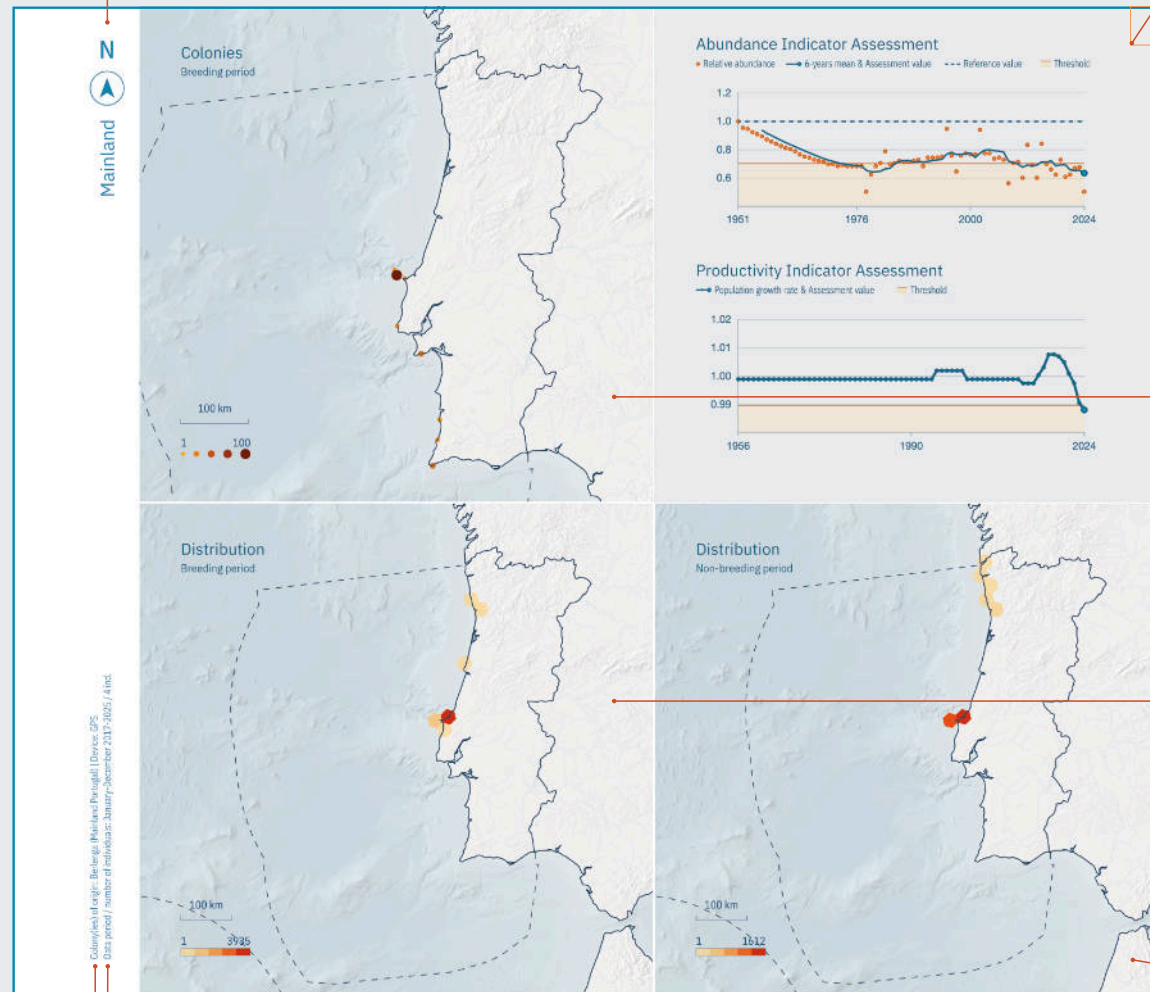
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49

Geographic region

Name of the geographic region to which the maps refer: mainland Portugal, corresponding to the mainland Portuguese EEZ sub-area; Madeira, corresponding to the Madeira EEZ sub-area; and the Azores, corresponding to the Azores EEZ sub-area.



Assessment plots for the Abundance and Productivity indicators

For seabird species with breeding populations, analyses are presented only for those populations, following the assessment of indicator Abundance of Breeding Seabirds, and Seabird Productivity. Exceptionally, for the European Shag and the Lesser Black-backed Gull, two abundance indicator plots are shown: one for the breeding population and one for the non-breeding population. For non-breeding seabirds and shorebirds, only analyses of indicator Abundance of Non-breeding Seabirds and Shorebirds are presented. The assessment value corresponds to the most recent value of the time series, as indicated in the plot legends.

Map of colony distribution and size

Regional maps showing the distribution and size of colonies of species breeding in Portugal, according to the legend displayed on the map, on a linear scale. Exceptionally, the scale is non-linear for few species and the value of each class is given. For some colonies, the minimum value shown is "P", indicating locations without available quantitative information.

Map of at-sea distribution during the breeding period

Regional maps showing species distribution within the corresponding EEZ sub-area, based on tracking data, during the breeding period. Data are displayed according to the classes shown on the map, representing the number of recorded locations. Classes vary depending on the species, and the period depends on its phenology.

Map of at-sea distribution during the non-breeding period

Regional maps showing species distribution within the corresponding EEZ sub-area, based on tracking data, during the non-breeding period. Data are displayed according to the classes shown on the map, representing the number of recorded locations. Classes vary depending on the species, and the period depends on its phenology.

Colony(ies) of origin and device type

Colony(ies) or location where the birds used to map at-sea distribution were tagged. The type of individual tracking device used is also indicated (GPS, PTT or GLS).

Period and number of tracked individuals

Period corresponding to the temporal coverage of the tracking data used to produce the at-sea distribution maps. The years and months covered by the data are indicated, as well as the number of tracked individuals per region.

Common Scoter

Melanitta nigra

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	VU	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Common Scoter breeds between May and September in the north of the United Kingdom, eastern Greenland, Iceland, Scandinavia and northern Russia (Billerman *et al.* 2026). In Mainland Portugal, it has a strictly marine distribution and can be found practically all year round. However, it is during winter and the migratory periods that the population is most abundant. In winter, it is mainly concentrated between Cape Mondego and Espinho (Meirinho *et al.* 2014; Jesus 2018). Pre-breeding migration mainly takes place from March to April, whilst post-breeding migration is observed from at least August to October (Catry *et al.* 2010a). During migration, it occurs practically along the entire coast (Meirinho *et al.* 2014), possibly due to the movements of some birds to other wintering areas located further south, notably the Atlantic coast of Morocco (Aðalsteinsson *et al.* 2025). This pattern is also suggested by the individual tracking data presented in this work, although it is limited to just two birds, fitted in 2009–2013 with GLS devices in Iceland. In the Azores and Madeira, it occurs occasionally in the coastal waters of most of the islands, between autumn and spring (Correia-Fagundes *et al.* 2021; Birding Azores 2022).

Abundance and population trends

The global population has been estimated at around 1,600,000 individuals, with an unknown trend (BirdLife International 2025). In Mainland Portugal, it is more abundant in the north, with a population of 20,000 to 21,000 individuals recently estimated between the mouth of the Douro and Nazaré (Jesus 2018). It is frequently observed in large flocks ranging from tens to many hundreds of birds (Rufino & Neves 1990; Petronilho *et al.* 2004). Despite the lack of recent estimates for the southern half of the country, historically this population would not have exceeded three hundred birds (Rufino & Neves 2004). In general terms, the population appears to have undergone several fluctuations over the last few decades, maintaining a stable trend, which coincides with the Good Environmental Status resulting from the assessment in this work. In the Azores and Madeira, however, the population size is very low, both in winter and during migration (Equipa Atlas 2018), and there is no information regarding the trends of these populations.

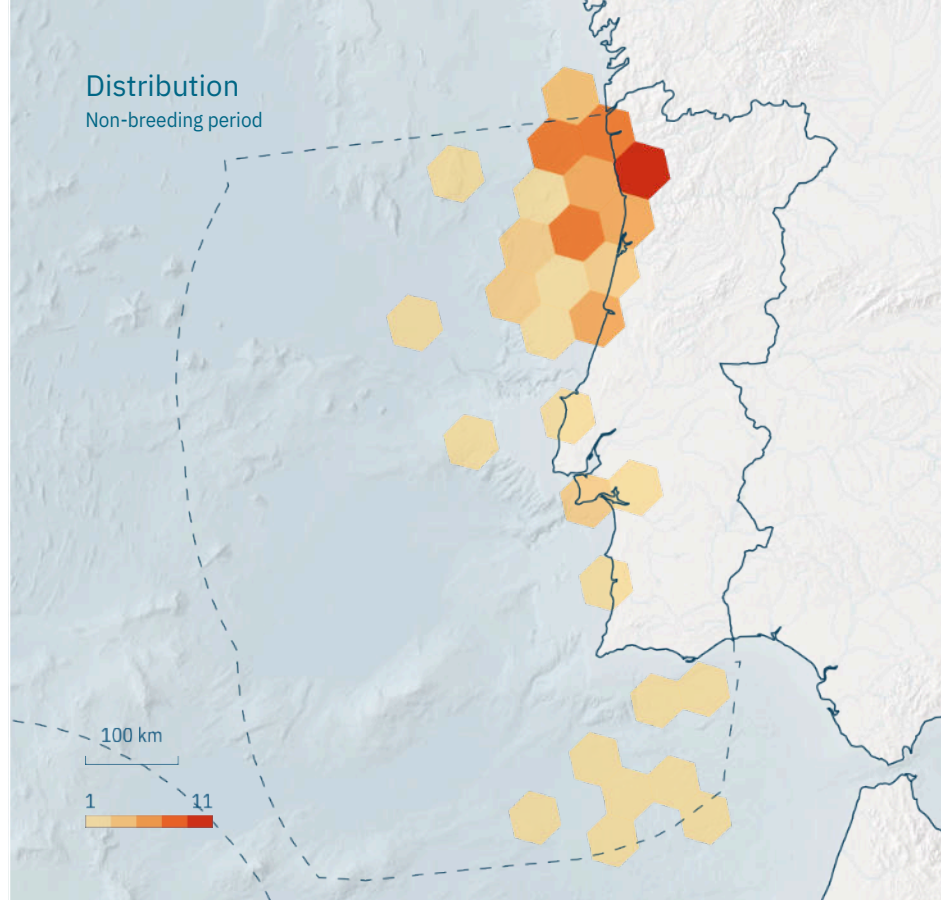
Ecology and habitat

The Common Scoter is the only sea duck that regularly winters in Portugal, generally frequenting shallow coastal waters with sandy bottoms. It usually feeds just beyond the surf zone and up to two or three kilometres from the coastline. Molluscs, mainly bivalves, are its primary prey, which it catches by diving to depths of up to 10–20 metres (Billerman *et al.* 2026).

Threats and conservation

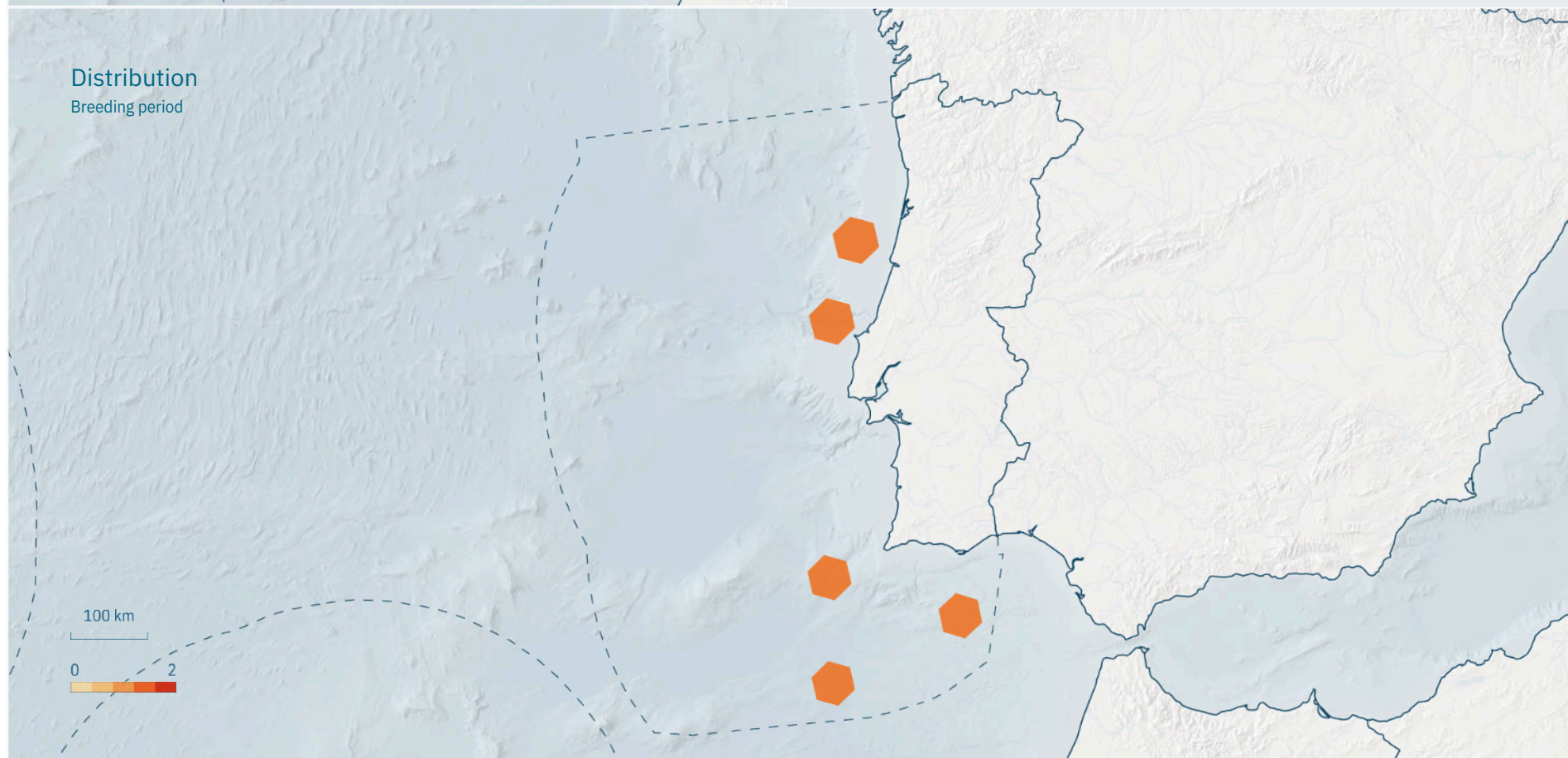
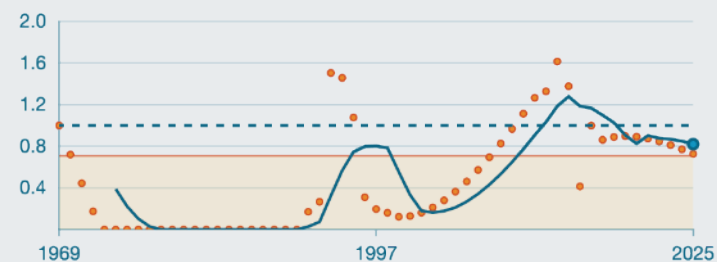
Globally, the Common Scoter appears to be particularly vulnerable to oil spills and chronic hydrocarbon pollution in its wintering grounds. Climate change also appears to have a negative impact, causing habitat loss and the degradation of the ecosystems it inhabits. In Portugal, the overexploitation of bivalves is considered its main threat (Cabral *et al.* 2005). However, there are no concrete data on its diet in our country (Catry *et al.* 2010a). Bycatch in fishing gear, particularly in beach seines and gillnets, is also a documented pressure on Portuguese waters (Oliveira *et al.* 2015). All these threats coincide with the causes cited for the admission of Common Scoters to rehabilitation centres, including poor plumage condition, emaciation, entanglement in fishing equipment, physical injuries and toxicity (Costa *et al.* 2021).

Authors: Ib Krag Petersen, Nuno Oliveira
Owners/sources of tracking data: Ib Krag Petersen



Abundance Indicator Assessment

● Relative abundance — 6-years mean & Assessment value - - - Reference value ■ Threshold



Distribution

Non-breeding period

100 km

1 11

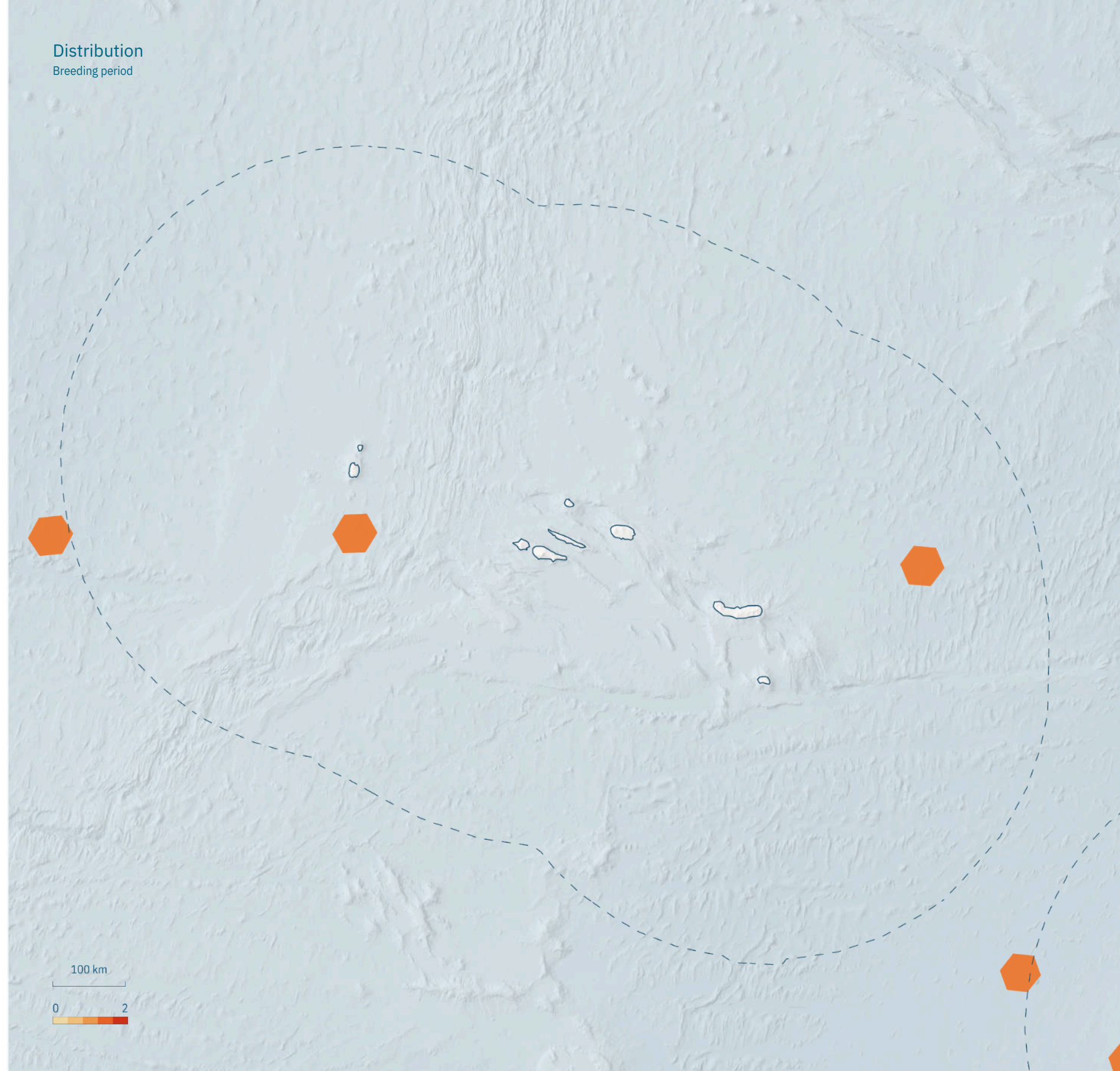
North arrow pointing up, labeled 'Madeira' and 'N'.

Distribution

Breeding period

100 km

0 2



Red-billed Tropicbird

Phaethon aethereus

Phenology		Conservation status			
Mainland	Vagrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	NA	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Red-billed Tropicbird breeds throughout the year, with seasonal peaks, in tropical and subtropical areas of the Atlantic, the north-west Indian Ocean and the eastern Pacific (BirdLife International 2025). It is not recognised as a migratory species, despite its dispersive movements over considerable distances. The birds occurring in Portugal are likely the result of these same movements, originating from the nearest breeding colonies, which are found in Cape Verde and the islands off the coast of Senegal. It is evident from individual tracking data that there is some dispersal of birds breeding in Cape Verde into the waters of Madeira and the Azores, although this information is limited to just two birds in 2008 and 2009. Regular records of this species in our waters may also be related to the relatively recent colonisation of the Canary Islands (Catry 2011; Keller *et al.* 2020).

Abundance and population trends

The global population has been estimated at around 8,000 to 15,000 breeding pairs, with a declining trend (BirdLife International 2025). In Portugal, this species is quite rare, with no estimates of its abundance or population trend. Records during past marine censuses were fewer than ten birds for the entire area covered by the EEZs of Madeira and the Azores (Meirinho *et al.* 2014). Occasional sightings have also been very few, despite the regular observation of a few individuals on the Selvagens between the late 1990s and throughout the 2000s (Catry 2011). However, there are no estimates of its abundance or population trends, which has made it impossible to assess its environmental status.

Ecology and habitat

The Red-billed Tropicbird is a strictly marine species that feeds on small fish, particularly flying fish, and squid. Most of its prey is caught following a vertical dive. Some flying fish are also caught in flight.

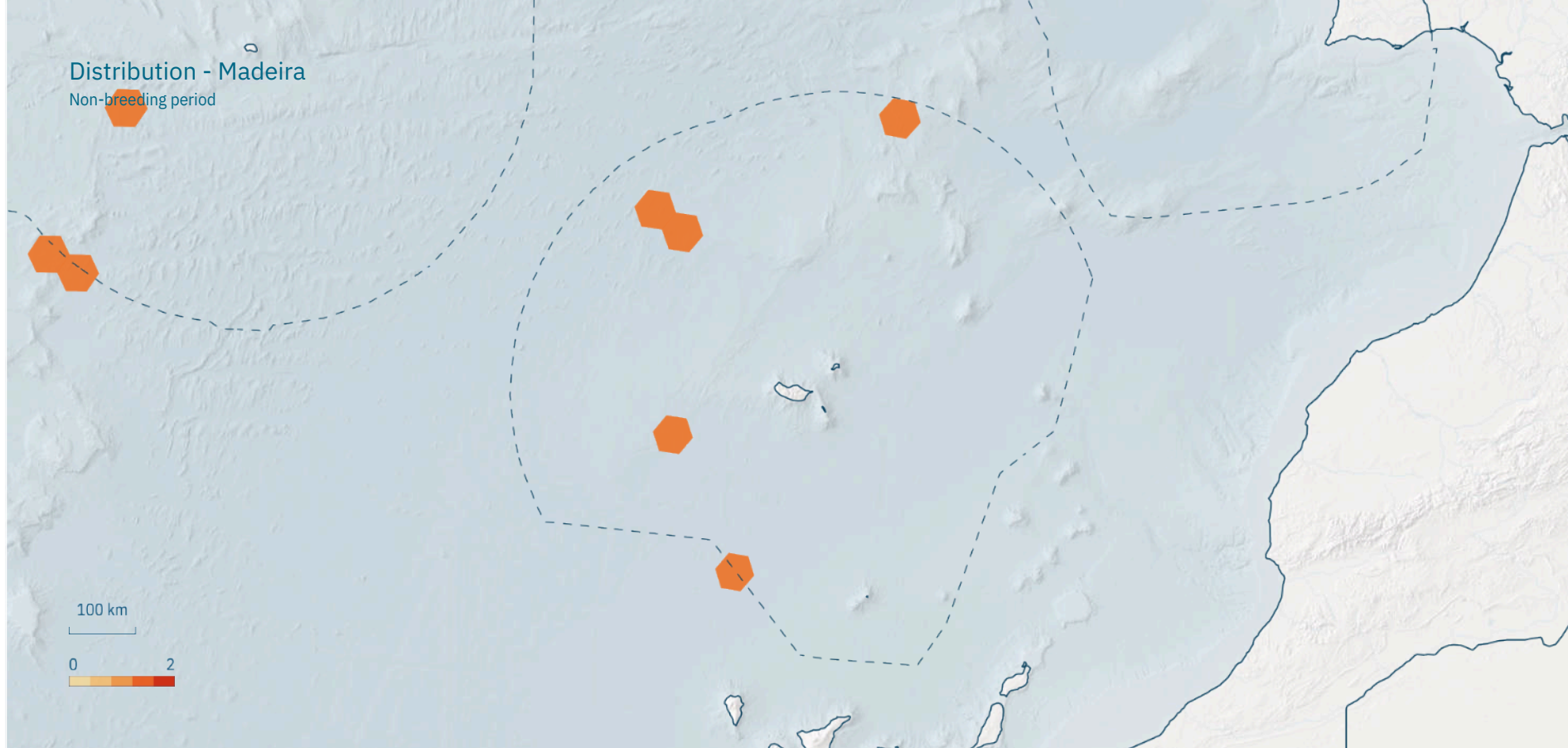
Threats and conservation

Globally, the Red-billed Tropicbird appears to be most vulnerable to pressures affecting its breeding colonies. Several populations have been severely affected by predation on eggs and chicks by invasive mammals, notably rats and cats (BirdLife International 2025). Habitat loss, due to urban development and construction in coastal areas, has also had a negative effect on these populations. At sea, there are records of bycatch in small-scale fishing gear, particularly line fishing, near breeding colonies in Cape Verde.



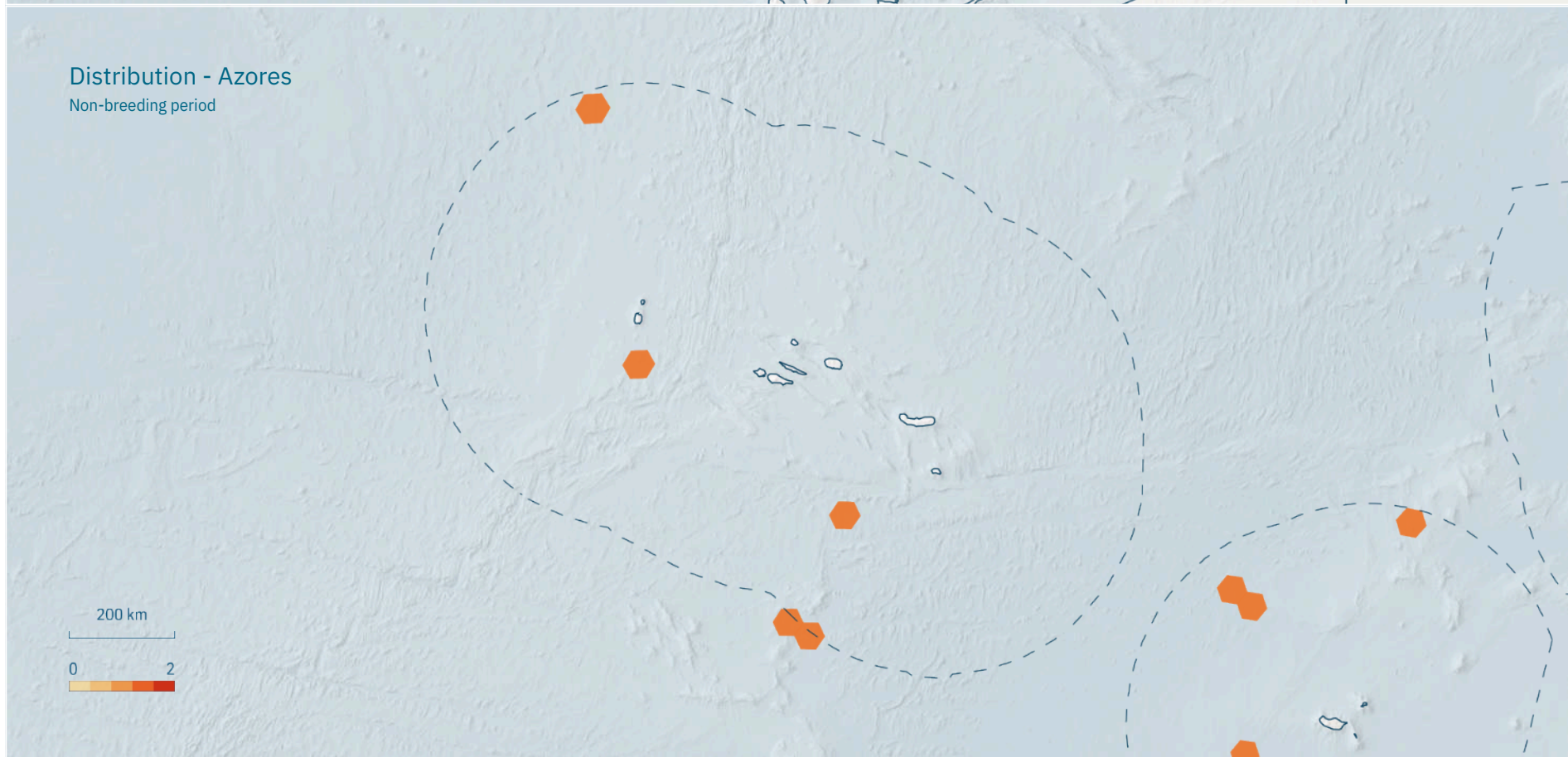
Distribution - Madeira

Non-breeding period



Distribution - Azores

Non-breeding period



White-faced Storm-petrel

Pelagodroma marina

Phenology		Conservation status			
Mainland	Vagrant	Mainland	Madeira	Azores	UICN Global
Madeira	Summer breeder	NA	VU	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The White-faced Storm-petrel breeds along the coasts of Australia and New Zealand, and on the remote islands of Tristan da Cunha in the South Atlantic. In the North Atlantic, colonies exist in the Selvagens (Madeira, Portugal), the Canary Islands (Spain), and Cape Verde (Billerman *et al.* 2026). In the Selvagens archipelago, the species breeds on Selvagem Grande, Selvagem Pequena and Fora Islet. Here, breeding occurs between February and August (Campos & Granadeiro 1999). Due to the presence of the breeding population, the species is common in Madeiran waters, whilst rarely observed in the Azores and on the Mainland (Catry *et al.* 2010a). Individual tracking of 34 birds from Selvagem Grande fitted with GPS during the 2018 and 2019 breeding seasons confirmed the use of the Madeira sub-area, with a higher concentration in the southern and south-east zones. These birds mainly use deep ocean waters, up to around 400 km from the colony, and may also explore the African continental margin and the Canary Islands region (Alho *et al.* 2022). As for wintering areas, these are mainly located in the North-west Atlantic, along the Mid-Atlantic Ridge and south of the Azores (Medrano *et al.* 2023).

Abundance and population trends

The global population of the species is estimated at at least 4,000,000 individuals, whilst the European population, consisting mainly of the Portuguese colonies, is estimated at 77,800 to 111,000 pairs, with a declining trend (BirdLife International 2025).

The breeding population on Selvagem Pequena and Fora Islet appears to number 62,550 pairs, with the largest colony in Portugal located on Selvagem Pequena (Catry *et al.* 2010b). On Selvagem Grande, the only estimate dates back to 1996, when around 36,000 pairs were breeding (Campos & Granadeiro 1999). The population trend appears to be stable, although there is a considerable margin of error in the estimate of the number of breeding pairs and a lack of current figures (Catry *et al.* 2010b; Equipa Atlas 2022). Consequently, it has not been possible to assess the environmental status of this population in Portugal.

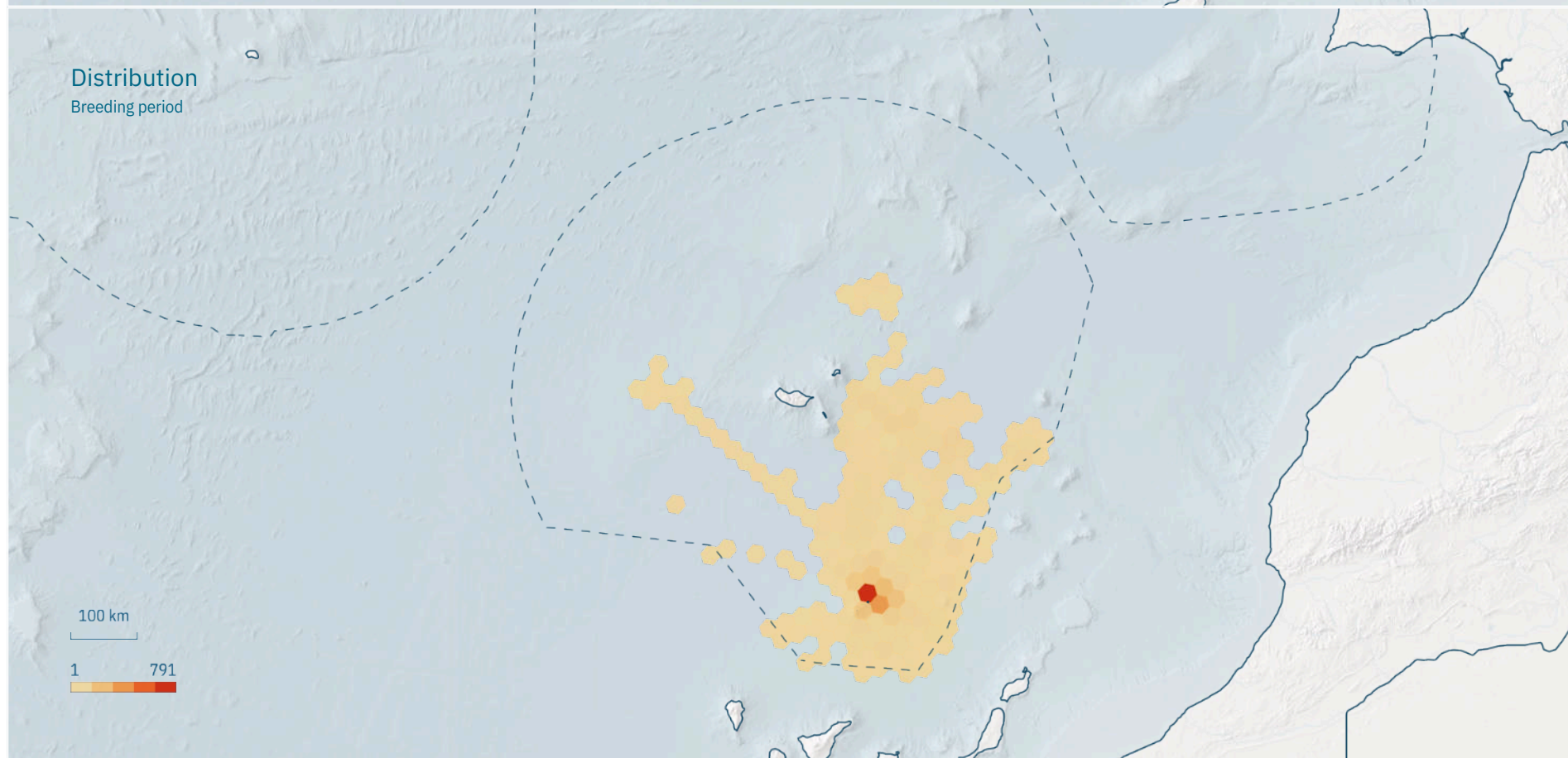
Ecology and habitat

The White-faced Storm-petrel is a pelagic bird, approaching land only to reach its breeding colonies. It has a highly diverse diet, consisting mainly of planktonic crustaceans, cephalopods and small epipelagic and mesopelagic fish (Alho *et al.* 2022; Billerman *et al.* 2026). Nests are dug in flat, sandy areas, usually in very dense colonies.

Threats and conservation

Globally, introduced mammals remain the main threat, due to predation on eggs, chicks and adults (Alho *et al.* 2021). Nest trampling by people or livestock can also cause significant impacts (Billerman *et al.* 2026). In Portuguese colonies, predation by house mice *Mus musculus* was, in the past, a major cause of breeding failure at Selvagem Grande (Campos & Granadeiro 1999), but this pressure was eliminated in 2002. However, some potential threats remain, such as the local increase in Yellow-legged Gulls *Larus michahellis* in nesting areas, leading to increased predation (Matias & Catry 2010), and attraction to artificial lights from vessels, leading to collisions and mortality; it is therefore important to ensure that lighting near breeding areas is minimised. Furthermore, the White-faced Storm-petrel frequently ingests floating plastic, so this marine pollution may come to affect its populations (Furtado *et al.* 2016).

Authors: Paulo Catry, Maria Alho
Owners/sources of tracking data: Catry *et al.* 2019a, Gonzalez-Solis 2021a



European Storm-petrel

Hydrobates pelagicus

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	IUCN Global
Madeira	Passage migrant	NE	NE	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The European Storm-petrel breeds between May and October in north-west Europe (the Faroe Islands, the United Kingdom, Ireland and Iceland), with small colonies found across various countries in southern and northern Europe, including Spain, France, Norway, Italy, Greece and Malta (Billerman *et al.* 2026).

It is a migratory species, wintering mainly in the South Atlantic, on the west and south coasts of Africa. However, part of the population is thought to remain in the waters off Mainland Portugal throughout the winter. Although it is more common in Portugal in autumn, during post-breeding migration, and in spring, during pre-breeding migration, it can be observed during the rest of the year (Meirinho *et al.* 2014). The north-central coast of the region is indeed one of the most important areas for the species in the Iberian Peninsula (De la Cruz *et al.* 2023). Individual tracking data from 8 birds fitted with GLS tags from colonies in Malta and Spain corroborate this distribution and phenology, with an increased use of the rest of the Mainland coast and deeper ocean waters, especially to the west and south. The Madeira sub-area appears to be used to a lesser extent and only during the wintering period, mainly in the eastern half. These data further reinforce the scarce occurrence in the Azores.

Abundance and population trends

The global population has been estimated at between 430,000 and 519,999 mature individuals, with an unknown trend (BirdLife International 2025). The breeding of the species in Portugal has also never been confirmed, despite suspicions and the presence of suitable habitat (Poot 2008). Based on the data used for the environmental status assessment, it was estimated that there are around 4,500 to 11,500 individuals on the continental shelf of Mainland Portugal, in line with the high number of historical records for the region (Catry *et al.* 2010a). Alongside the wide variation in abundance figures for the continental shelf, this population has not achieved Good Environmental Status for the respective indicator. In the case of Madeira and the Azores, there is no information regarding population trends, thus preventing the assessment of their environmental status.

Ecology and habitat

The European Storm-petrel is an essentially pelagic bird. It can occasionally be seen very close to the coast or even inside harbours. Its diet consists of small fish, squid and crustaceans (Catry *et al.* 2010a; Billerman *et al.* 2026), and it occasionally follows fishing vessels to feed on discards.

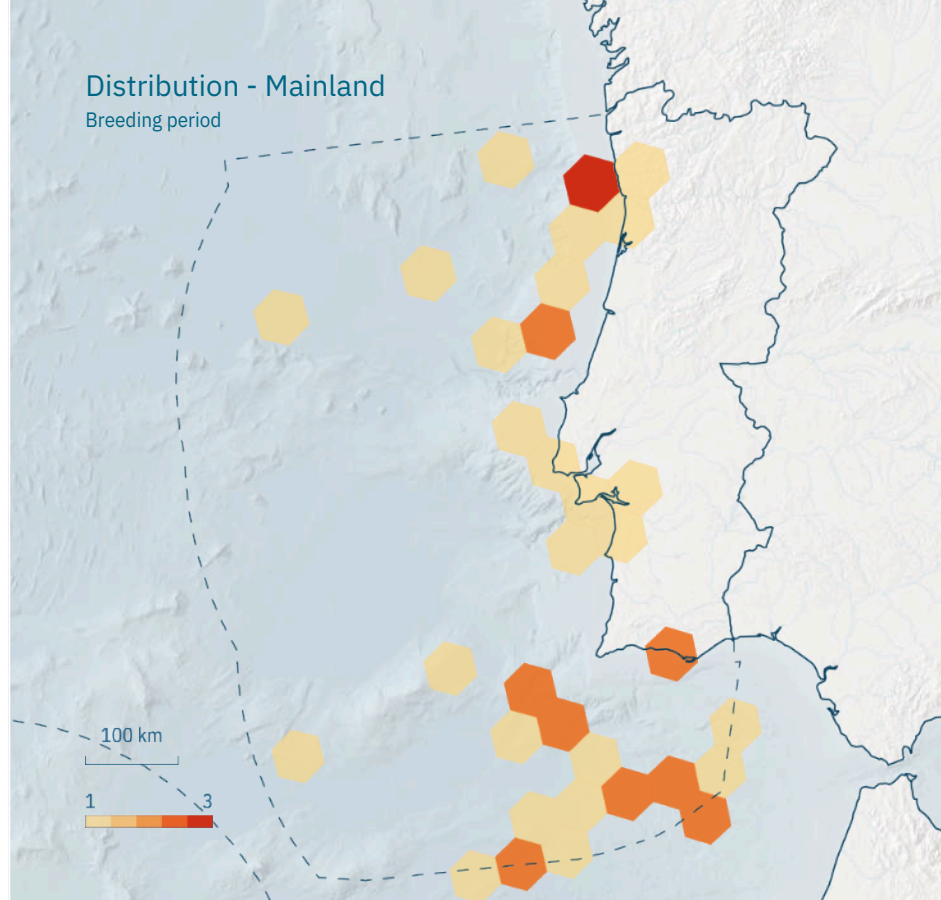
Threats and conservation

In breeding areas, the greatest threats relate to predation of adults and chicks by rats and cats, and the destruction of nesting sites. Predator eradication and control measures are an effective conservation strategy, as is the provision of artificial nests, which increase breeding success (BirdLife International 2025). In the marine environment, the creation of protected areas or the expansion of existing ones would be a measure that could ensure the effective protection of the species (De la Cruz *et al.* 2023).

Author: Tânia Nascimento
Owners/sources of tracking data: Ramos 2020a, Lago *et al.* 2017

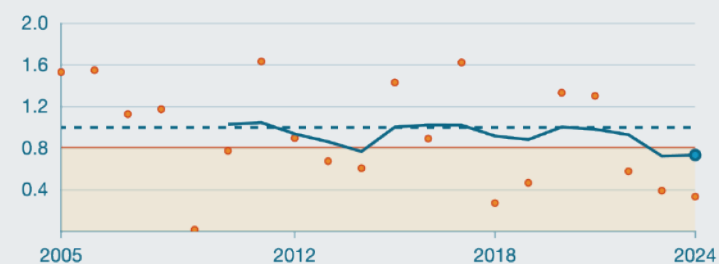


Distribution - Mainland Breeding period

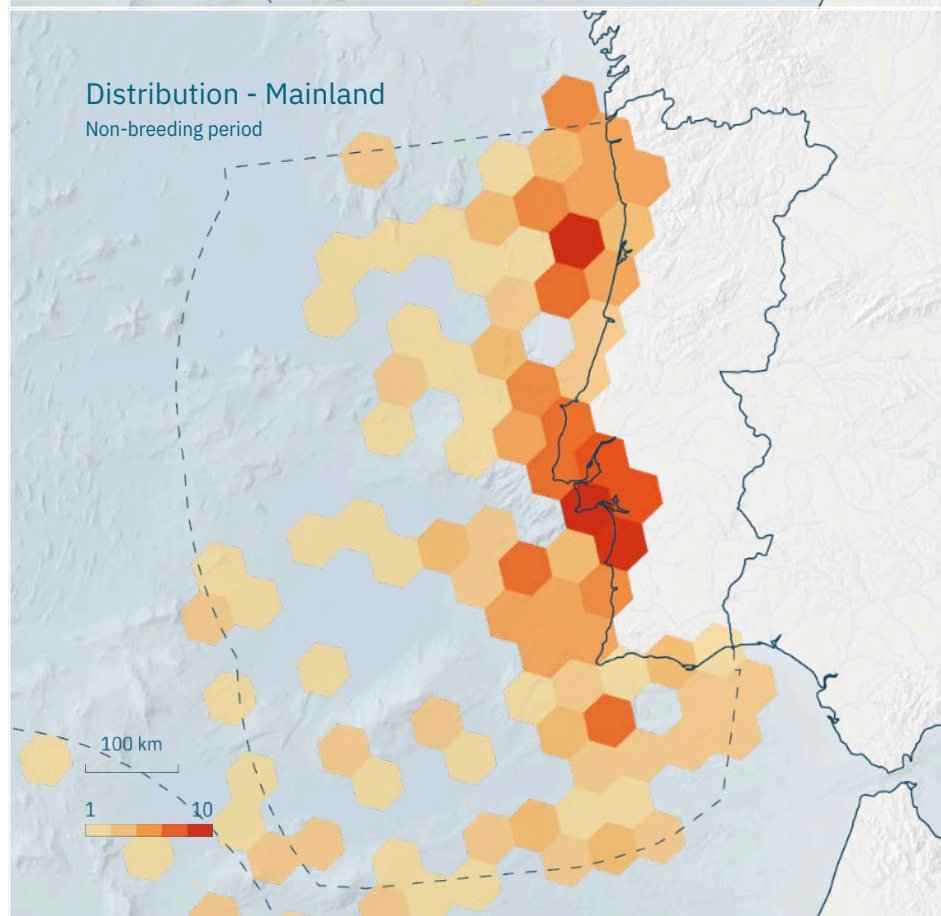


Abundance Indicator Assessment

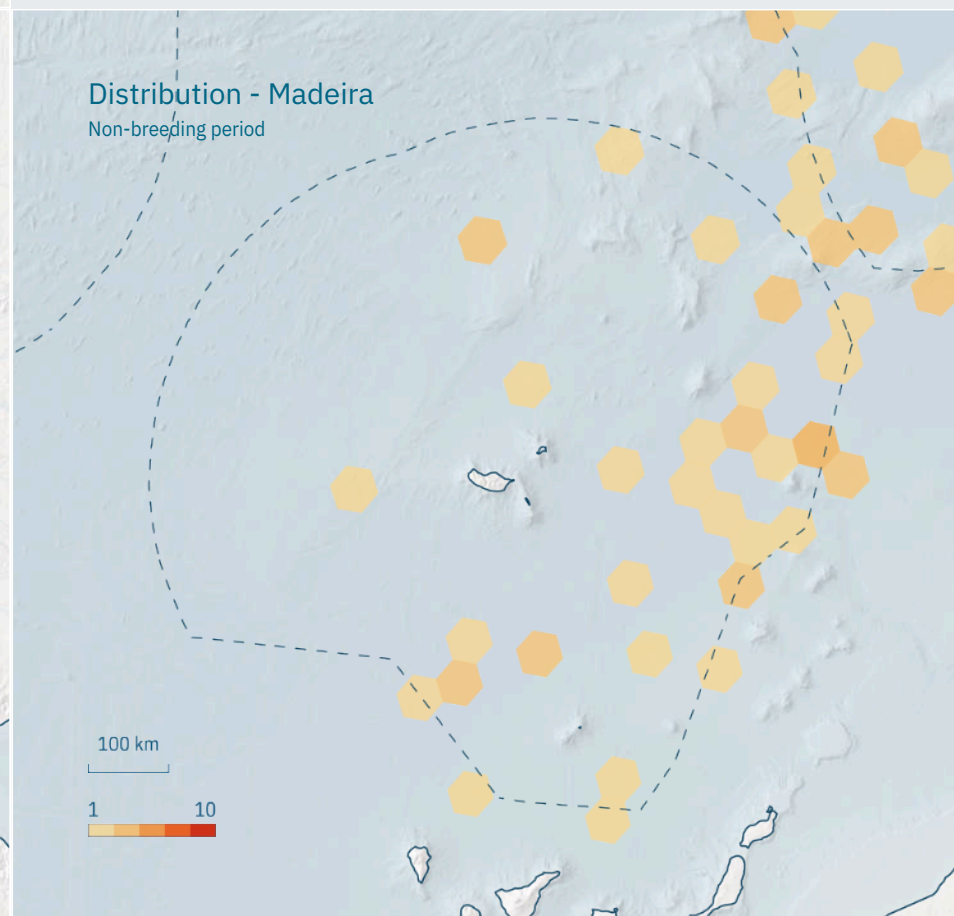
● Relative abundance — 6-years mean & Assessment value - - - Reference value — Threshold



Distribution - Mainland Non-breeding period



Distribution - Madeira Non-breeding period



Band-rumped Storm-petrel

Hydrobates castro

Phenology		Conservation status			
Mainland	Winter breeder	Mainland	Madeira	Azores	UICN Global
Madeira	Summer and winter breeder	VU	LC	VU	LC
Azores	Winter breeder				



Distribution, movements and phenology

The Band-rumped Storm-petrel breeds in the Atlantic, specifically on the Berlengas, the Azores, Madeira (Portugal), Ascension and St Helena. In the Pacific, it breeds off the coast of Japan, in Hawaii and in the Galápagos (Billerman *et al.* 2026). In Madeira, there are two populations with distinct breeding seasons: a summer population, which breeds between March and October, and a winter population, which breeds between September and February (Granadeiro *et al.* 1998; Nunes 2000). In the remaining Portuguese colonies, the species breeds only in winter. Colonies have been identified on Farilhão Grande and Berlenga Island on the Mainland, on the island of Madeira, the Desertas and Selvagens islands in Madeira, and on Santa Maria, Graciosa, São Jorge, Terceira, São Miguel, Flores and Corvo in the Azores (Equipa Atlas 2022; Pipa *et al.* 2023). Based on the individual tracking of 22 birds fitted with GPS, from the colonies on the islet of Praia (Terceira) and Farilhão Grande, extensive use of the Portuguese EEZ was observed during the breeding season, particularly in the subregions of origin of the populations, the Azores and the Mainland. These birds showed a preference for marine areas situated north of their respective colonies, although some of them also appear to use waters further south as far as the coast of Morocco (Carreiro *et al.* 2020). After breeding, both summer and winter breeding birds migrate to the east coast of Central America and the Gulf of Mexico (Raúl Ramos & Beñat Garcia-Urdangarin *pers. comm.*).

Abundance and population trends

The global population has been estimated at around 150,000 mature individuals, with a declining trend. The European population, meanwhile, has been estimated at between 6,600 and 6,900 pairs (BirdLife International 2025). In Mainland Portugal, the population numbers around 420 to 784 pairs (Equipa Atlas 2022), showing interannual fluctuations (Oliveira *et al.* 2025a). In the Azores, the breeding population was estimated at between 664 and 1,173 pairs at the end of the 2010s, using passive acoustic monitoring, with evidence of a recent decline (Pipa & Silva 2021; Pipa *et al.* 2023; Pipa *et al.* 2024). For Madeira, there are no precise estimates of the size of the breeding populations, with a minimum of 5,000 pairs assumed (Equipa Atlas 2022). Despite fluctuations or declines, the populations on the Mainland and in the Azores have achieved Good Environmental Status for the abundance and productivity indicators.

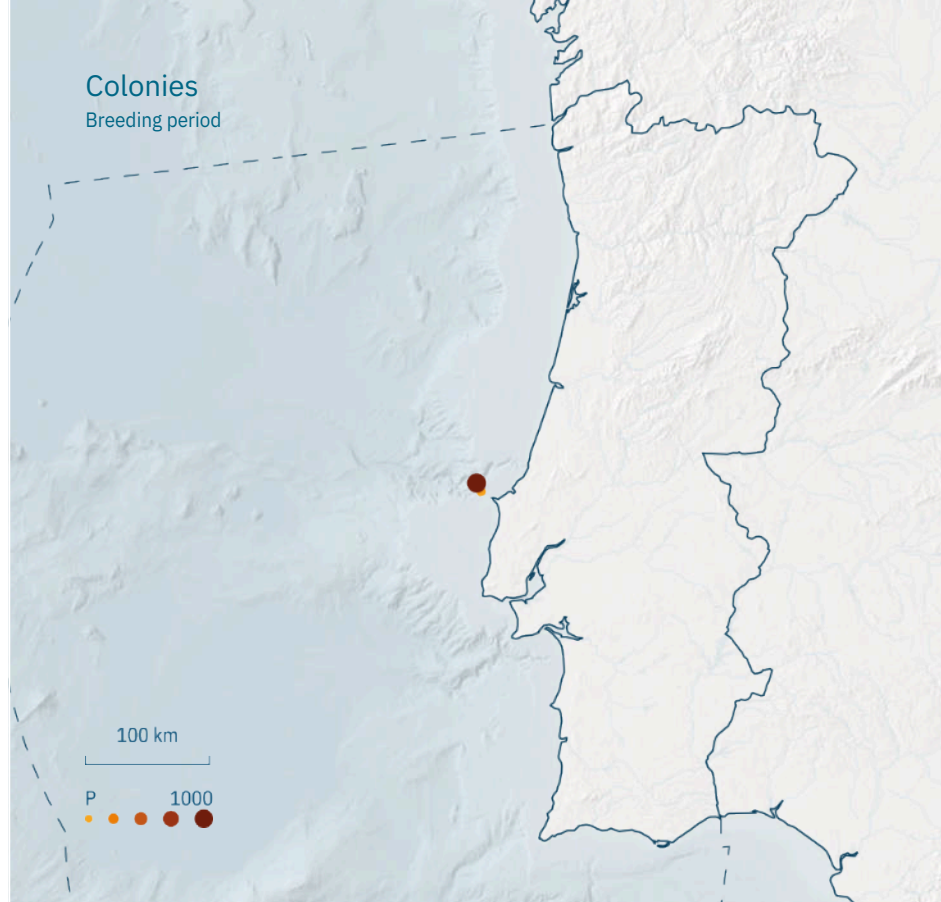
Ecology and habitat

The Band-rumped Storm-petrel is a pelagic species, spending most of its annual life cycle in the open sea. Its diet consists of small pelagic fish of the Gadidae family, as well as cephalopods and deep-sea fish of the Myctophidae family; it may also feed on food scraps and fishing discards (Monteiro *et al.* 1996b; Carreiro *et al.* 2020; Billerman *et al.* 2026). It nests in small cavities or crevices in rocks, on islands and islets.

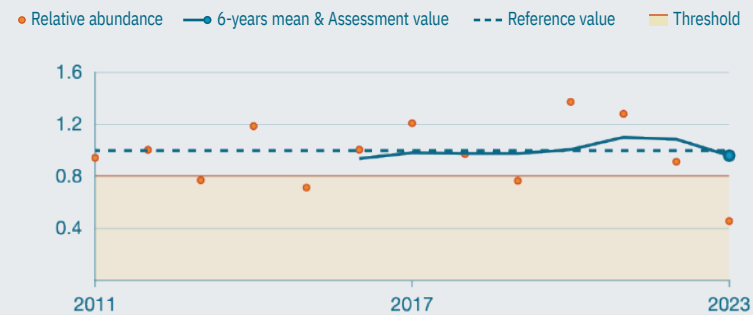
Threats and conservation

The presence of introduced mammals in the colonies, such as rats and cats, poses a serious threat through the predation of eggs, chicks and even adults, and may also lead to the abandonment of nesting sites (Monteiro *et al.* 1999; Raine *et al.* 2017). Predation by other animals, including wall lizards, Yellow-legged Gulls *Larus michahellis* and nocturnal birds of prey, may also contribute to local declines (Matias & Catry 2010; Bried & Neves 2015; Oliveira *et al.* 2023a). Light pollution can cause disorientation and collisions with structures, but the species appears to have low susceptibility to this threat (Rodriguez & Rodriguez 2009; Raine *et al.* 2017).

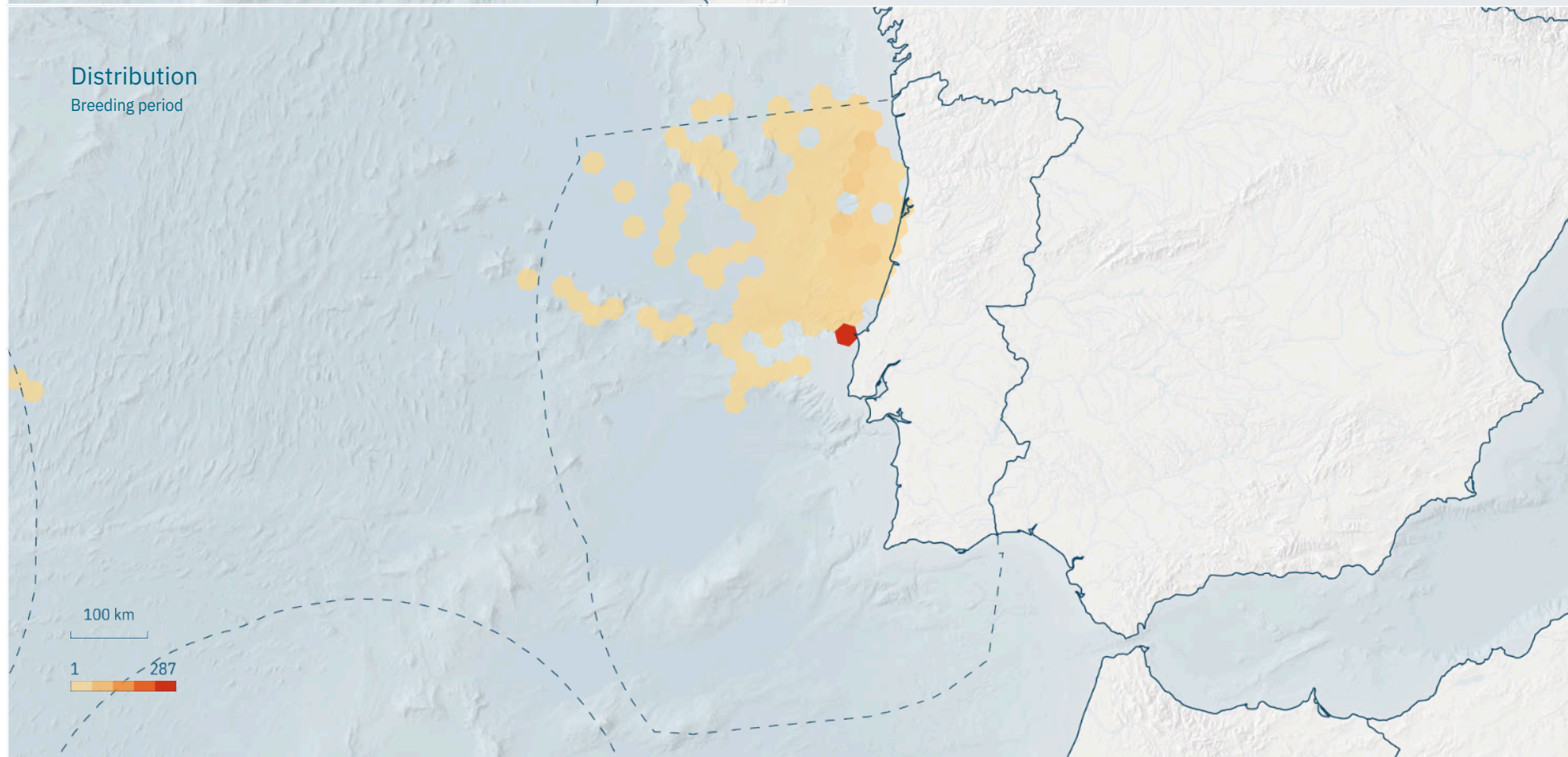
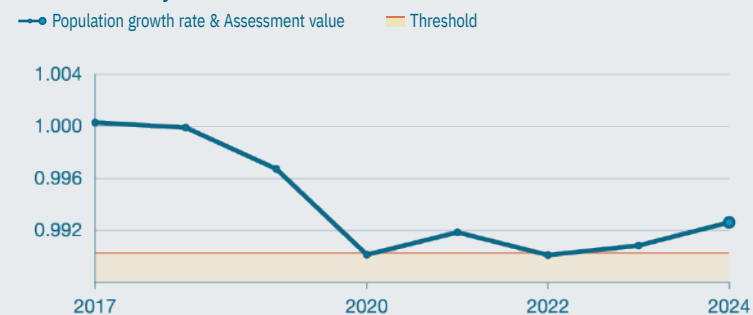
Authors: Tânia Pipa, Ben Porter, Hannah F. R. Hereward, Verónica Neves
Owners/sources of tracking data: SPEA BirdLife, Porter *et al.* 2019, Porter *et al.* 2020



Abundance Indicator Assessment



Productivity Indicator Assessment



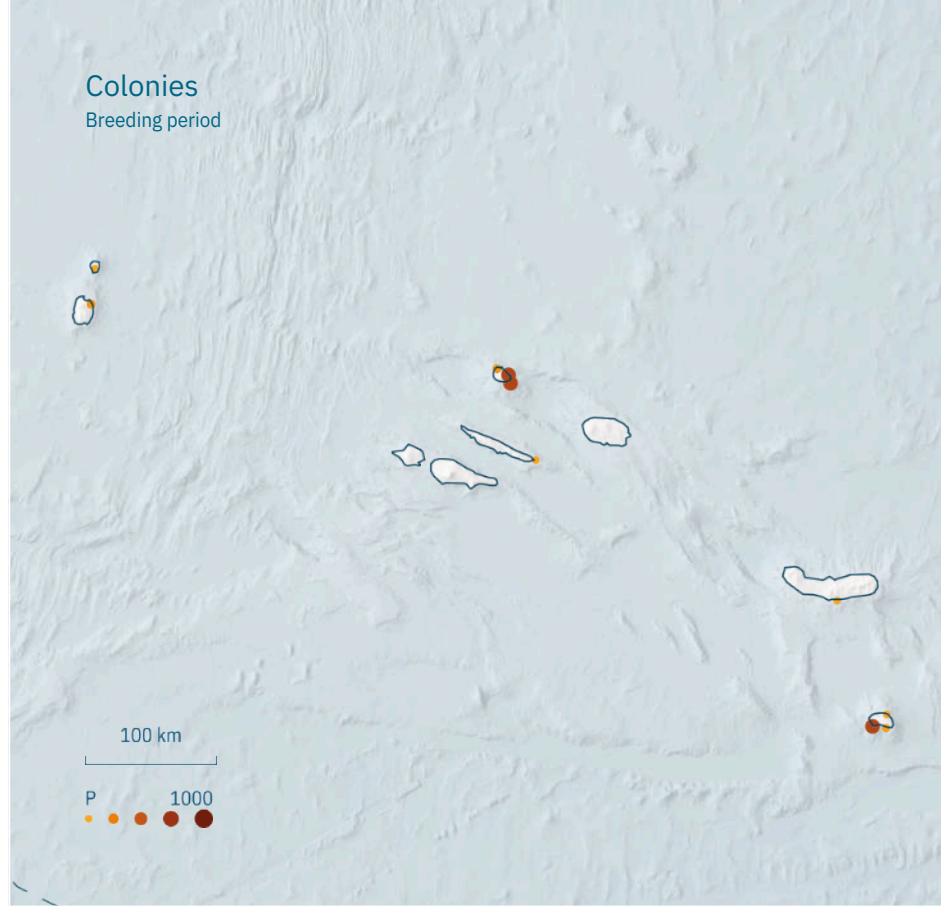
Colonies
Breeding period



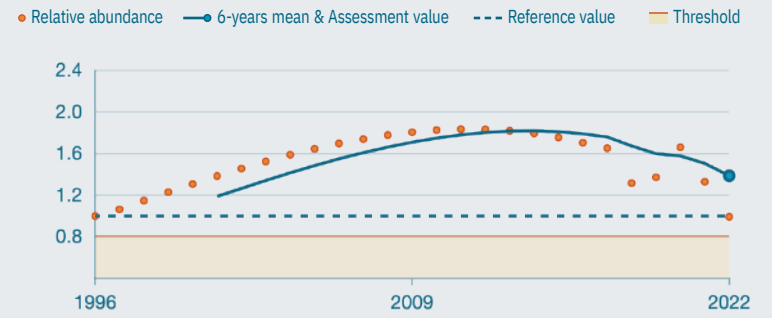
Madeira



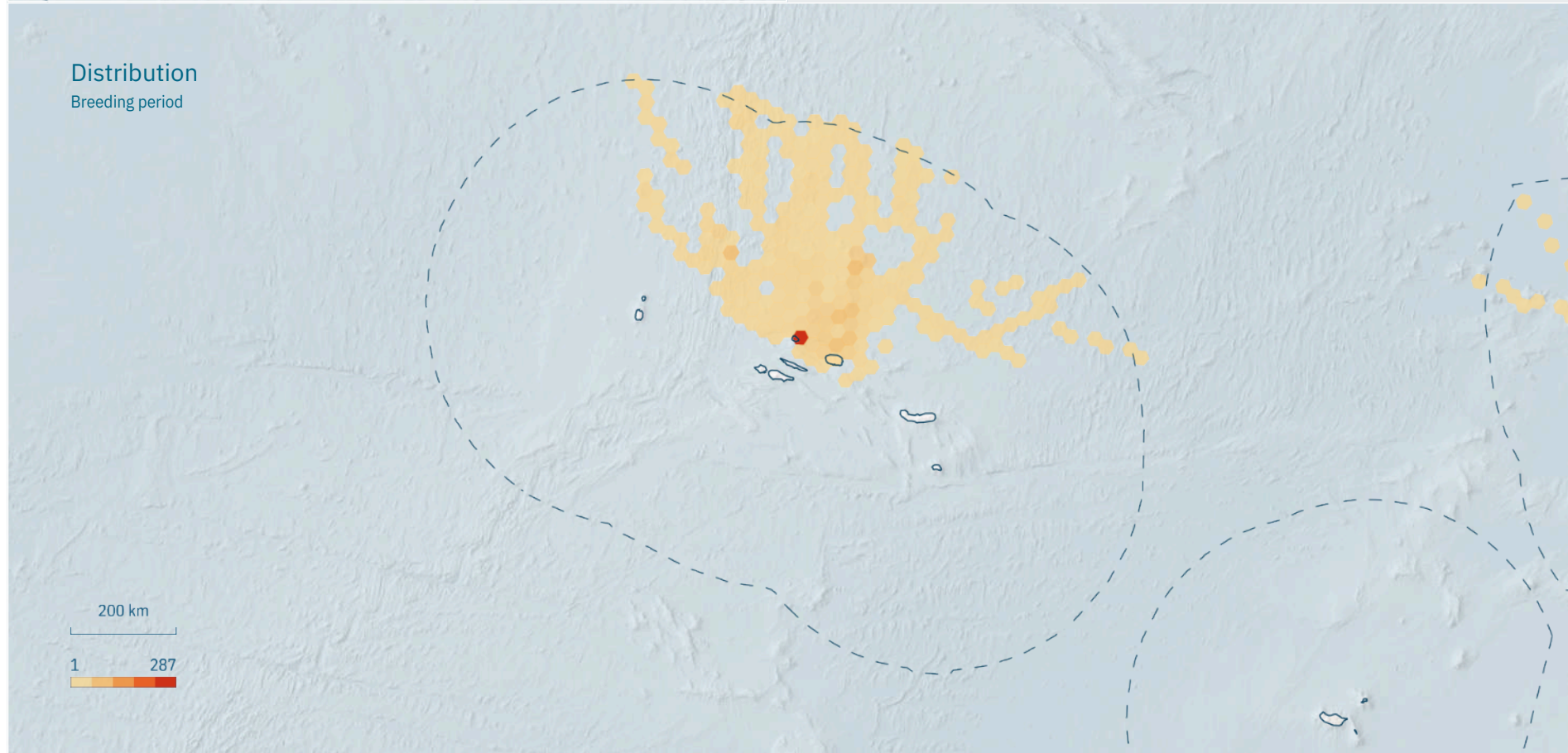
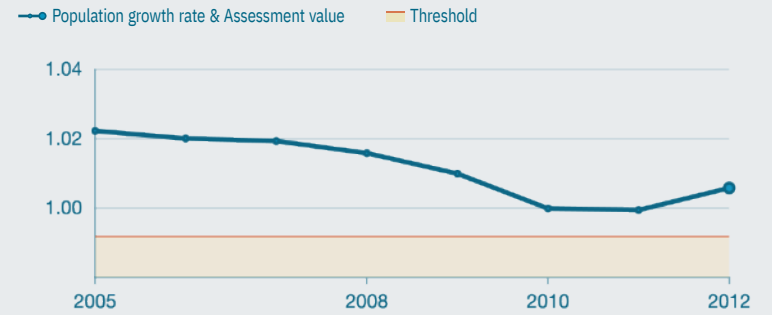
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Abundance Indicator Assessment



Productivity Indicator Assessment



Monteiro's Storm-petrel

Hydrobates monteiroi

Phenology		Conservation status			
Mainland	Absent	Mainland	Madeira	Azores	UICN Global
Madeira	Absent	NA	NA	EN	VU
Azores	Summer breeder				



Distribution, movements and phenology

The Monteiro's Storm-petrel is an endemic species to the Azores archipelago, breeding from March to October on the islets of Praia, Baixo (Graciosa), Sentado (Flores) and Topo (São Jorge), with breeding also suspected on the islet of Ponta do Marco, on Corvo (Monteiro *et al.* 1999; Oliveira 2018; Pipa & Silva 2021; Pipa *et al.* 2023; Pipa *et al.* 2024). After the breeding season, most of the population is expected to migrate to the east coast of South America (Raúl Ramos & Beñat Garcia-Urdangarin *pers. comm.*), although it was previously assumed that the species would remain in the vicinity of the Azores, given the results of the analysis of its diet using stable isotopes (Bolton *et al.* 2008).

Based on individual tracking of 63 birds from the islet of Praia, fitted with GPS between 2018 and 2021 during the breeding season, it is confirmed that the Portuguese EEZ is used exclusively within the Azores sub-area, with a distribution preference for areas to the north and north-west of the colony. There is a geographical segregation between the distribution of males and females, with the former using deeper areas but relatively closer to the colony, whilst females appear to use shallower waters, but further away (Paiva *et al.* 2018).

Abundance and population trends

The total population, restricted to the Azores, was estimated at between 301 and 503 pairs between 2017 and 2019 (Pipa & Silva 2021; Pipa *et al.* 2023), although not all possible colonies of the species were surveyed. Based on passive acoustic monitoring studies, it was estimated that, for the period 2015 to 2023, there were approximately 135 pairs on the islet of Baixo, 112 pairs on the islet of Praia and 9 pairs on the islet of Topo (Pipa *et al.* 2024). The scarcity of data for other colonies limits the assessment of the species' overall population trend, although it is currently considered stable (BirdLife International 2025). The environmental assessment carried out in this study for the abundance indicator shows, however, a decline from 2020 onwards, despite having achieved Good Environmental Status. With regard to the productivity indicator, the population has not achieved Good Environmental Status, confirming its unfavourable conservation status.

Ecology and habitat

The Monteiro's Storm-petrel nests in flat, low-lying areas with little disturbance, but also on cliffs, in small cavities and crevices (Oliveira 2018). It is a pelagic bird that feeds on planktonic crustaceans, small pelagic and deep-sea fish, and cephalopods (Monteiro *et al.* 1998; Carreiro *et al.* 2022).

Threats and conservation

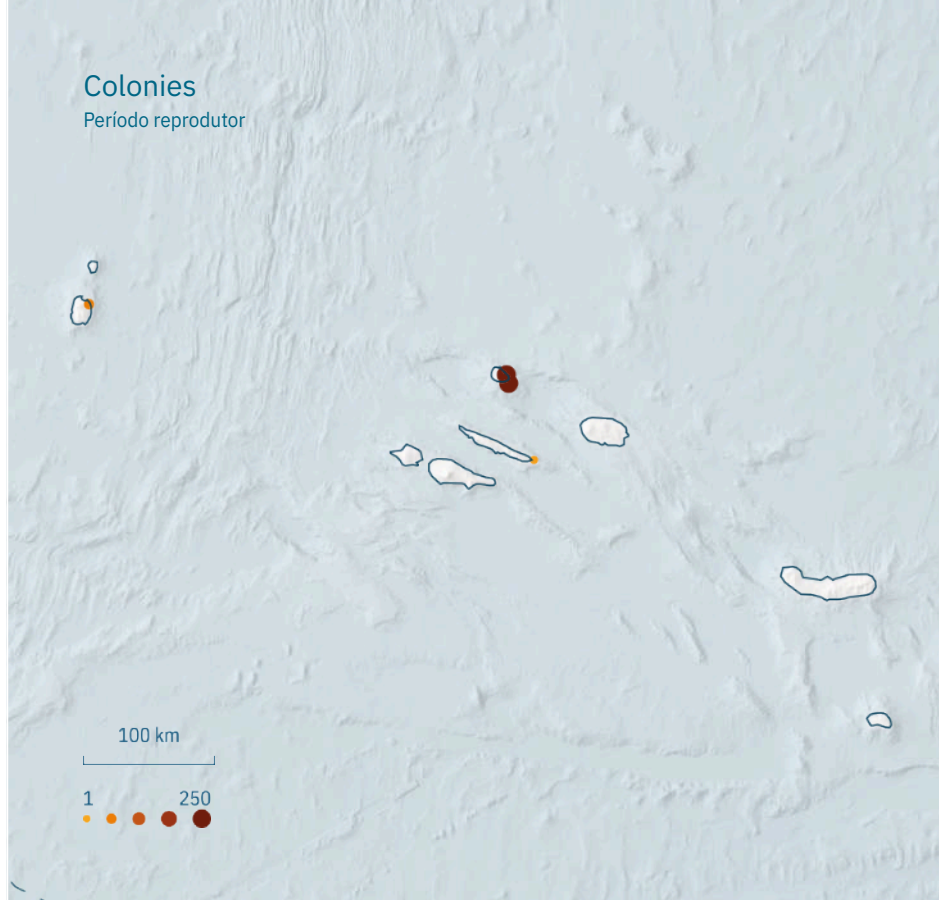
Introduced or native predators pose the main threat to the Monteiro's Storm-petrel, notably the Madeiran Wall Lizard *Teira dugesii*, Yellow-legged Gull *Larus michahellis*, Long-eared Owl *Asio otus*, mustelids, cats and rats (Oliveira 2018; Neves *et al.* 2017; Bolton *et al.* 2008). Competition with larger seabirds for nesting cavities (Ramos *et al.* 1997; Bolton *et al.* 2008), habitat loss, pollution (including oil spills and plastics) and climate change are other significant threats, alongside bycatch in fisheries, human disturbance, light pollution, wind farms and natural disasters (Oliveira 2018). The installation of artificial nests has contributed to an increase in the availability of nesting sites, as well as to increased breeding success (Bolton *et al.* 2004; Bolton *et al.* 2008; Bried *et al.* 2009a).

Authors: Tânia Pipa, Ben Porter, Hannah F. R. Hereward, Petra Quillfeldt, Verónica Neves, Wiebke Schäfer

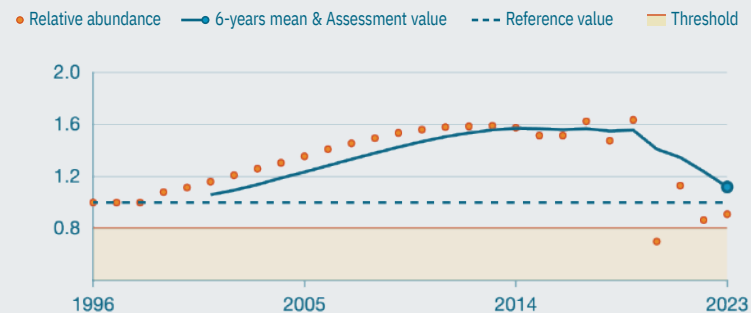
Owners/sources of tracking data: Neves *et al.* 2021, Hereward *et al.* 2020

Colonies

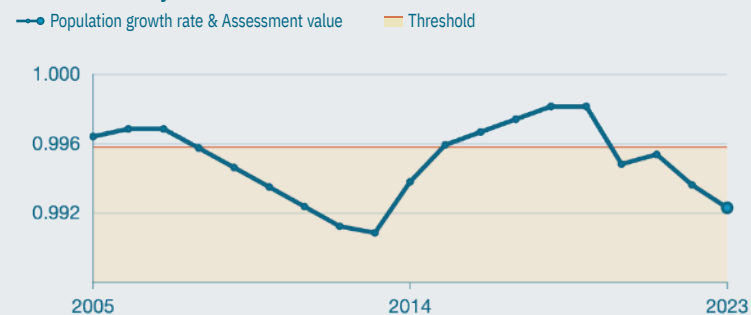
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Abundance Indicator Assessment

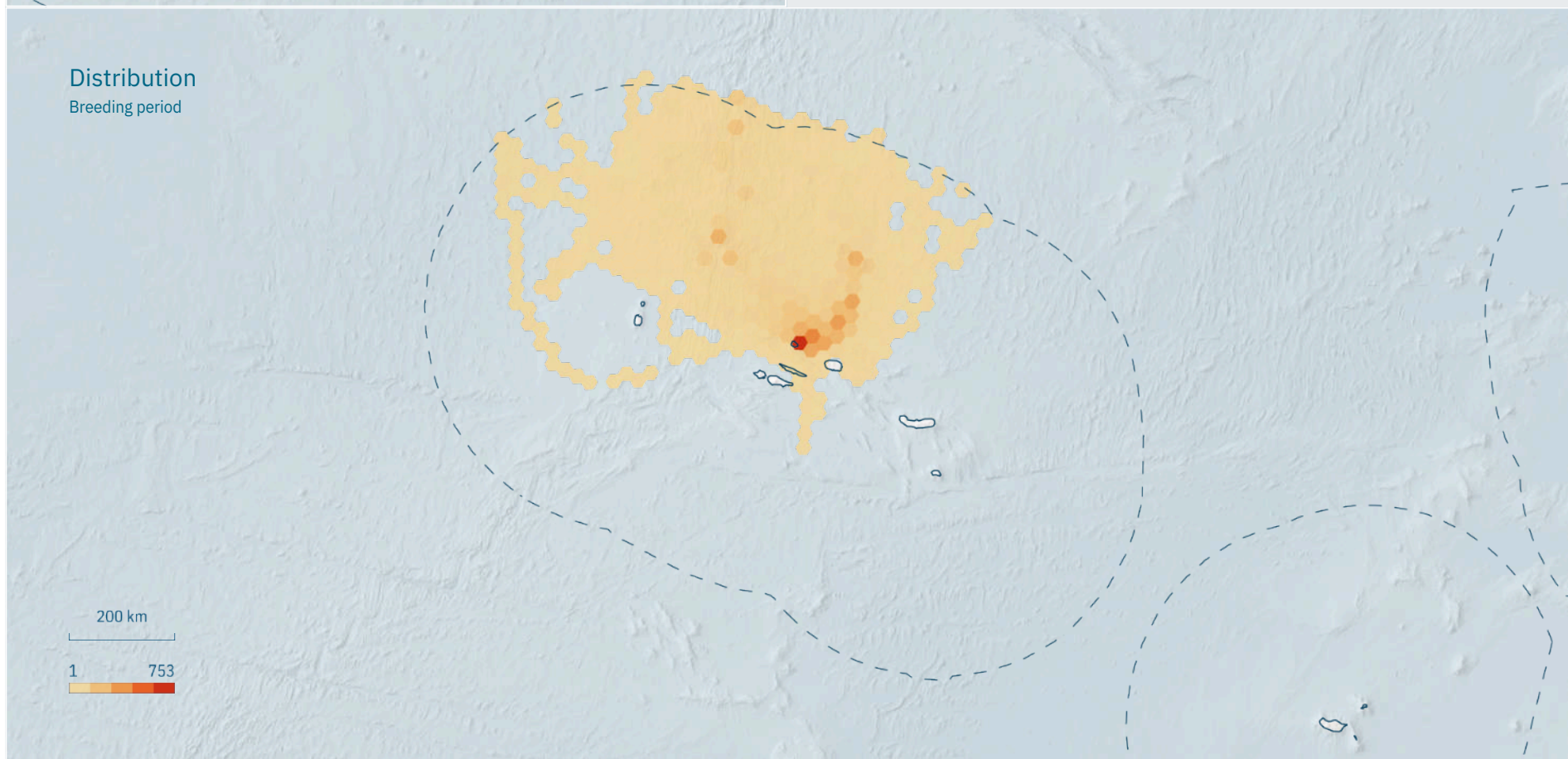


Productivity Indicator Assessment



Distribution

Breeding period



Leach's Storm-petrel

Hydrobates leucorhous

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NE	VU
Azores	Passage migrant				



Distribution, movements and phenology

The Leach's Storm-petrel breeds on oceanic islands in the North Atlantic, the North Pacific and off the coast of South Africa (Billerman *et al.* 2026). The breeding season for the North Atlantic population runs from May to September, after which the birds migrate towards the tropical Atlantic, occasionally reaching South Africa and the western Indian Ocean. During this period, the small portion of the population passing through Portuguese waters appears to prefer deep-sea areas (Meirinho *et al.* 2014), and is observed near the Mainland coast following major storms (Catry *et al.* 2010a). In winter, the distribution becomes more restricted again, although some birds remain in the Azores (Hurling *et al.* 2024). Subsequently, during the spring migration, it occurs more abundantly in deeper waters. Based on the individual tracking of a small sample of 8 birds fitted with GLS devices, originating from two colonies in Canada in 2012, the use of the Portuguese EEZ during migratory periods is confirmed, particularly in the Azores sub-area, and less frequently in the Madeira sub-area.

Abundance and population trends

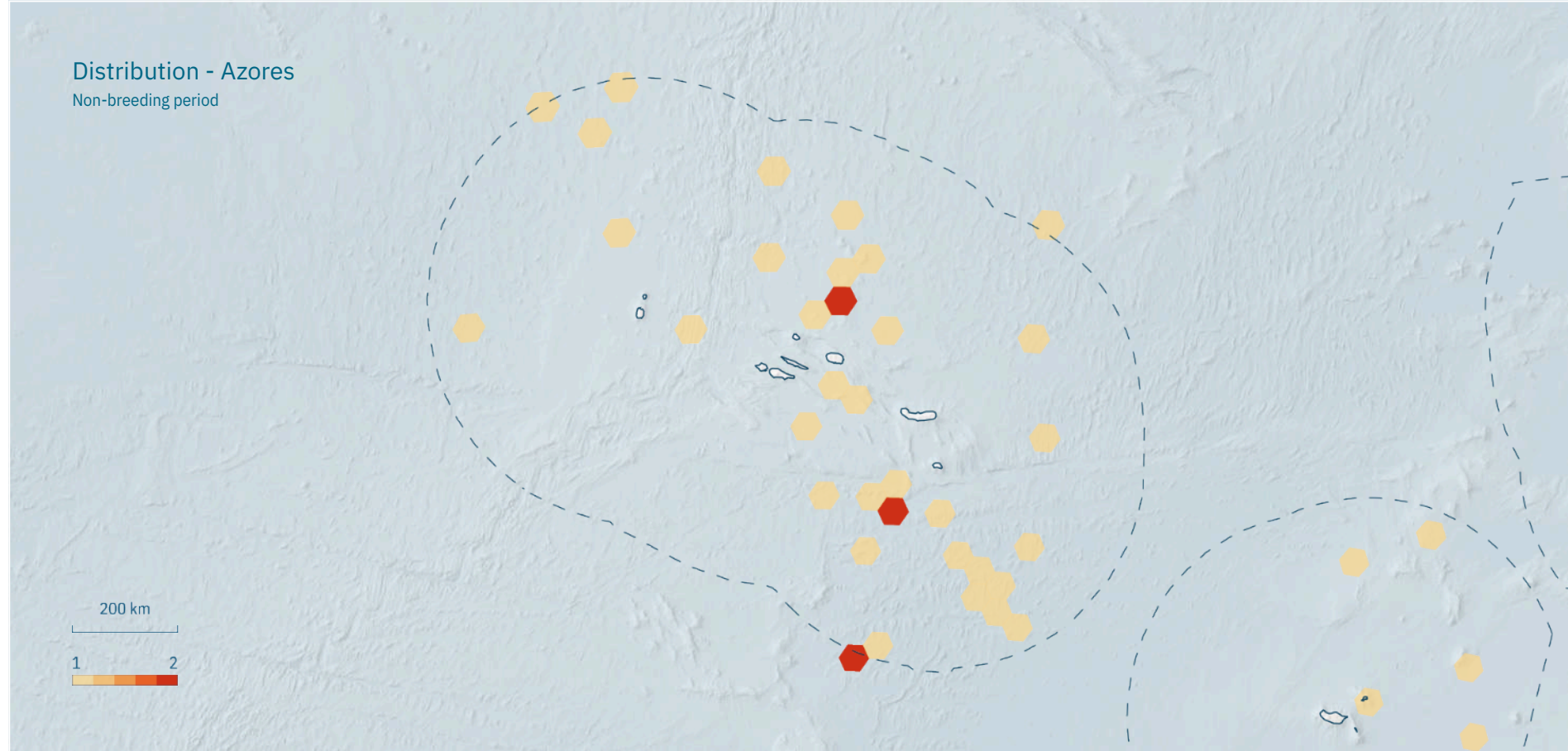
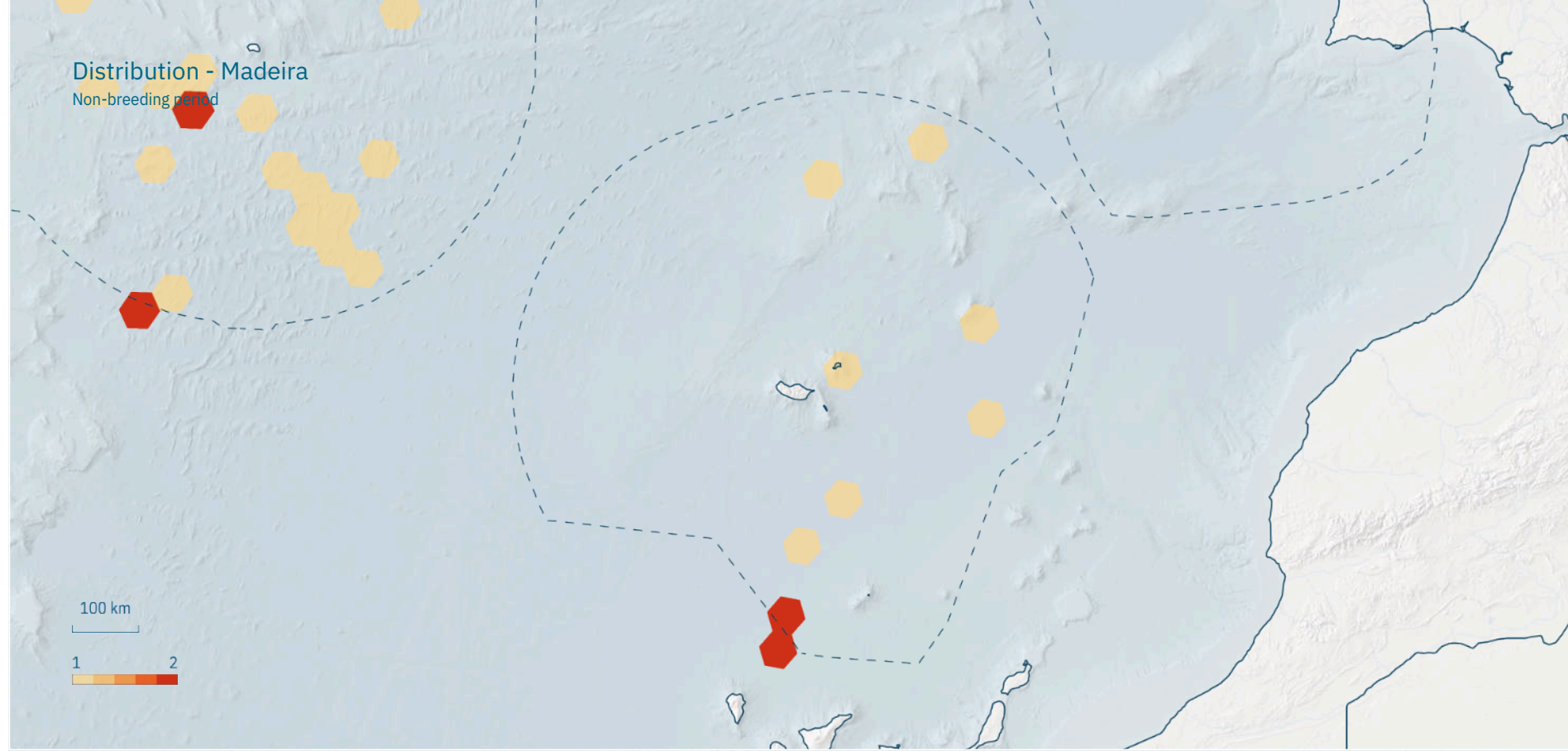
The global population of the Leach's Storm-petrel has been estimated at around 6.7 to 8.3 million pairs, with a very sharp decline in the main breeding colonies (BirdLife International 2025). Its occurrence is relatively well documented along the coast of Mainland Portugal, appearing following severe storms during autumn and winter. During this period, it is equally common in the Azores and Madeira. However, there is no information regarding its abundance or population trends for any of the three regions, making it impossible to assess the environmental status of these populations.

Ecology and habitat

The Leach's Storm-petrel is a pelagic bird found in areas where ocean currents converge or where upwelling occurs, as well as over continental shelves. It feeds during the day or at night on small mesopelagic fish, mainly from the families Myctophidae and Sternoptychidae, as well as cephalopods and planktonic crustaceans (Silva *et al.* 2024; Hedd & Montevicchi 2006).

Threats and conservation

Globally, the population of this species has declined sharply in its largest breeding colonies, located in Canada and Europe, leading to its recent reclassification to an unfavourable conservation status. This sharp decline (>30%) is mainly linked to predation by invasive mammals (rats, mice and foxes) and by native species (large gulls and skuas) (Jones 2013; BirdLife International 2025). At sea, the greatest threats stem from attraction to lights and consequent collisions, spatial changes in prey distribution and contaminants (Pollet *et al.* 2023).



Northern Fulmar

Fulmarus glacialis

Phenology		Conservation status			
Mainland	Vagrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	NA	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Northern Fulmar breeds between March and August across vast areas of the North Atlantic and North Pacific, from Japan and the United Kingdom to the High Arctic. The northern populations are migratory, moving southwards as the sea freezes. The more southerly populations, however, tend to be more dispersive, but rarely reach warm-water areas (Billerman *et al.* 2026). Records in Portuguese waters are rare and mostly occasional in any of the three regions (Correia-Fagundes *et al.* 2021; Birding Azores 2022; Robb *et al.* 2025). These observations are usually of solitary birds occurring during winter or following severe storms, during which some dead or weakened birds are found on beaches (Costa *et al.* 2020).

Based on data from 34 birds fitted with GLS between 2007 and 2021 in colonies on the Faroe Islands, Iceland, Norway and the United Kingdom, the species was found to occur in the Portuguese EEZ throughout most of the year, with greater use in March and between August and October, corresponding to the start of the breeding season and post-breeding movements. It is during this latter period that the species exhibits a more extensive distribution, particularly in the Azores sub-area and in the oceanic waters off the Mainland, especially in the northern and north-western regions of the archipelago. In the Madeira sub-area, the distribution appears to be less extensive.

Abundance and population trends

The global population has been estimated at 20 million individuals, of which 7 million are found in Europe (BirdLife International 2025). Whilst the population trend in North America is one of growth, Europe has seen a decline since the 1980s, with an estimated reduction of over 40%.

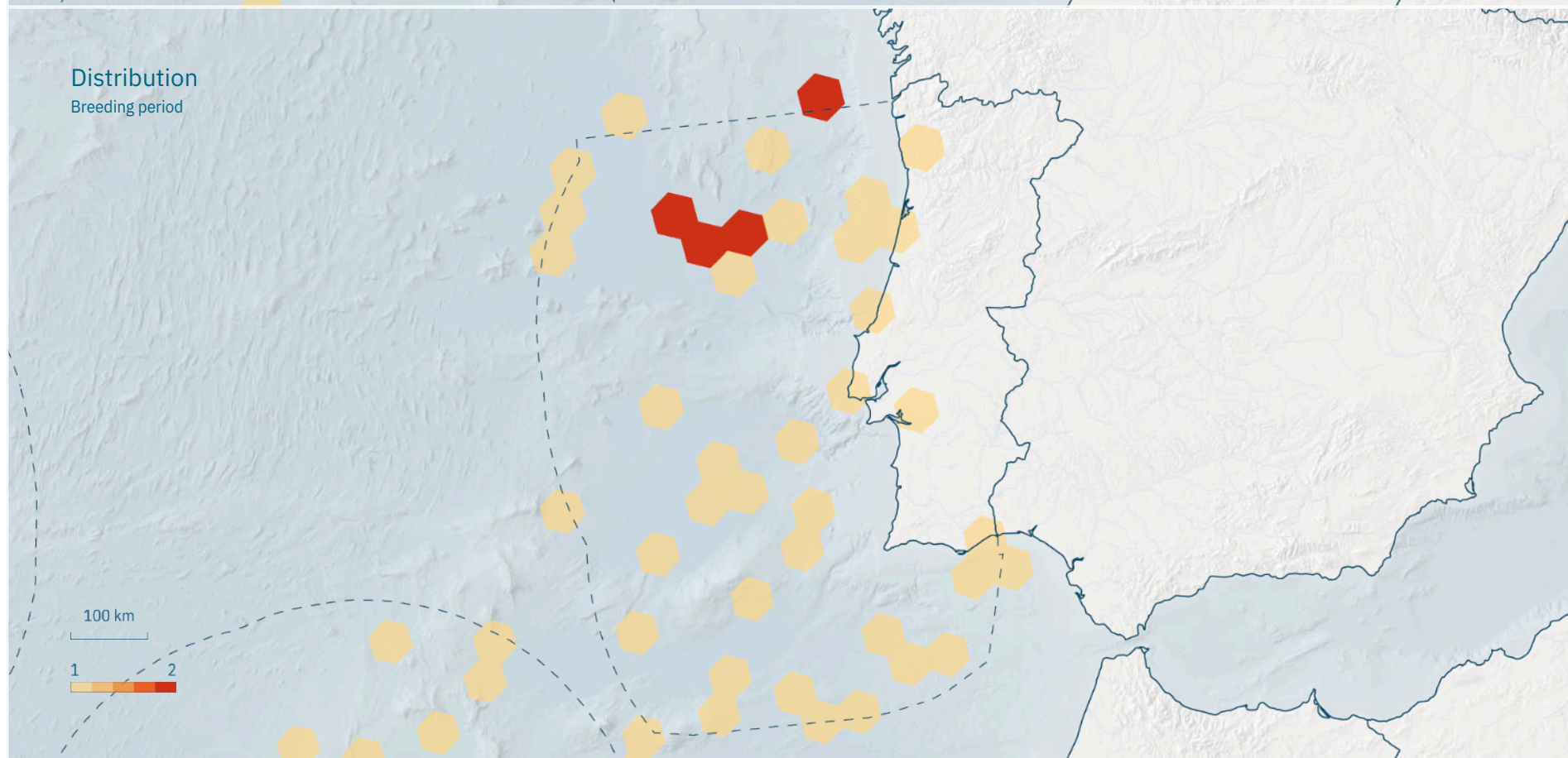
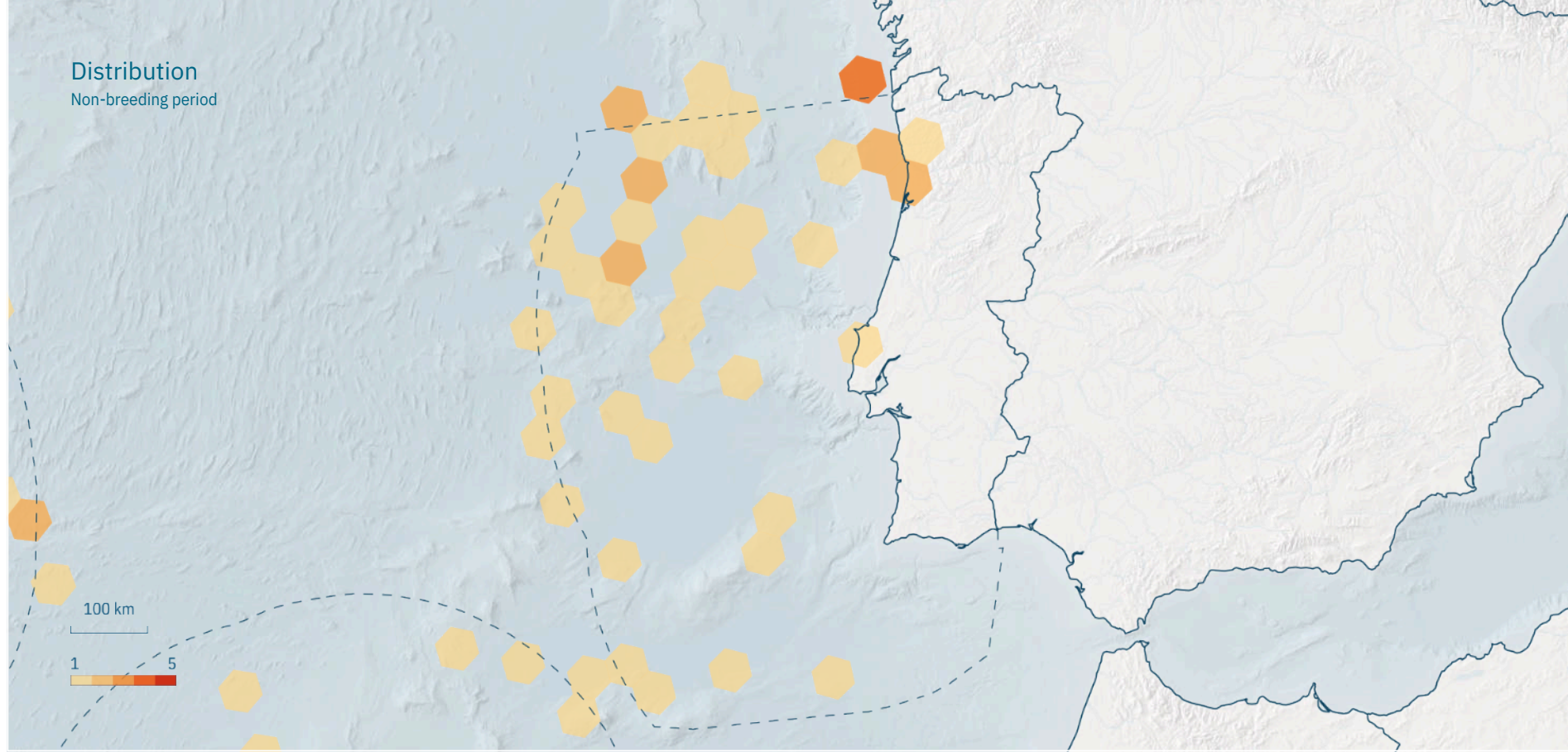
In Portugal, as this is a species that very rarely approaches the coast, the population size using Portuguese waters is difficult to estimate. The lack of information regarding its population trends makes it impossible to assess its environmental status. However, stranding data recorded between the 1990s and the present day point to similar orders of magnitude, with only a few individuals being recorded on the Mainland coast (Granadeiro *et al.* 1997; Oliveira *et al.* 2023c).

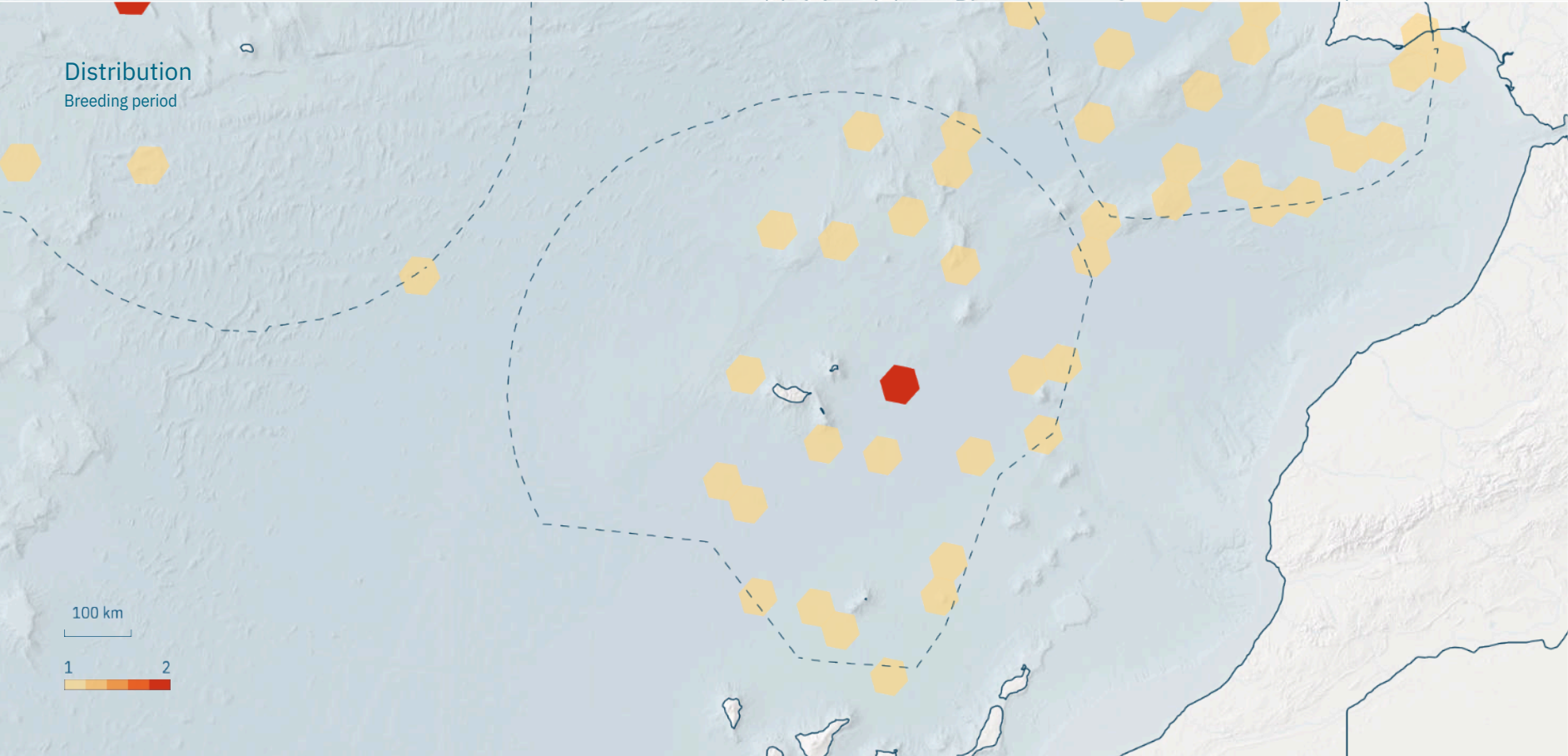
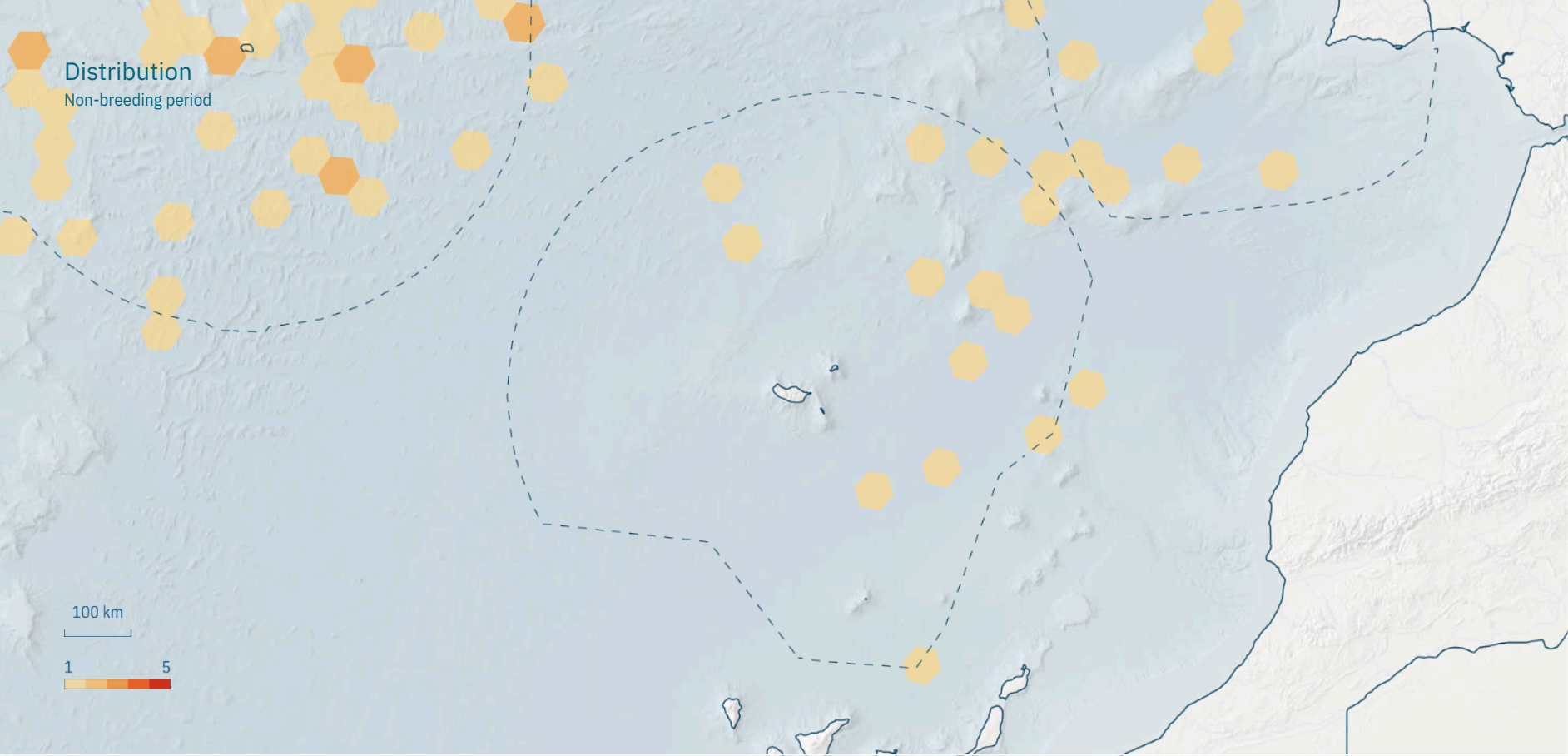
Ecology and habitat

This species typically nests on cliffs and rocky faces, but also occasionally on flatter terrain. Its diet consists of various species of fish, squid and zooplankton (particularly amphipods), and it also feeds on offal and carrion. Most of its food is obtained by surface feeding, but it can also make short dives (Billerman *et al.* 2026). It is also common to see large numbers approaching fishing vessels, particularly trawlers, longliners and gillnet vessels.

Threats and conservation

Outside breeding areas, the main threats to the species are mortality due to bycatch in fishing gear, particularly in demersal longlines, trawls and gillnets (Dunn *et al.* 2001; Anderson *et al.* 2011; Žydelis *et al.* 2013). Plastic ingestion is also a significant threat to the Northern Fulmar, with studies showing that around 95% of birds washed ashore in the North Sea have plastic in their stomachs (van Franeker *et al.* 2011). Most contain quantities exceeding the limit of 0.1 g per individual established by the OSPAR Convention. However, the population impacts of this ingestion remain unknown.







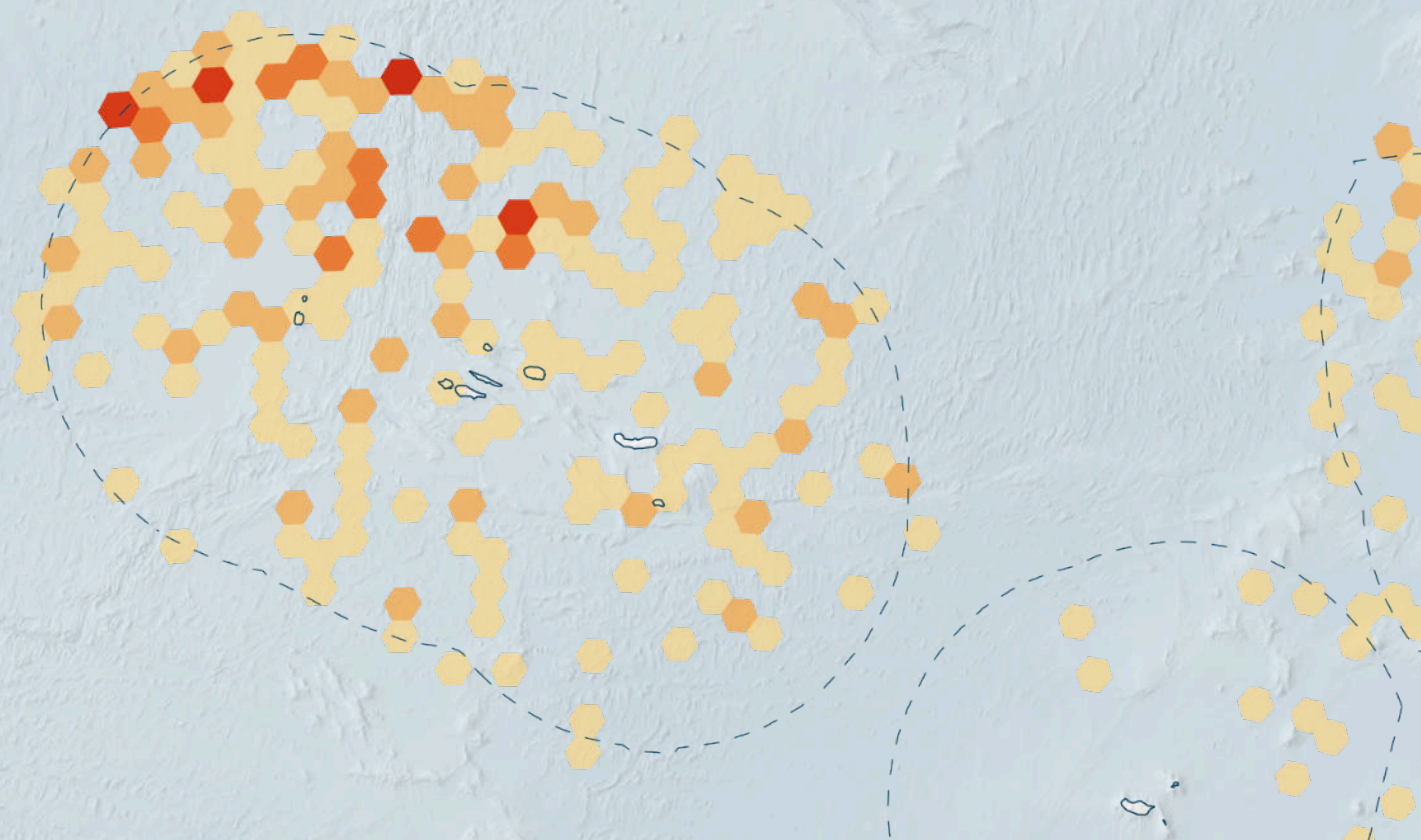
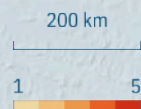
 Madeira

Colony(ies) of origin: Faroe Islands (Denmark), Langesundfjord (Iceland) Jan Mayen (Norway),
 Eyrethall, Inishkea, Little Saltee (UK) | Device: GLS
 Data period / number of individuals: March and October 2011-2021 / 11 ind.



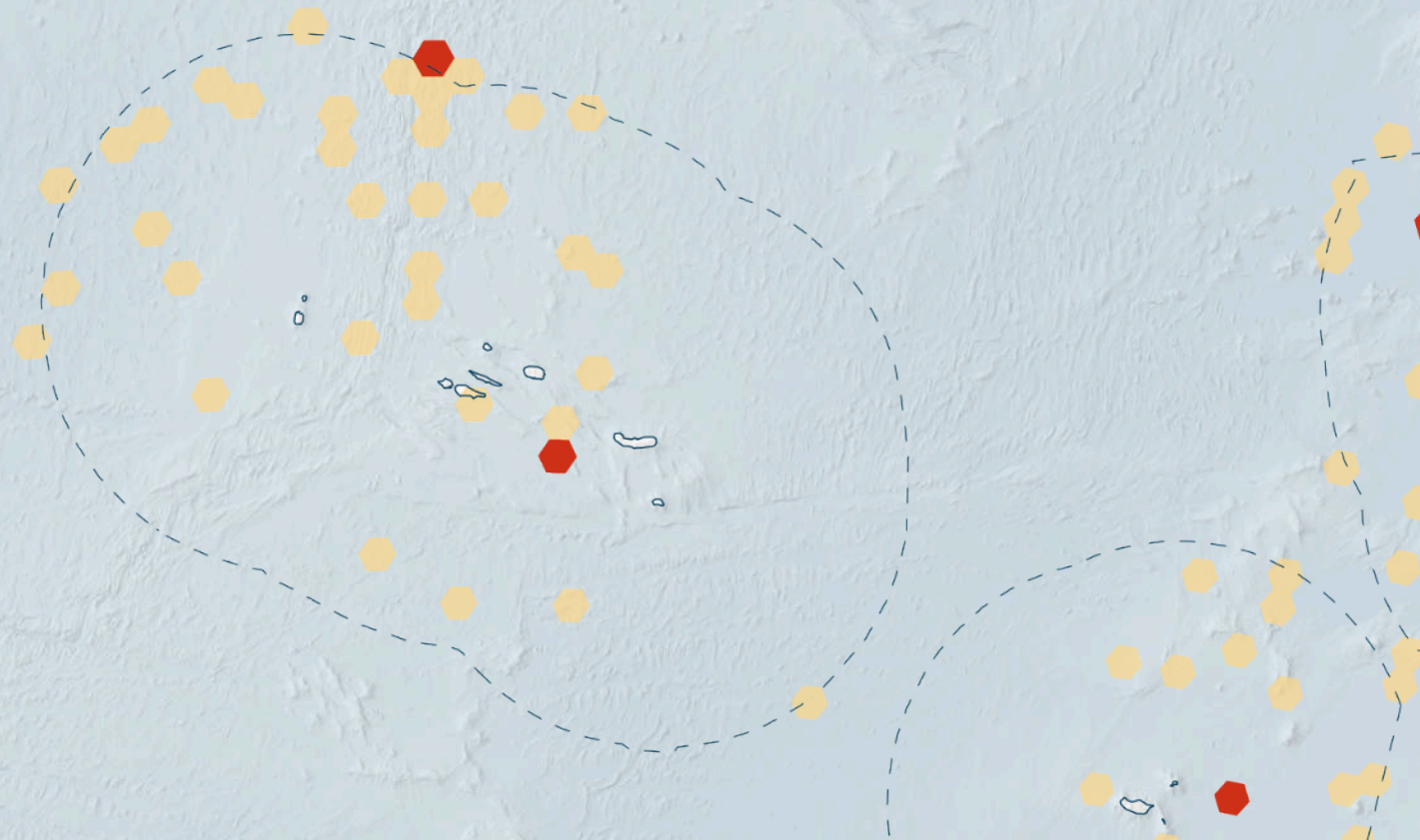
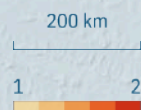
Distribution

Non-breeding period



Distribution

Breeding period



Trindade Petrel

Pterodroma arminjoniana

Phenology		Conservation status			
Mainland	Absent	Mainland	Madeira	Azores	UICN Global
Madeira	Absent	NA	NA	NA	VU
Azores	Vagrant				



Distribution, movements and phenology

The Trindade Petrel breeds exclusively on the islands of Trindade and Martim Vaz, off the coast of Espírito Santo in Brazil, and on Ronde Island in Mauritius (Billerman *et al.* 2026). Breeding birds are found in these areas throughout the year; it is a species with two distinct breeding seasons, one peaking in October and the other in April. However, the birds only breed during one of these periods (BirdLife International 2025). During the breeding season, they feed in the more coastal waters of Brazil (Leal *et al.* 2017). Movements outside the breeding season are very poorly understood. Recent data suggest that the birds migrate to the central and North-west Atlantic to spend their wintering season there (Krüger *et al.* 2016). In fact, of the four birds fitted with GLS on Trindade Island in 2014, one utilised the Azores sub-area of the EEZ, specifically the waters of the western half. This very brief incursion occurred at the end of April, corresponding to the bird's wintering period.

Abundance and population trends

The global population was estimated at 1,228 pairs in 2014 (Krüger 2018). Despite its unfavourable conservation status, the species shows a stable trend (BirdLife International 2025). It is a very rare species in our waters, with only ten records submitted to the Portuguese Rarities Committee, all of them referring to solitary birds observed in the Azores (Robb *et al.* 2025).

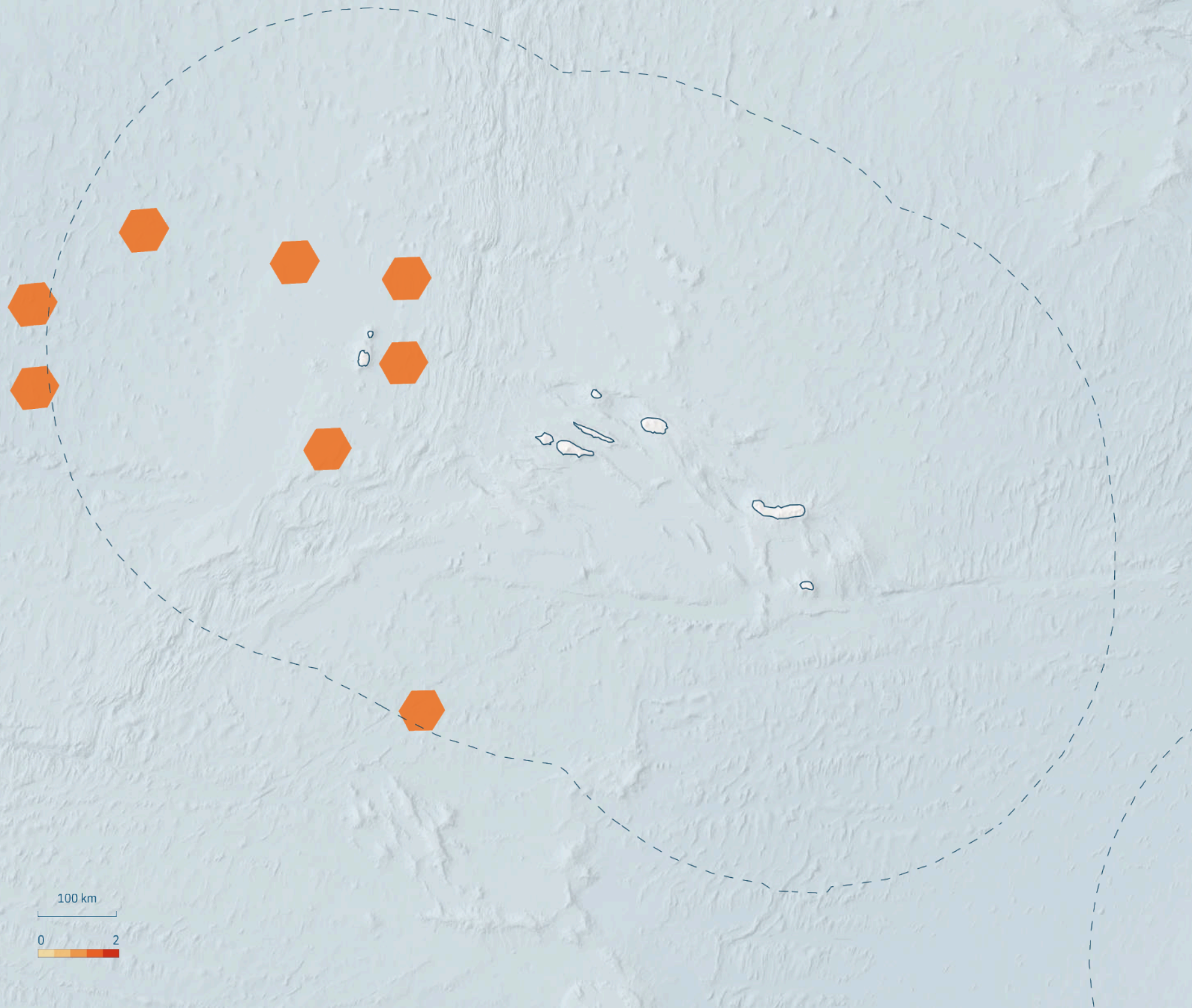
Ecology and habitat

It is believed that the Trindade Petrel has an ecology very similar to that of other petrels, exploiting similar habitats for feeding. It is a distinctly pelagic species that feeds mainly on cephalopods, but also on fish, caught using different strategies (Leal *et al.* 2017). However, it differs from its congeners in the type of habitat it uses for nesting, being able to use both cliff cavities and low-altitude areas at sea level (Krüger 2018).

Ameaças e conservação

The Trindade Petrel has an unfavourable conservation status due to its small population size and restricted nesting range. It is also subject to predation by invasive mammals (cats and rats) in these areas (Alves *et al.* 2011; BirdLife International 2025). The species has benefited from the eradication of goats and pigs, as well as the control of feral cats, in its main breeding colony (BirdLife International 2025). The potential increase in disturbance, habitat loss and mortality due to recent infrastructure development plans on the island of Trindade, including wind turbines, could degrade the conservation status of this population. The species also ingests plastic particles in significant quantities, although the effect of this on the birds' health has not yet been established (Leal *et al.* 2017).

Distribution
Non-breeding period



Bermuda Petrel

Pterodroma cahow

Phenology		Conservation status			
Mainland	Absent	Mainland	Madeira	Azores	IUCN Global
Madeira	Vagrant	NA	NA	NE	EN
Azores	Wintering and passage migrant				



Distribution, movements and phenology

The Bermuda Petrel breeds exclusively on a small number of islets in the Bermuda archipelago between January and June, from which the adults undertake extensive movements across the North-west Atlantic (Billerman *et al.* 2026). During the breeding season, the species regularly inhabits the waters of the USA and Canada, concentrating along the continental slope, beyond the continental shelf (Raine *et al.* 2021; Campioni *et al.* 2023). Outside the breeding season (mid-June to October), the species migrates eastwards, crossing the Atlantic and concentrating in the NACES Marine Protected Area (Medeiros *et al.* 2014). During these transoceanic movements, Bermuda Petrels frequently enter the Portuguese EEZ. Data from 14 birds fitted with GLS between 2021 and 2023 in Bermuda showed that 45% of individuals used Azorean waters between February and December, with a peak in October, indicating that Portuguese oceanic waters play an important role in the species' migratory corridor. Some occurrences were also recorded in the Madeira sub-area, whilst the species was absent from the Mainland waters.

Abundance and population trends

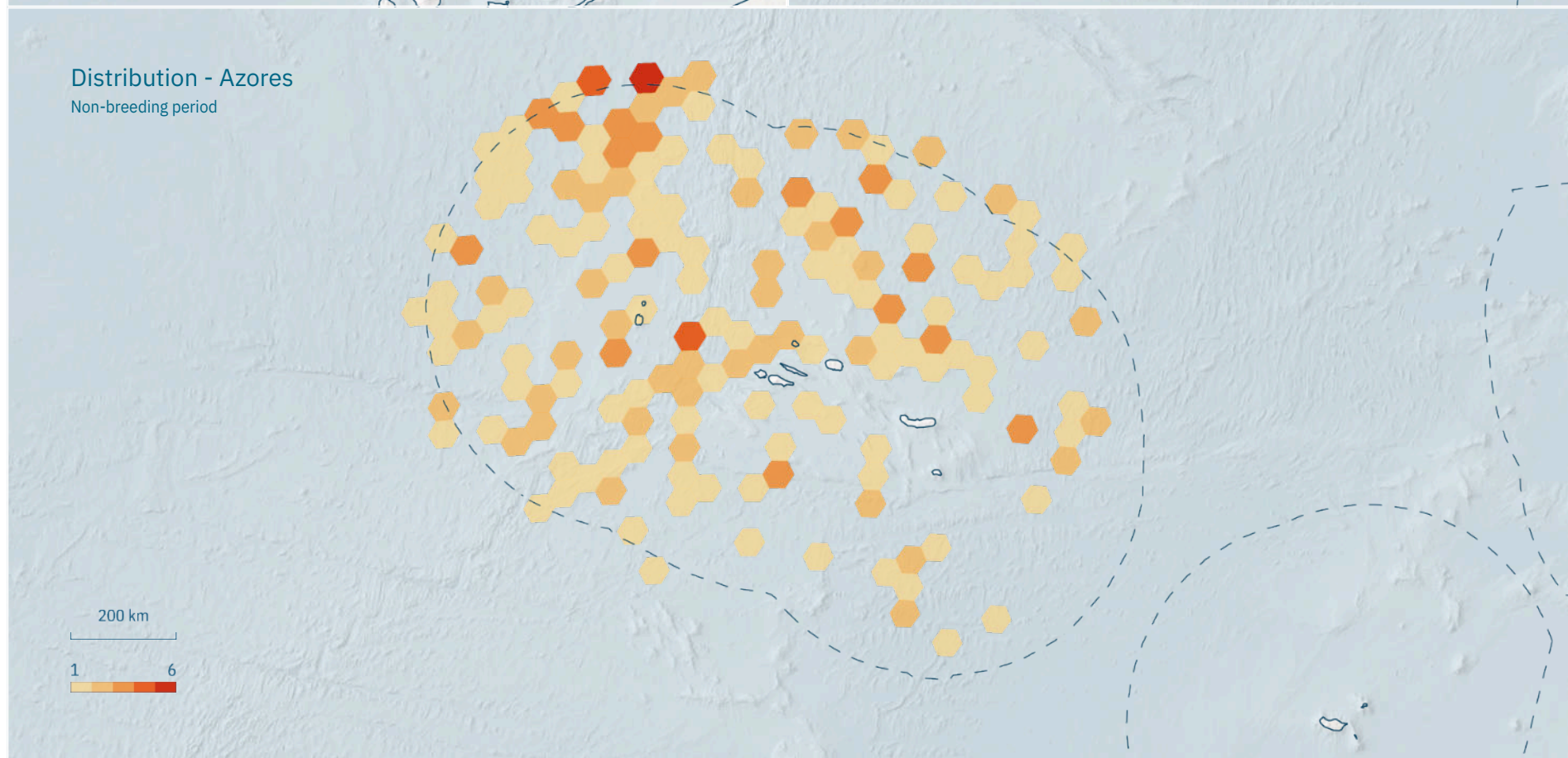
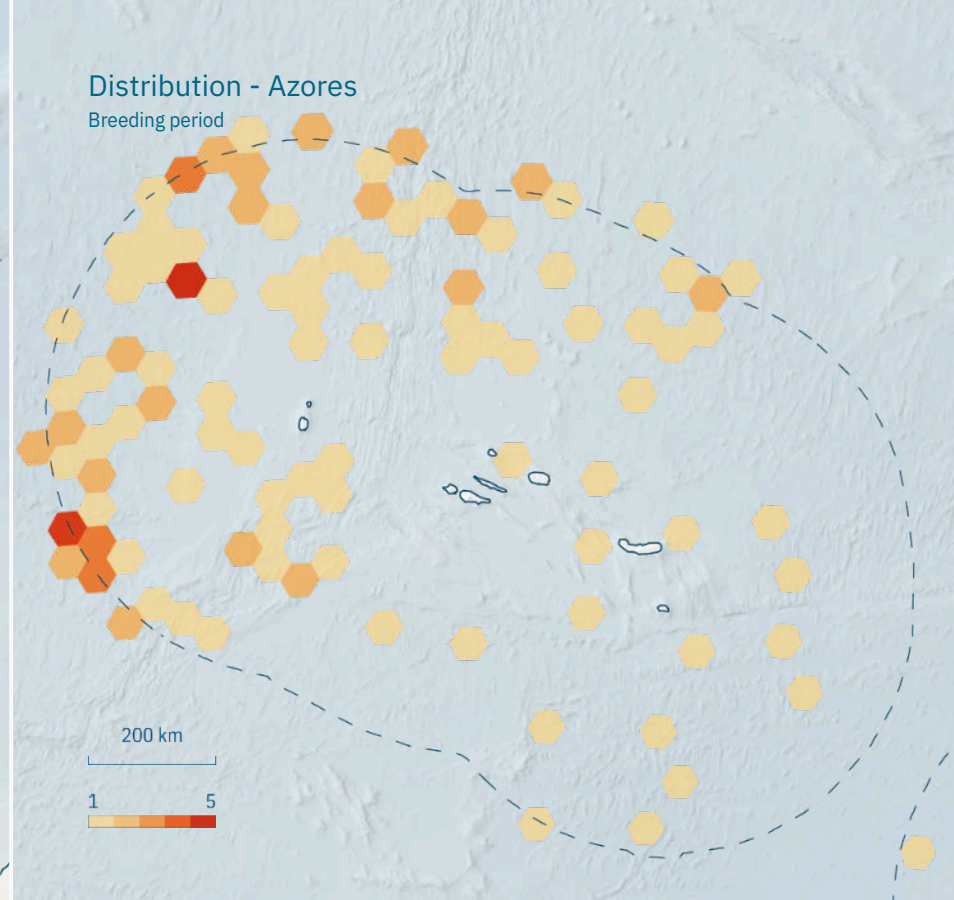
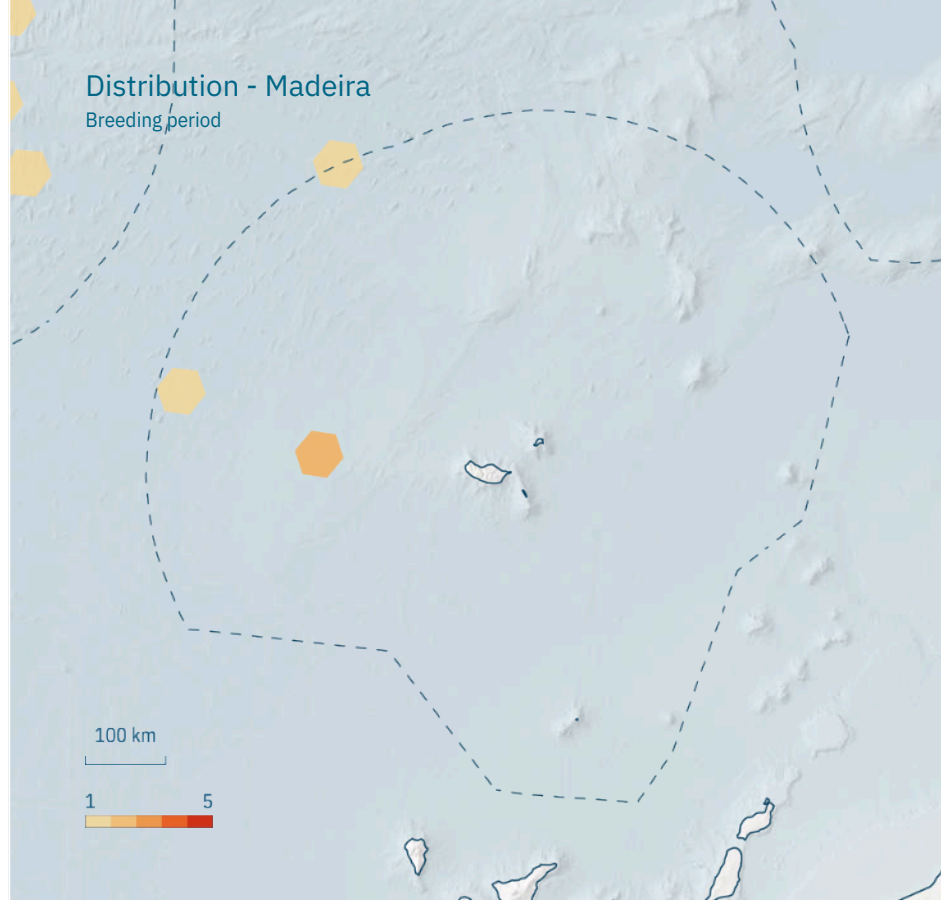
The global population was estimated at 165 pairs in 2024 (Medeiros 2024). Ten years after the 1951 rediscovery of 13 pairs, following a long period during which the species was considered extinct, a monitoring and recovery programme was implemented. This has led to a slow but steady increase in the population, with an average annual growth rate of 1.04% (Medeiros *et al.* 2012). The recovery included the successful re-establishment of a historic colony on Nonsuch Island through the translocation of chicks, which currently numbers 39 pairs. Although the species breeds exclusively in Bermuda, the record of an individual in an Azorean colony in November 2002, at the beginning of the breeding season, is of particular note (Bried & Magalhães 2004). This record constitutes the first documented observation of the species in the Palearctic region and, although there is no further evidence of breeding, fossils have recently been found in the Azores that may belong to this species (Rando *et al.* 2024).

Ecology and habitat

The Bermuda Petrel is a pelagic seabird that feeds in deep ocean waters. Its diet consists of squid and small mesopelagic fish. It breeds mainly in artificial nests (98% of the population) installed in areas of restored forest or on rocky terrain with native vegetation.

Threats and conservation

The species is protected at national level in Bermuda, Canada and the USA, ensuring partial international protection. The recovery plan, implemented by the Bermudian government since 1960, includes measures to control the main threats to the species, such as erosion and flooding caused by hurricanes and rising sea levels, predation by invasive rats, and competition for burrows with the White-tailed Tropicbird *Phaethon lepturus*. At sea, it faces risks of food contamination from polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PTCs) and mercury, and is also vulnerable to collisions following attraction by artificial light, and to climate change, which may affect the availability of prey (BirdLife International 2025).



Cape Verde Petrel

Pterodroma feae

Phenology		Conservation status			
Mainland	Absent	Mainland	Madeira	Azores	UICN Global
Madeira	Summering and wintering	NA	NE	NE	NT
Azores	Summering and wintering				



Distribution, movements and phenology

The Cape Verde Petrel breeds exclusively on four islands in Cape Verde (Fogo, Santo Antão, São Nicolau and Santiago) between November and May (Ratcliffe *et al.* 2000). Although it is an oceanic species, the birds remain in the vicinity of the breeding area throughout the year (Ramos *et al.* 2016). This species has only been recognised very recently, which may explain the lack of records of its occurrence in Portuguese waters. Based on data from 13 birds fitted with GLS between 2007 and 2014, two regularly used the Azores and Madeira sub-areas of the EEZ throughout the year, specifically between the easternmost part of the Azores and the western half of Madeira.

Abundance and population trends

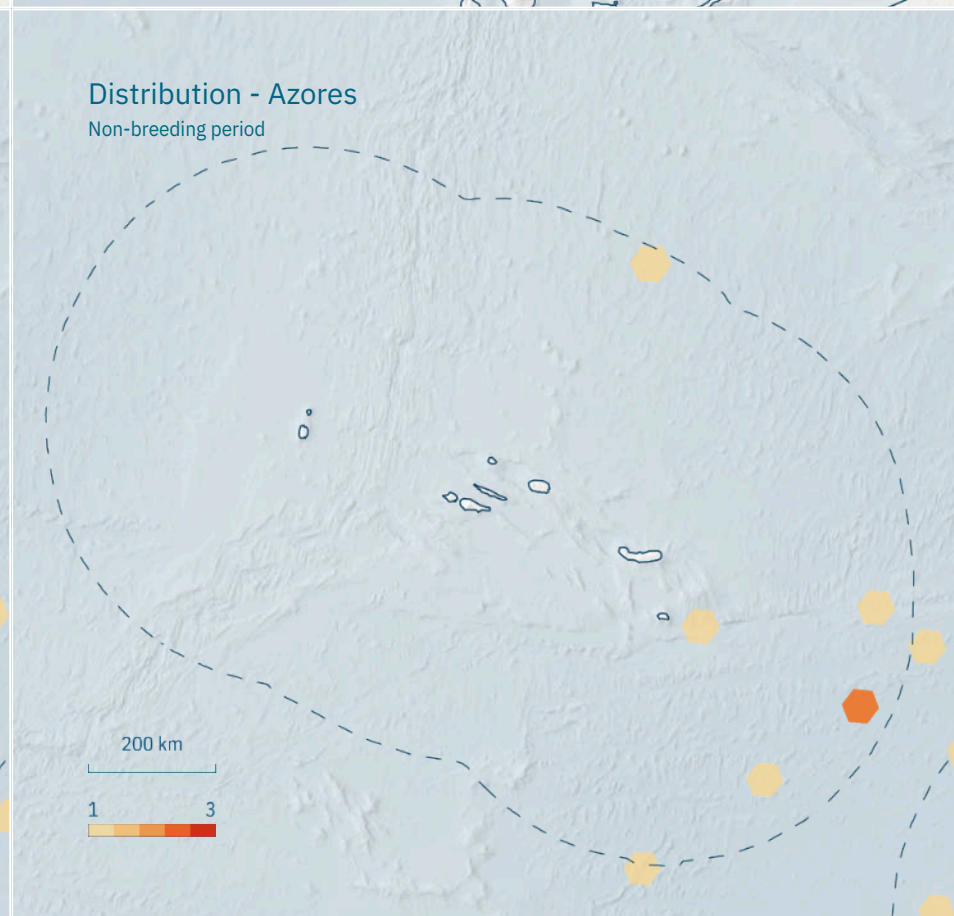
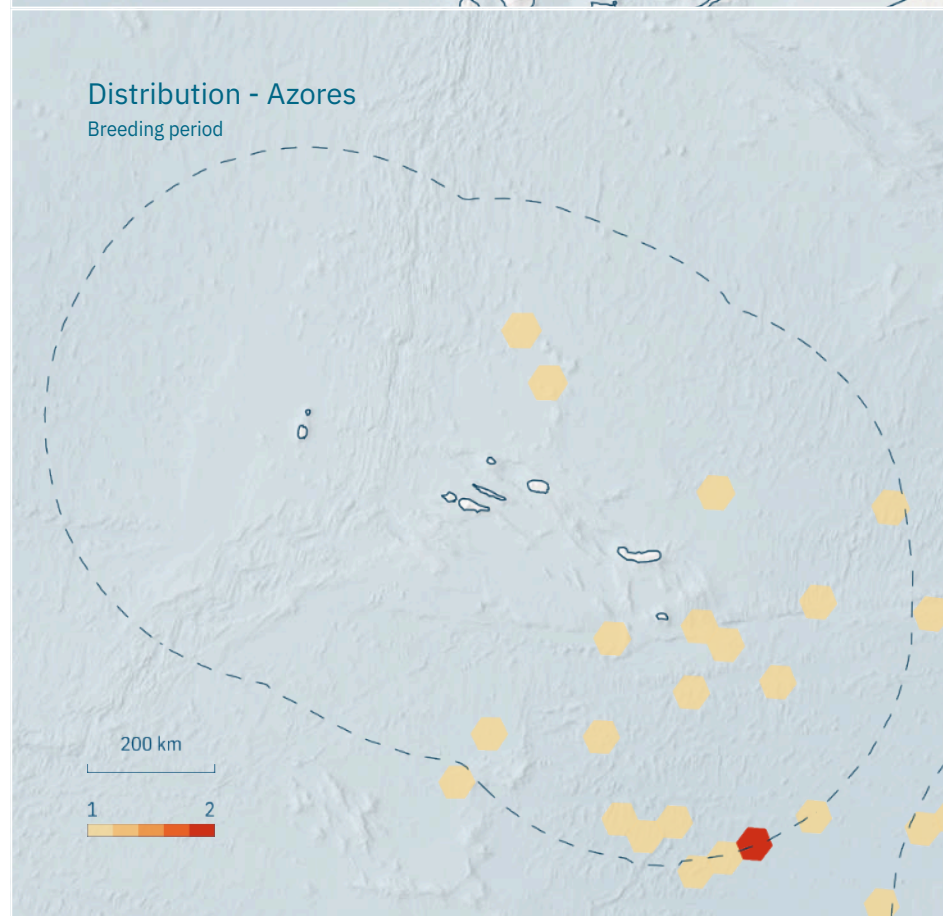
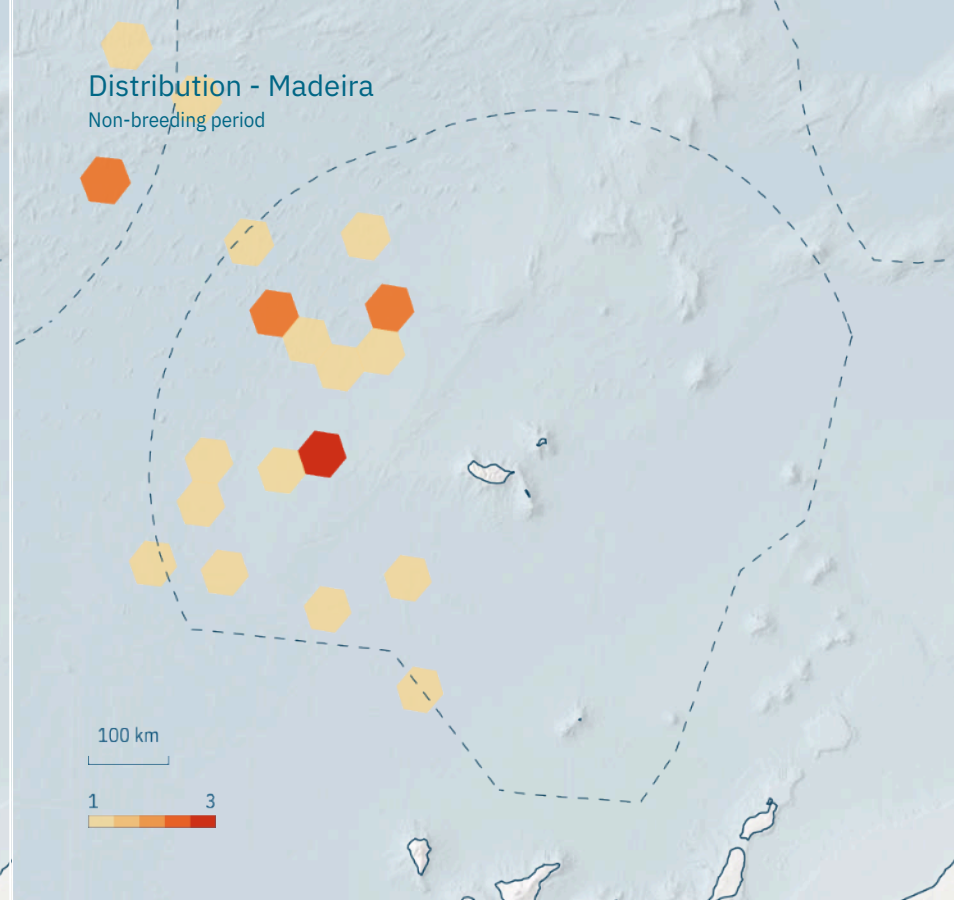
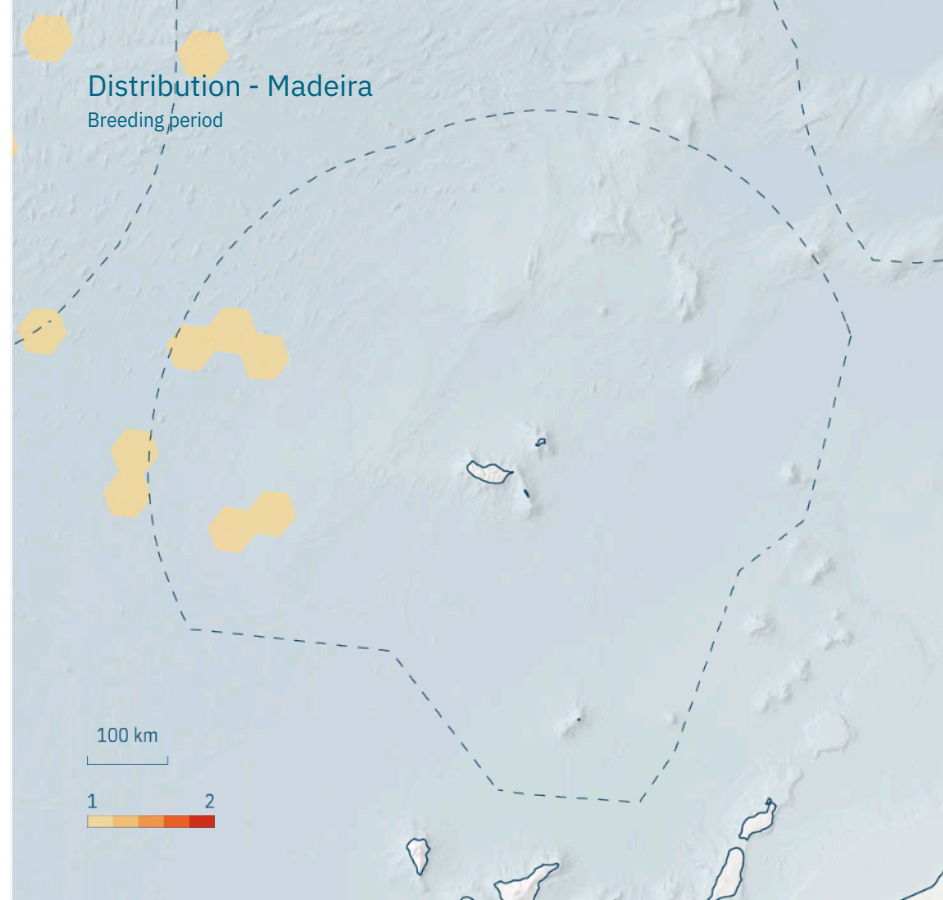
The global population has been estimated at 500 to 1,000 breeding pairs (Ratcliffe *et al.* 2000). In addition to being out of date and likely underestimated, the population appears to be in decline (BirdLife International 2025). In Portugal, its abundance is also unknown, and may be higher than would be expected based on the information presented in this publication. The lack of information regarding its population trends has made it impossible to assess its environmental status.

Ecology and habitat

It is believed that the Cape Verde Petrel has an ecology and diet very similar to most other petrels. Although little information is available, it is a distinctly pelagic species that is thought to feed mainly on cephalopods and fish (Ramos *et al.* 2016).

Threats and conservation

The Cape Verde Petrel is not currently threatened with extinction, but there are indications that its population trend is declining (Militão *et al.* 2017). It is subject to predation by invasive mammals (cats, rats and dogs) at breeding sites, as well as capture for human consumption and medicinal purposes (BirdLife International 2025).



Desertas Petrel

Pterodroma deserta

Phenology		Conservation status			
Mainland	Summering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Summer breeder	NE	VU	NE	VU
Azores	Summering and passage migrant				



Distribution, movements and phenology

The Desertas Petrel breeds on the island of Bugio, in the Madeira archipelago, between late May and early January. There are strong indications that it also breeds on an adjacent island, Deserta Grande (Menezes *et al.* 2010a), including a recent record of vocalisations during the breeding season. During incubation, taking advantage of prevailing winds, adults undertake long journeys across the North Atlantic that can take them as far south as Cape Verde and as far west as Canada (Ventura *et al.* 2022; Ventura *et al.* 2024). Based on data obtained from tracking 20 birds fitted with GPS between 2008 and 2013, extensive use of the Portuguese EEZ during the breeding season was observed, particularly in the sub-areas of Madeira and the Azores, but also with some exploration of the deeper parts of the Mainland sub-area. It should be noted that marine censuses carried out in the past already pointed to this distribution pattern (Meirinho *et al.* 2014). After breeding, it winters mainly in the South and West Atlantic, with part of the population remaining in the waters off Cape Verde, and may also occasionally explore Azorean waters (Ramírez *et al.* 2013).

Abundance and population trends

The global population has been estimated at 160 to 180 breeding pairs, with a stable population trend, although its highly restricted distribution makes it susceptible to extreme weather events (Equipa Atlas 2022; BirdLife International 2025). The estimated number of breeding pairs has fluctuated over the years, with a maximum of 173 to 258 pairs in 2001 (Geraldes 2002) and a minimum of 120 to 150 pairs in 2006; however, these variations appear to be more closely related to differences in monitoring methods (Menezes *et al.* 2010b).

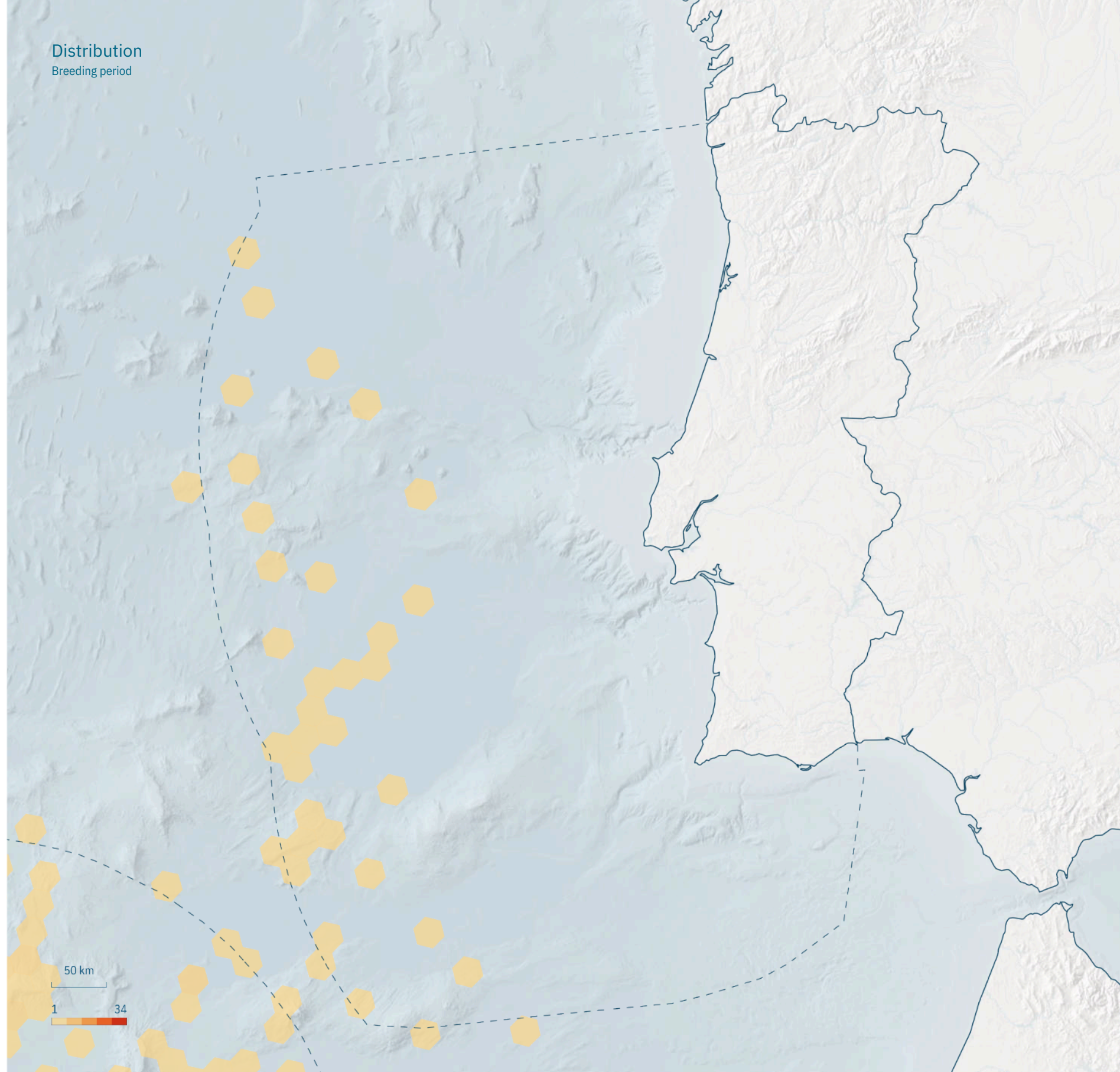
The breeding population has achieved Good Environmental Status for the abundance indicator. Conversely, this has not been achieved for the productivity indicator.

Ecology and habitat

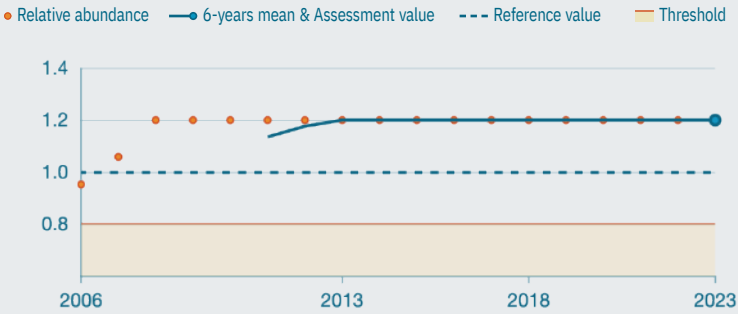
The Desertas Petrel nests at altitudes between 80 and 300 m, generally in burrows dug into the ground, although nests may also occur in rock crevices where there is no soil (BirdLife International 2025). Since 2008, 50 artificial nests have been constructed on the Bugio Plateau to increase habitat availability for the species, with an occupancy rate currently exceeding 80%. At sea, the species utilises a wide variety of habitats, although there is some individual specialisation (Ramírez *et al.* 2016). The diet consists mainly of cephalopods and fish (Menezes *et al.* 2010b).

Threats and conservation

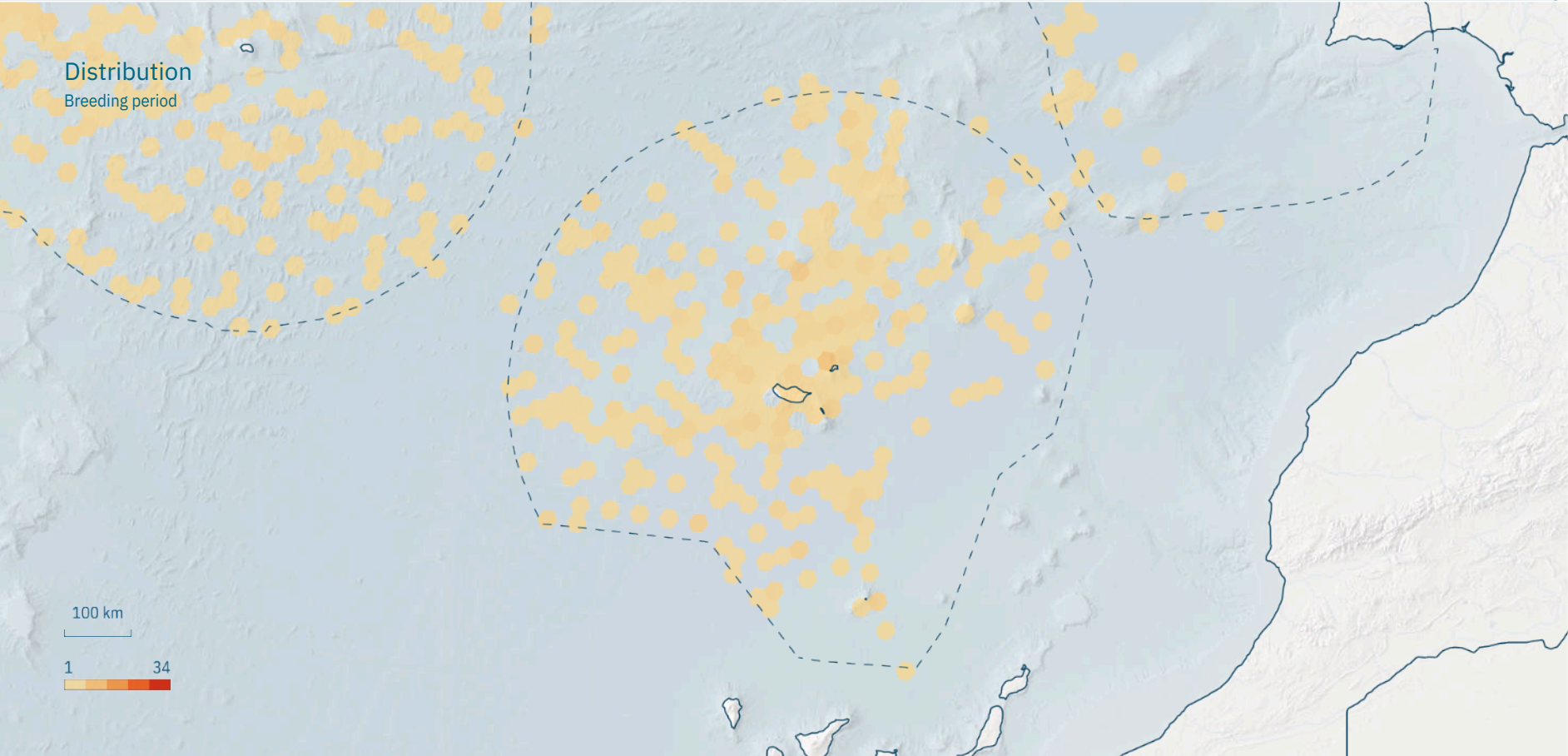
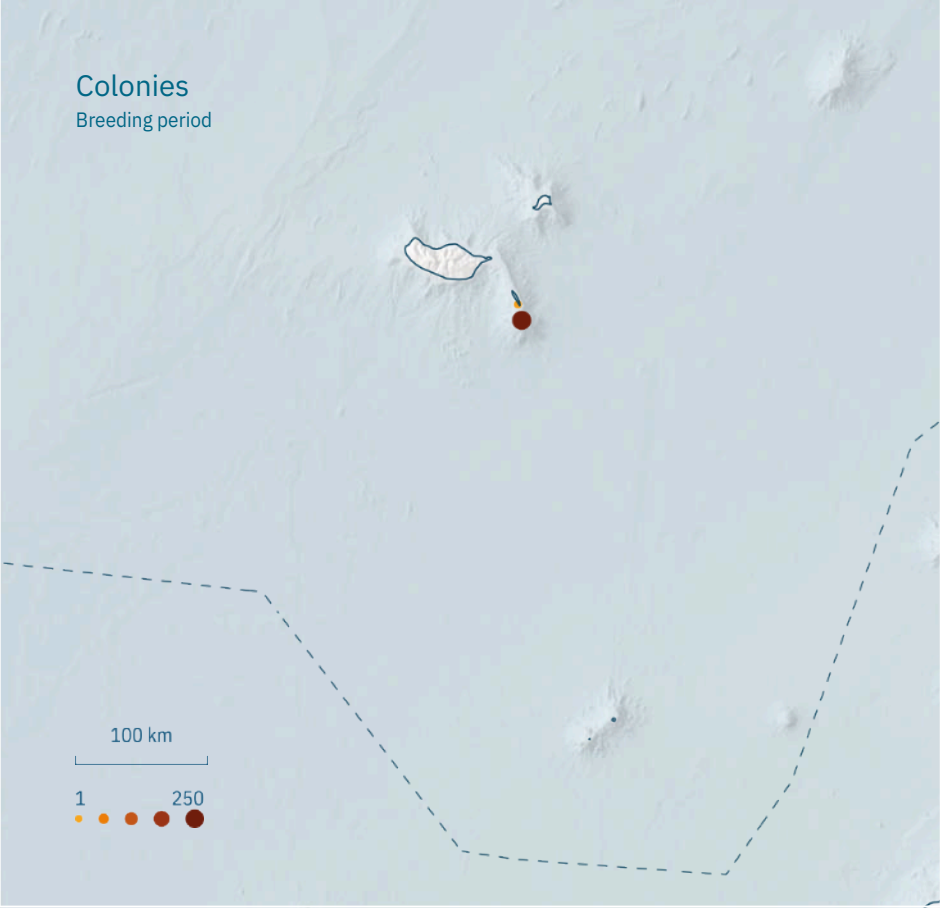
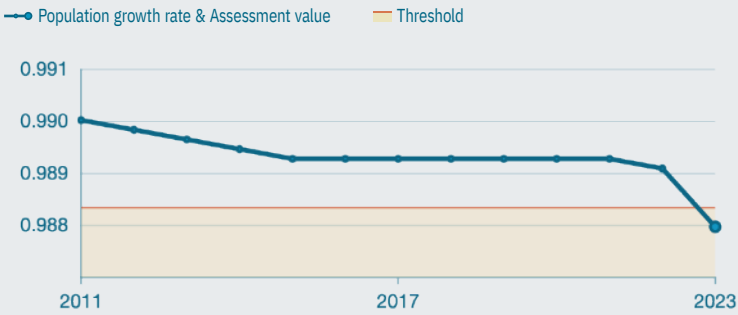
Currently, the main threat to this species is the loss of nesting habitat due to erosion caused by wind and rain (Menezes *et al.* 2011). Predation by Yellow-legged Gulls *Larus michahellis* represents a potential threat in nesting areas. At sea, no specific threats to the species have yet been identified, although it is acknowledged that collisions with brightly lit vessels do occur. In terms of conservation, there is an action plan published in 1996 (Zino *et al.* 1996), which is in need of updating. Conservation priorities focus on maintaining existing artificial nests, constructing new nests, controlling native predatory and competing species, and gaining detailed knowledge of breeding phenology.

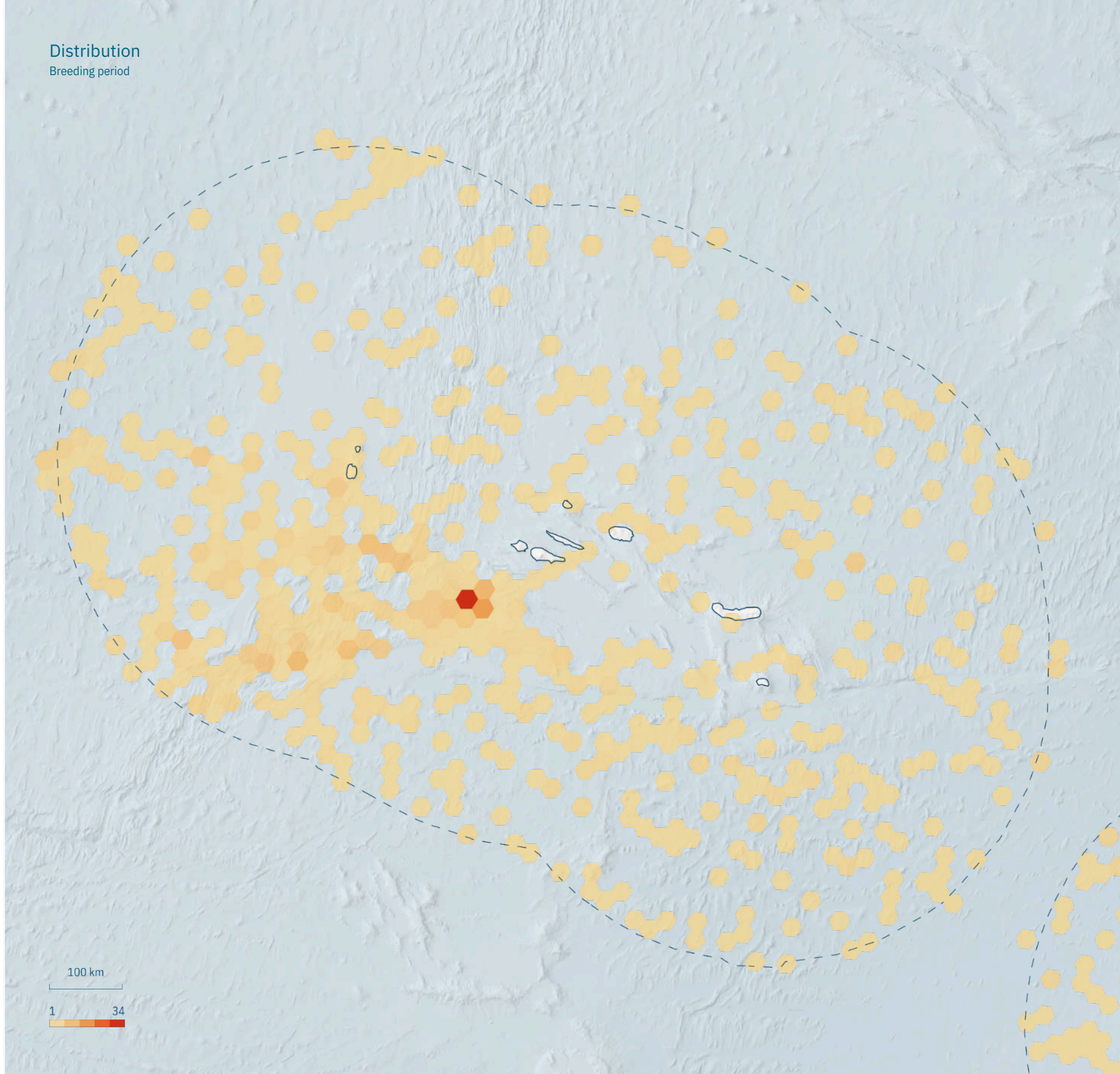


Abundance Indicator Assessment



Productivity Indicator Assessment





Zino's Petrel

Pterodroma madeira

Phenology		Conservation status			
Mainland	Vagrant	Mainland	Madeira	Azores	UICN Global
Madeira	Summer breeder	NA	EN	NE	EN
Azores	Summering and passage migrant				



Distribution, movements and phenology

The Zino's Petrel is found primarily in the North-east Atlantic region and is endemic to Madeira. The first birds arrive at their breeding grounds in late March and the last juveniles leave the nest in the first half of October (Zino *et al.* 1995b). During the breeding season, the distribution of the Zino's Petrel is concentrated in the waters around Madeira and the Azores (Zino *et al.* 2011). Outside the breeding season, the species disperses widely across the Atlantic, migrating to tropical and equatorial regions (Zino *et al.* 2011; Ramos *et al.* 2017).

Individual tracking data from 12 birds fitted with GPS in 2018 and 2019 reveal extensive use of the Portuguese EEZ, mainly in the sub-areas of Madeira and the Azores. It occurs mainly in deeper waters or those further from land masses, with the exception of the breeding colony. It is also worth noting the evident concentration in the extreme North-west of Azorean waters. The few forays it made into Mainland waters also appear to be restricted to the deep waters of the North-central region.

Abundance and population trends

The global population has been estimated at around 200 individuals, with fewer than 100 breeding pairs (Equipa Atlas 2022). Currently, it nests only in the central mountain range of the island of Madeira, although subfossil evidence indicates that its past distribution was wider, including other areas of the island and Porto Santo (Zino *et al.* 2001). Despite the negative effects of forest fires in the main breeding area, the population has remained stable. The environmental assessment indicates that the breeding population has achieved Good Environmental Status for the abundance indicator. Conversely, this population has not achieved Good Environmental Status for the productivity indicator.

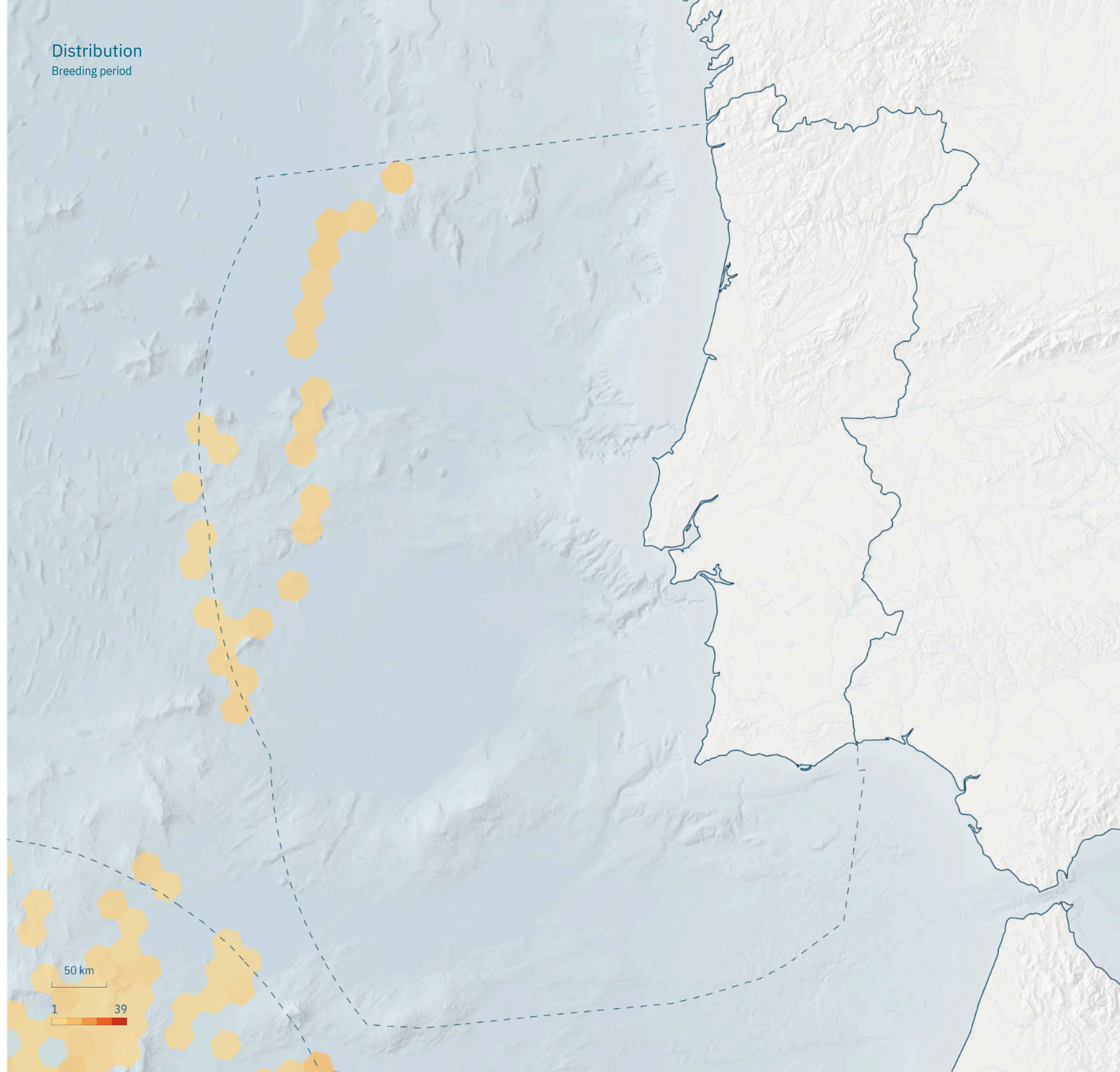
Ecology and habitat

The species nests above 1,600 m in altitude, preferring areas with vegetation characteristic of high altitudes and in a good state of conservation (Zino *et al.* 2001; Oliveira & Menezes 2004). Nests are excavated in the ground, in a few inaccessible rocky outcrops, and may reach great depths and contain several chambers inside (Menezes *et al.* 2010a). It is possible that there are still nesting sites yet to be identified.

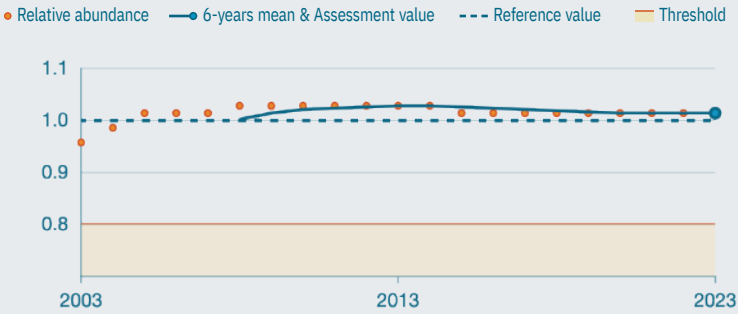
Threats and conservation

Forest fires in nesting areas pose a critical threat, causing direct mortality of adults and chicks, destruction of nests and habitat degradation, with long-term effects on survival and breeding success (Projeto Freira da Madeira 2010). Direct predation by rats and feral cats also poses a threat to reproduction, and is controlled through trapping programmes and biosecurity measures. Direct human impact on the colonies is limited, despite the high number of visitors, with poorly monitored night-time access restrictions (BirdLife International 2025). The restricted nesting area makes the species even more vulnerable to occasional events such as fires (Menezes *et al.* 2010b).

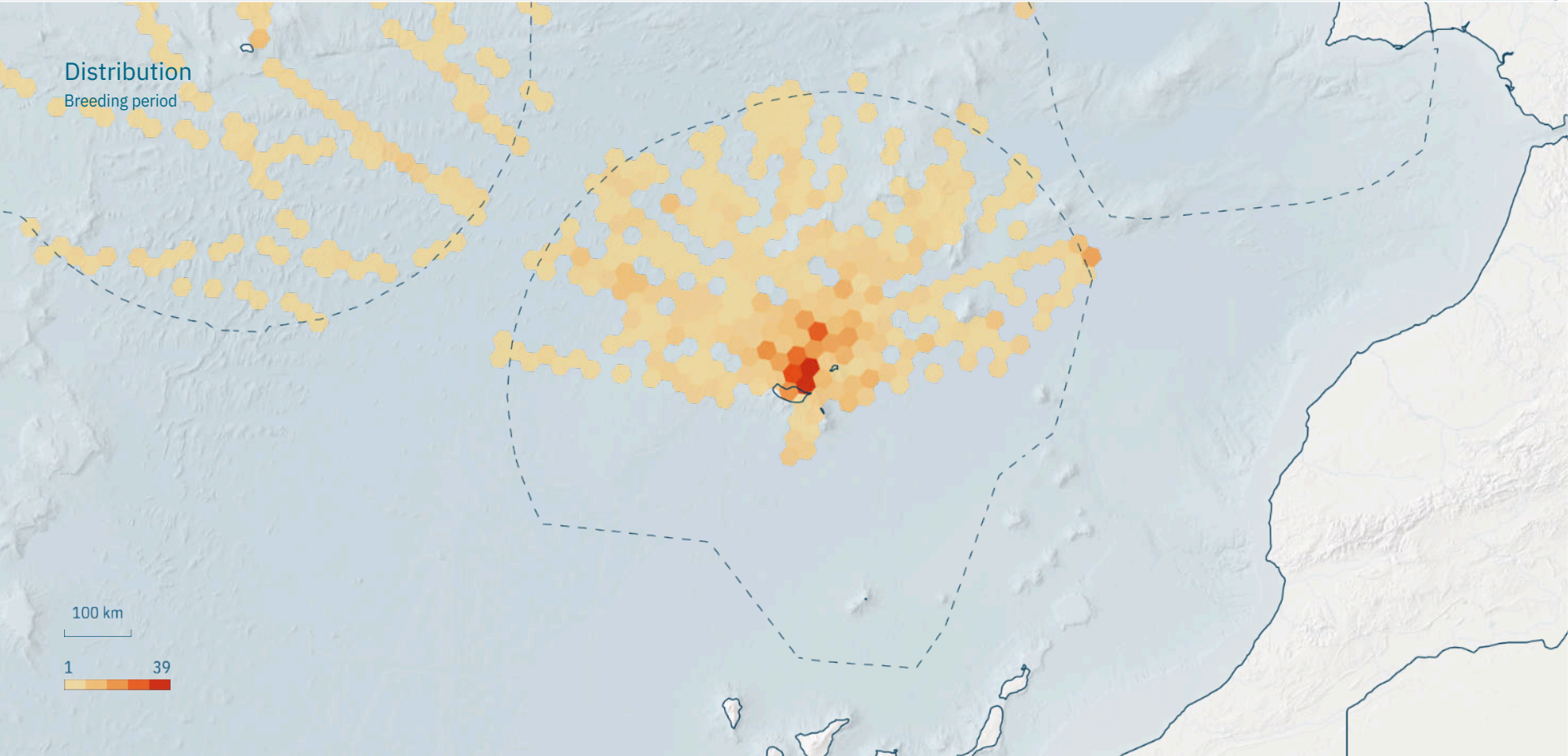
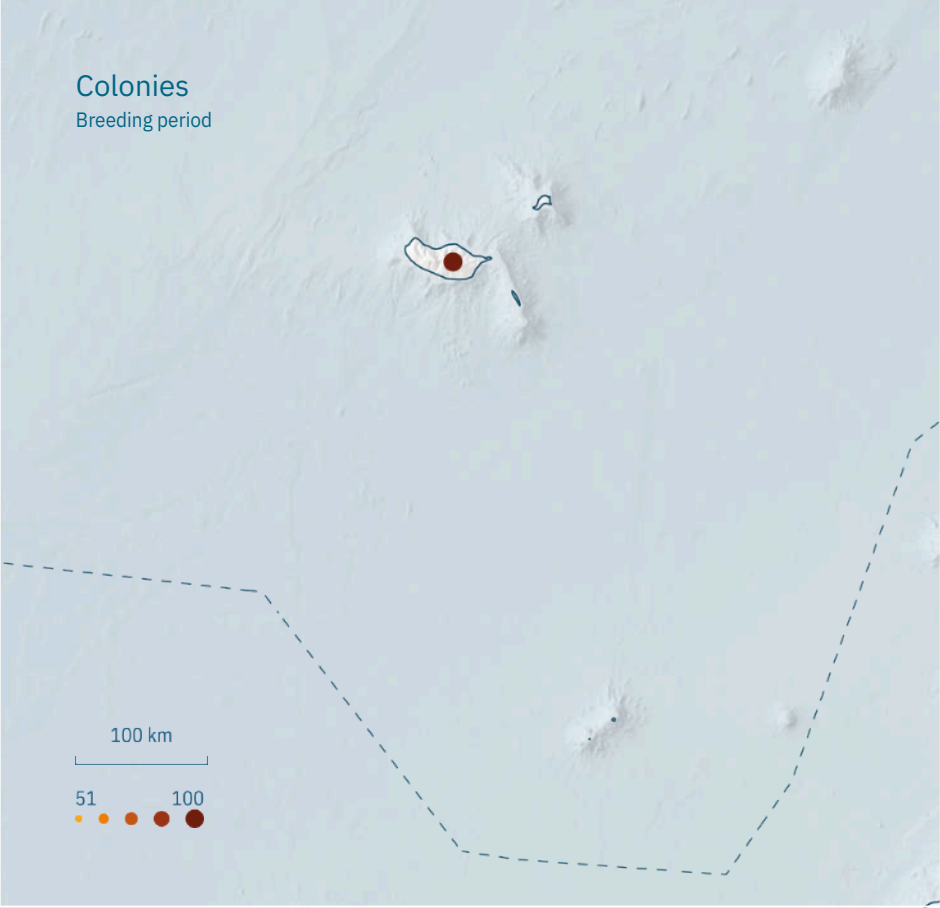
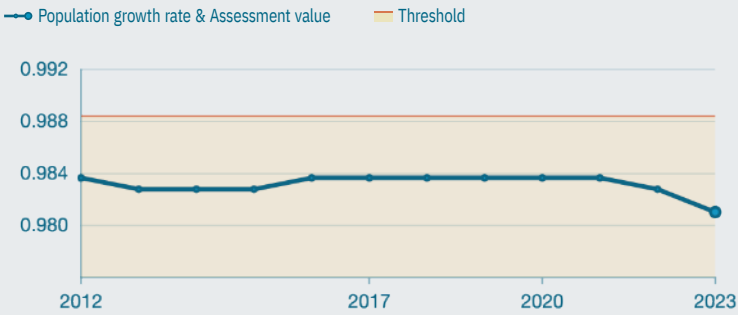
Authors: Francis Zino, Manuel Biscoito, Tânia Nascimento
Owners/sources of tracking data: Catry *et al.* 2019b, Zino & Biscoito 2010a, Zino & Biscoito 2010b

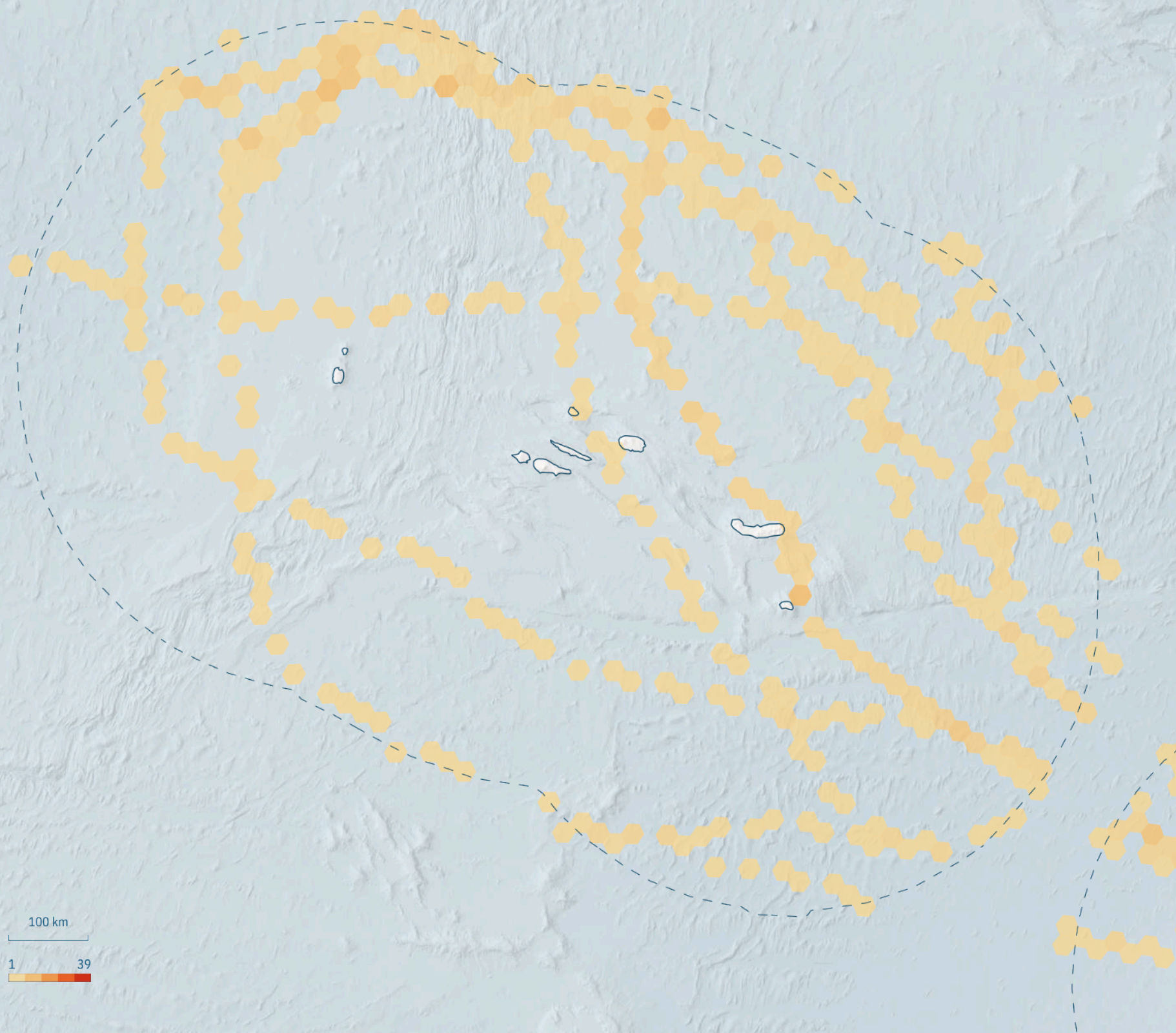


Abundance Indicator Assessment



Productivity Indicator Assessment





Sooty Shearwater

Ardenna grisea

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NE	NT
Azores	Passage migrant				



Distribution, movements and phenology

The Sooty Shearwater breeds between October and April on islands off the coasts of New Zealand, Australia, and Chile, as well as in the Falkland Islands (BirdLife International 2025). After the breeding season, the species embarks on one of the largest known mass migrations. It heads north to spend the wintering period at the far reaches of the Pacific and Atlantic Oceans, respectively (Hedd *et al.* 2012). The species is regularly observed in Portuguese waters between spring and autumn (Meirinho *et al.* 2014), with particular importance during the pre-breeding migration (Catry *et al.* 2010a). Data from 29 birds fitted with GLS in 2008 and 2017 in the Falklands confirm that the species remains in the Portuguese EEZ throughout the non-breeding period, from May to November. This pattern is particularly evident in the Azores, where the species has a fairly wide distribution, but with a higher concentration in the western half. In Mainland waters, the distribution appears to be less extensive, centring mainly on the continental shelf and slope. This pattern appears to be similar to that found in the waters of Madeira.

Abundance and population trends

The global population has been estimated at 4,400,000 breeding pairs, with a declining trend (BirdLife International 2025). This decline has been observed over recent decades, particularly in North America and New Zealand. In Mainland Portugal, the species has shown fluctuations in abundance, with figures ranging from 0 to 0.03 birds/km². Despite the lack of more concrete estimates, this population appears to be in Good Environmental Status for the abundance indicator. There is no up-to-date information on abundance or population trends for the Azores and Madeira.

Ecology and habitat

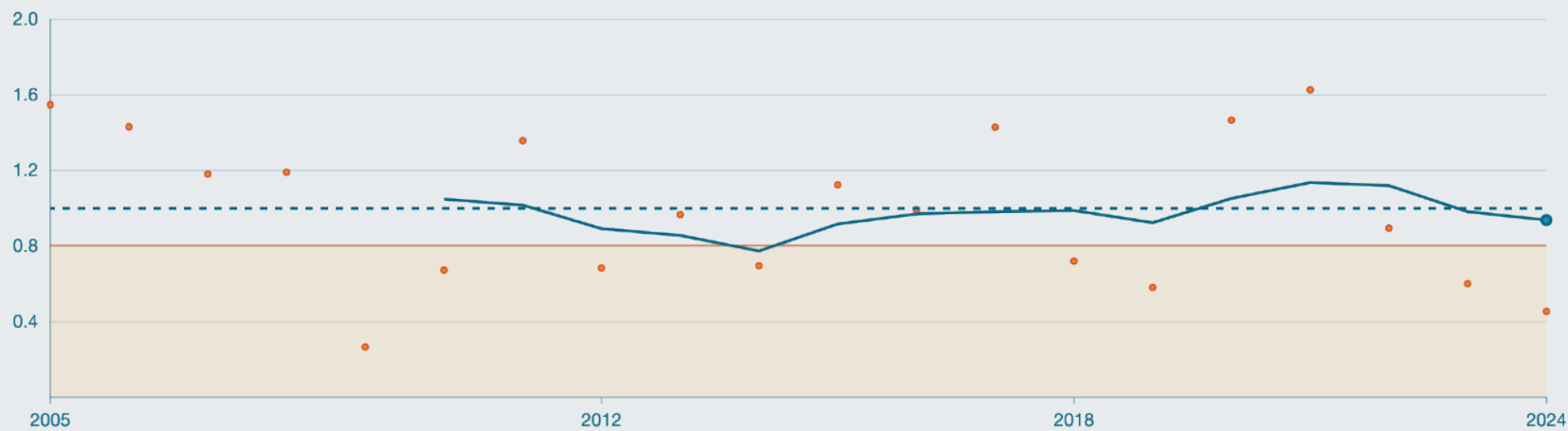
During its wintering period, the Sooty Shearwater shows a preference for the waters of the continental shelf and slope, using deep-sea areas less frequently. During its migrations, however, it appears to prefer the latter. It feeds on small fish, cephalopods, and crustaceans, often joining other seabirds in veritable feeding frenzies (Billerman *et al.* 2026). It is common for them to approach fishing vessels in large numbers, particularly trawlers and longliners.

Threats and conservation

At sea, bycatch in longlines, trawls, and gillnets is one of the main threats to the species (Uhlmann 2003), although there is no evidence of this occurring in Portugal. The species is also susceptible to prey depletion due to overfishing and climate change (Hyrenbach & Veit 2003; Uhlmann 2003). On land, the main threats relate to predation by introduced mammals and the capture of juveniles for human consumption, with the latter being a commercial and legally established activity in New Zealand (Billerman *et al.* 2026). Conservation priorities have focused on the legal designation of nesting areas, the eradication of introduced predators, and the use of mitigation measures to reduce bycatch (BirdLife International 2025).

Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold



Distribution

Breeding period

100 km



Distribution

Non-breeding period

50 km

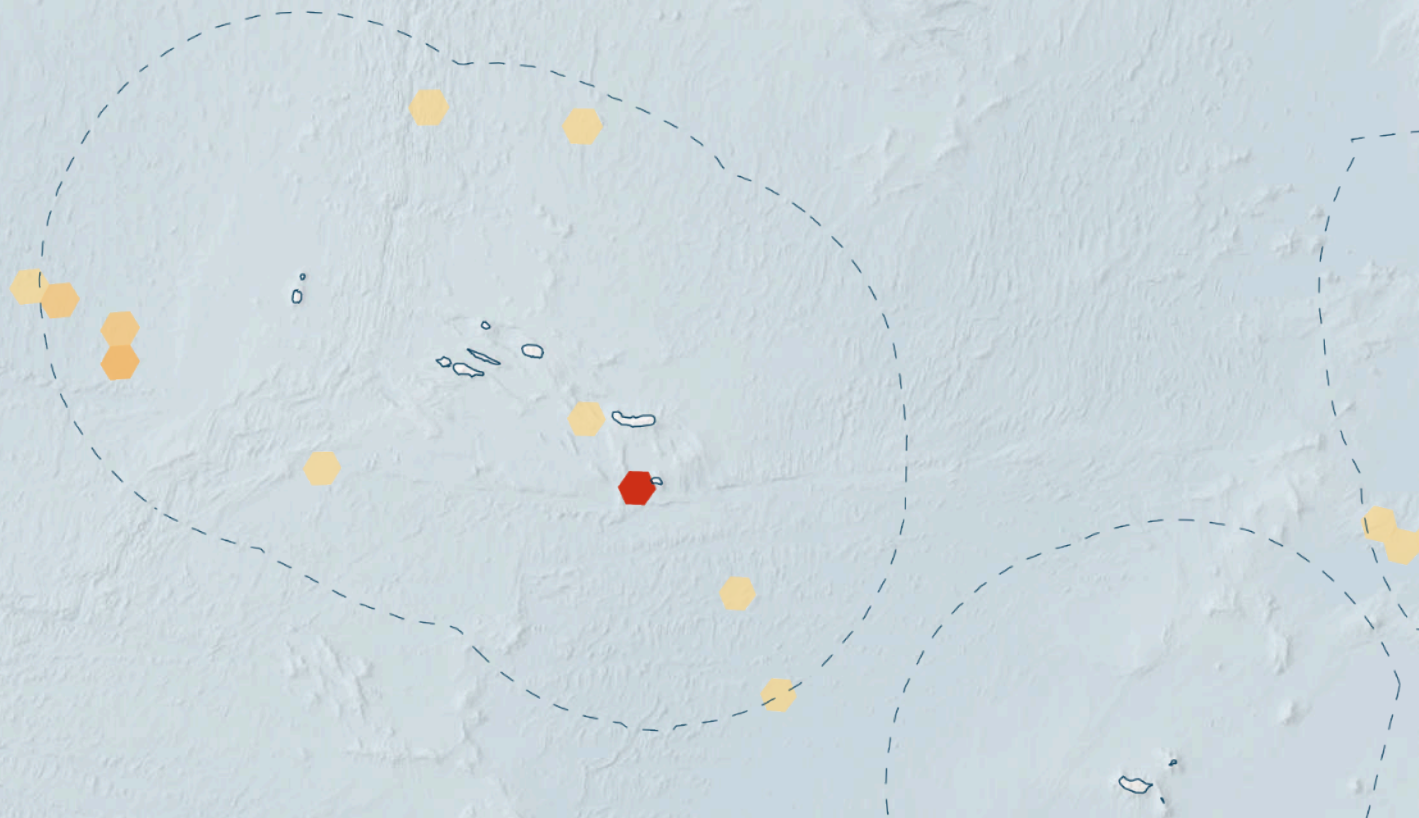
1 3

North arrow
Madeira

Colony(ies) of origin: Kidney (Falkland) | Device: GLS
Data period / number of individuals: September 2008 / 1 ind.

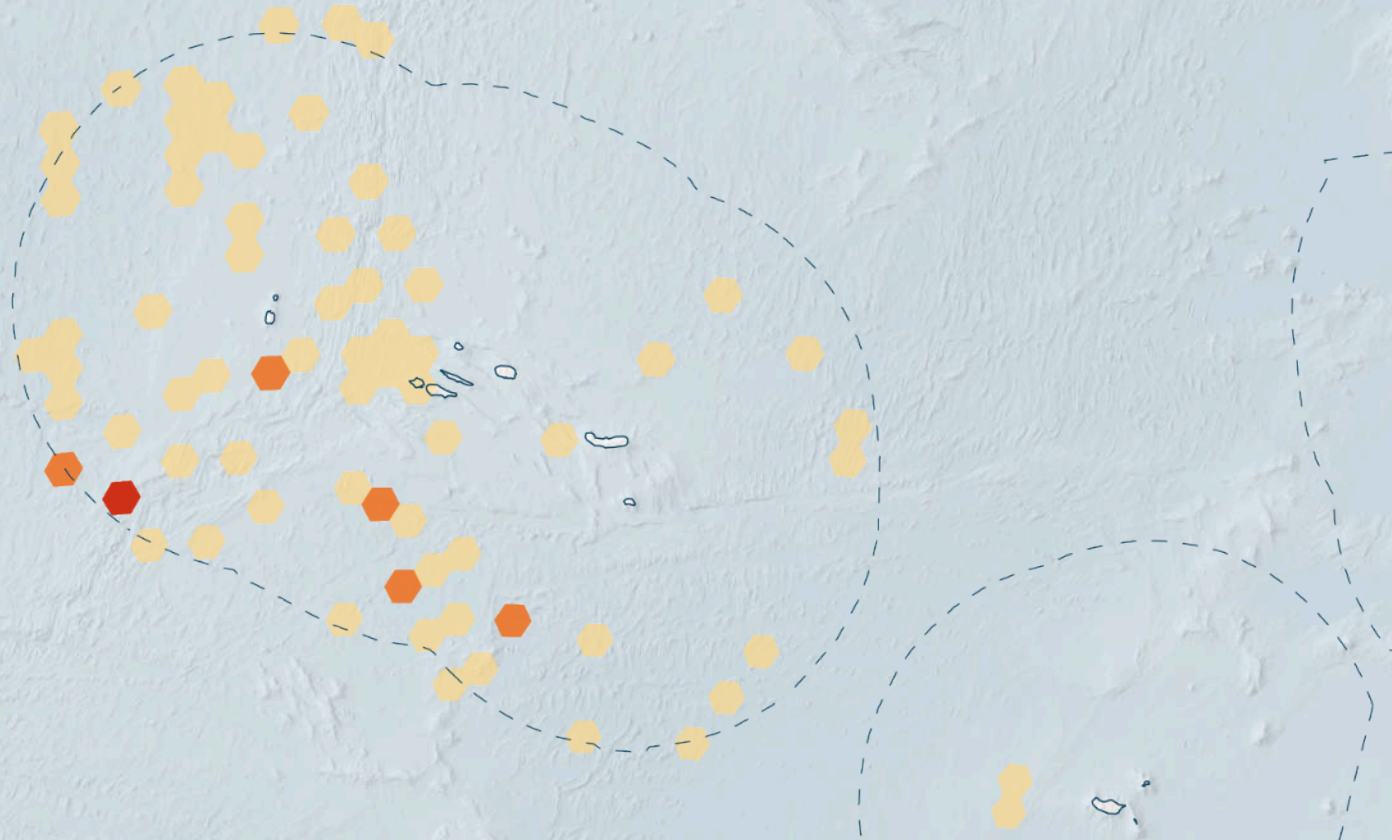
Distribution

Breeding period



Distribution

Non-breeding period



Great Shearwater

Ardenna gravis

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NE	LC
Azores	Passage migrant				



Distribution, movements and phenology

The Great Shearwater breeds in the South Atlantic, on the Tristan da Cunha archipelago, and in the Falkland Islands between mid-September and late May (Cuthbert 2005; Billerman *et al.* 2026). After breeding, it begins a long migration across the North-west Atlantic, reaching the coast of Canada, before heading eastwards, passing through the waters of the United Kingdom and the Iberian Peninsula (Billerman *et al.* 2026). In Portugal, it occurs throughout almost the entire EEZ during summer and autumn, being closer to the coast in summer and further out to sea in autumn (Meirinho *et al.* 2014), when it heads south towards its breeding grounds (Catry *et al.* 2010a; Billerman *et al.* 2026). Based on data from 44 birds fitted with GLS between 2009 and 2014 from colonies on Gough Island, greater use of the Portuguese EEZ was observed throughout September, although some birds used these waters as early as June. Their movements were concentrated mainly in the Azores sub-area and the north-west region of Madeira. On the Mainland, however, records were scarce, despite the species being known to occur frequently, with considerable concentrations along the southern coast (Araújo *et al.* 2022a).

Abundance and population trends

The global population was estimated at over 10 million mature individuals in 2004 (Brooke 2004). No estimates have been made since then, although the population is thought to be stable (BirdLife International 2025).

In Mainland Portugal, the population was estimated at between 5,399 and 25,379 individuals for the period between 2012 and 2015 (Araújo *et al.* 2022a). Despite significant interannual variations, an upward trend has been observed since 2015, reflected in the population abundance indicator, which justifies the population's Good Environmental Status. In the case of the Azores and Madeira, however, the available information does not allow for firm conclusions to be drawn regarding the species' population trends.

Ecology and habitat

During its wintering period, the Great Shearwater uses both coastal waters and those further offshore, preferring the latter during its pre-breeding migration. This essentially pelagic bird feeds mainly on fish, cephalopods, and crustaceans, caught at the surface or while diving (Billerman *et al.* 2026). It frequently feeds on discards from commercial fishing, mainly following trawlers (Paz *et al.* 2018), but also vessels using other fishing gear, notably gillnets and longliners (Bugoni *et al.* 2008; Pereira *et al.* 2025a).

Threats and conservation

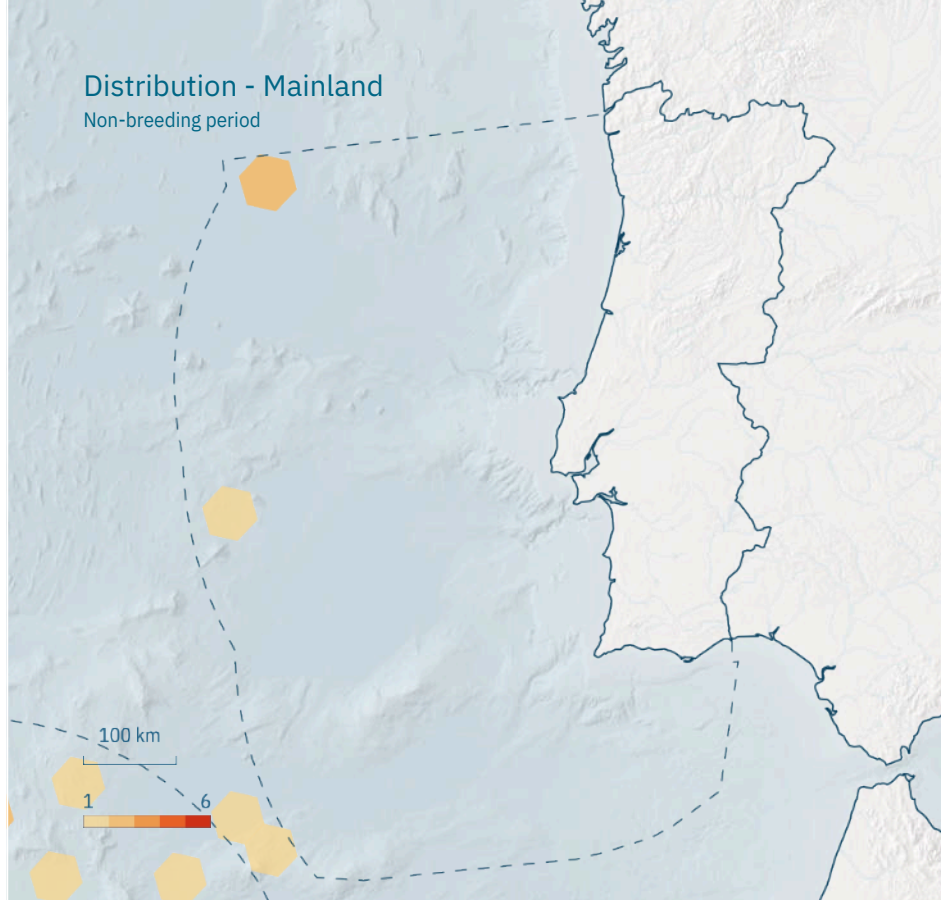
In its breeding areas, the Great Shearwater is still caught for food (BirdLife International 2025). At sea, the greatest threat relates to bycatch in fishing gear operated in the North-east Atlantic, primarily longlines, trawls and gillnets (Perez & Wahrlich 2005; Bugoni *et al.* 2008; Hatch *et al.* 2016; Paz *et al.* 2018), the latter being a threat also reported in Mainland Portugal (Pereira *et al.* 2025a). Other causes of mortality may be related to heavy metal contamination and the ingestion of plastics (Pierce *et al.* 2004; Barbieri *et al.* 2007).

Author: Tânia Nascimento
Owners/sources of tracking data: Ronconi & Ryan 2010, Gonzalez-Solis & Ryan 2014



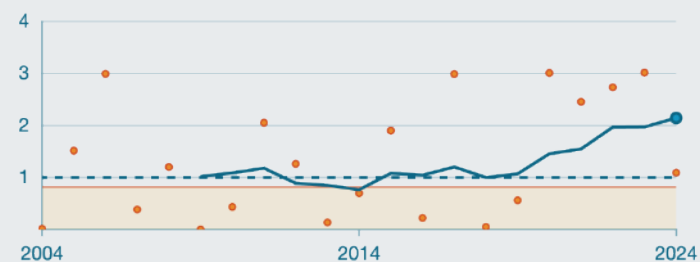
Distribution - Mainland

Non-breeding period



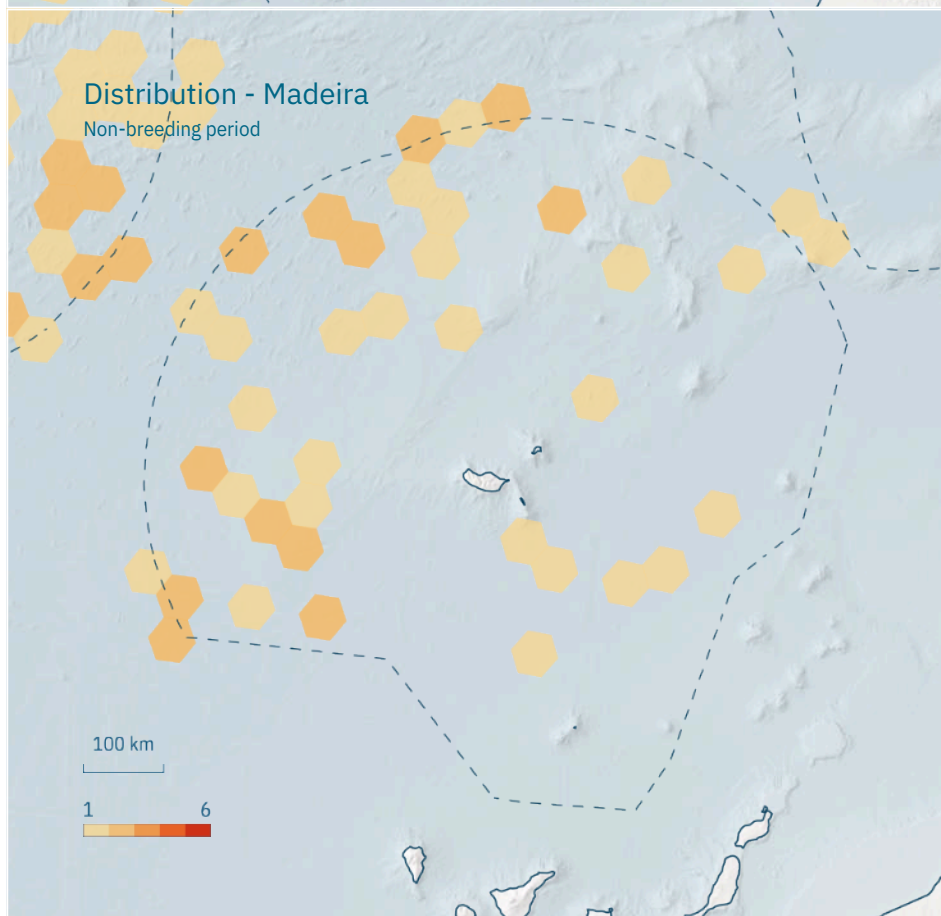
Abundance Indicator Assessment - Mainland

● Relative abundance — 6-years mean & Assessment value - - - Reference value ■ Threshold



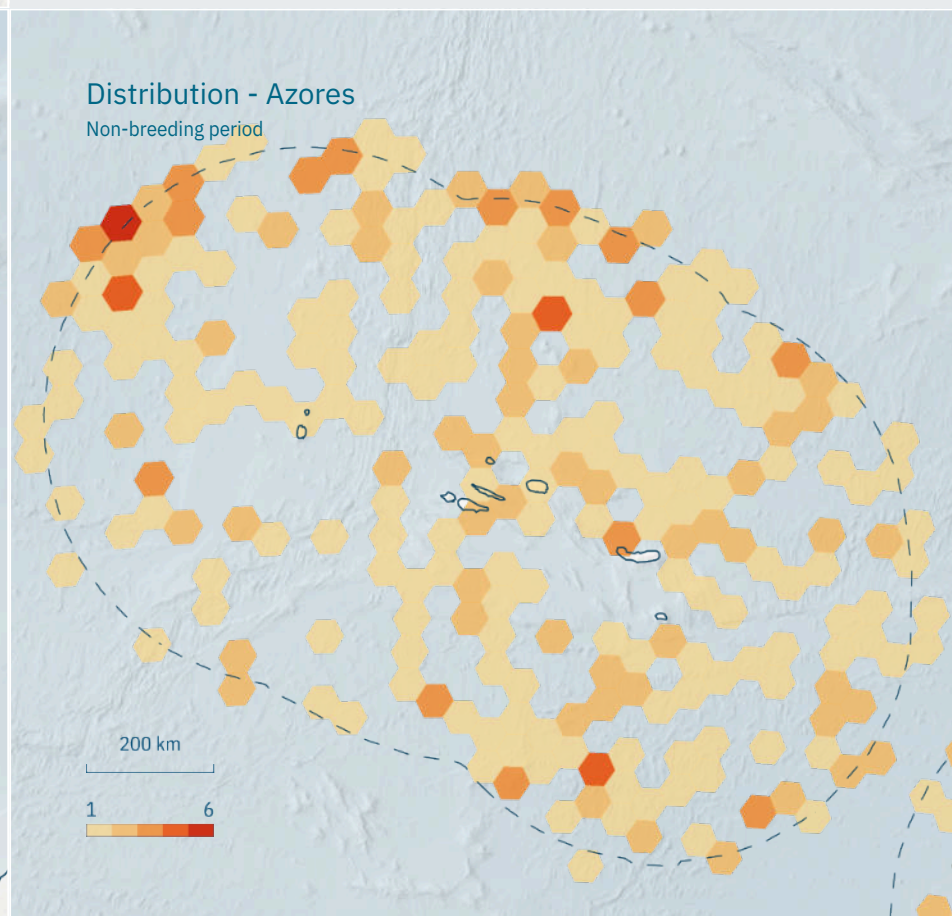
Distribution - Madeira

Non-breeding period



Distribution - Azores

Non-breeding period



Scopoli's Shearwater

Calonectris diomedea

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NE	LC
Azores	Passage migrant				

Distribution, movements and phenology

The Scopoli's Shearwater is a trans-equatorial migrant, widespread and common in the Mediterranean during the breeding season (Keller *et al.* 2020). Its wintering grounds are located mainly in Atlantic waters between 20°N and 20°S, occurring predominantly in coastal waters from the Canary Current in North-west Africa to the Gulf of Guinea and Angola in the south, but also in some oceanic waters (Morera-Pujol *et al.* 2025). The birds return to their Mediterranean breeding colonies from late February after spending four to five months in their wintering areas. The breeding season lasts from late May until late October.

Based on the individual tracking of 28 birds from the Chafarinas (Spain) and Riou (France) colonies, equipped with GPS devices between 2007 and 2014, an extensive use of the Portuguese EEZ was recorded. Occurrence was observed during the breeding and migratory periods, concentrated mainly on the southern section of the continental shelf and along the Mainland coast, as well as southeast of the Azores sub-area and north of Madeira.

Abundance and population trends

The global population is estimated at 141,000 to 223,000 breeding pairs (Defos du Rau *et al.* 2015). This estimate is consistent with counts of approximately 600,000 individuals recorded at the Strait of Gibraltar during autumn passage, when the birds leave the Mediterranean basin (Derhé 2012; Carboneras *et al.* 2013).

The global population is estimated to be declining by around 2% over three generations (since 1980), although this estimate is based on data from only 6% of the population (Carboneras *et al.* 2013). Despite documented local declines, the species is globally classified as Least Concern (BirdLife International 2025). However, updated data from the largest colony, in Tunisia, are still needed to robustly assess its overall status (Carboneras *et al.* 2013). There is currently no available information to assess the environmental status of the population using the Portuguese EEZ.



Ecology and habitat

The Scopoli's Shearwater is a migratory pelagic bird. It breeds on inaccessible cliffs of islands and uninhabited remote islets, occupying a wide variety of natural cavities, including rocky crevices, under shrubs, or in burrows excavated by the birds themselves (Karris *et al.* 2024). It feeds mostly at the water surface, although it also dives to capture prey. Its diet consists mainly of pelagic fish, crustaceans, and cephalopods, but the species also utilises demersal trawling discards, which consist mainly of benthopelagic species (Karris *et al.* 2018; Austad *et al.* 2025).

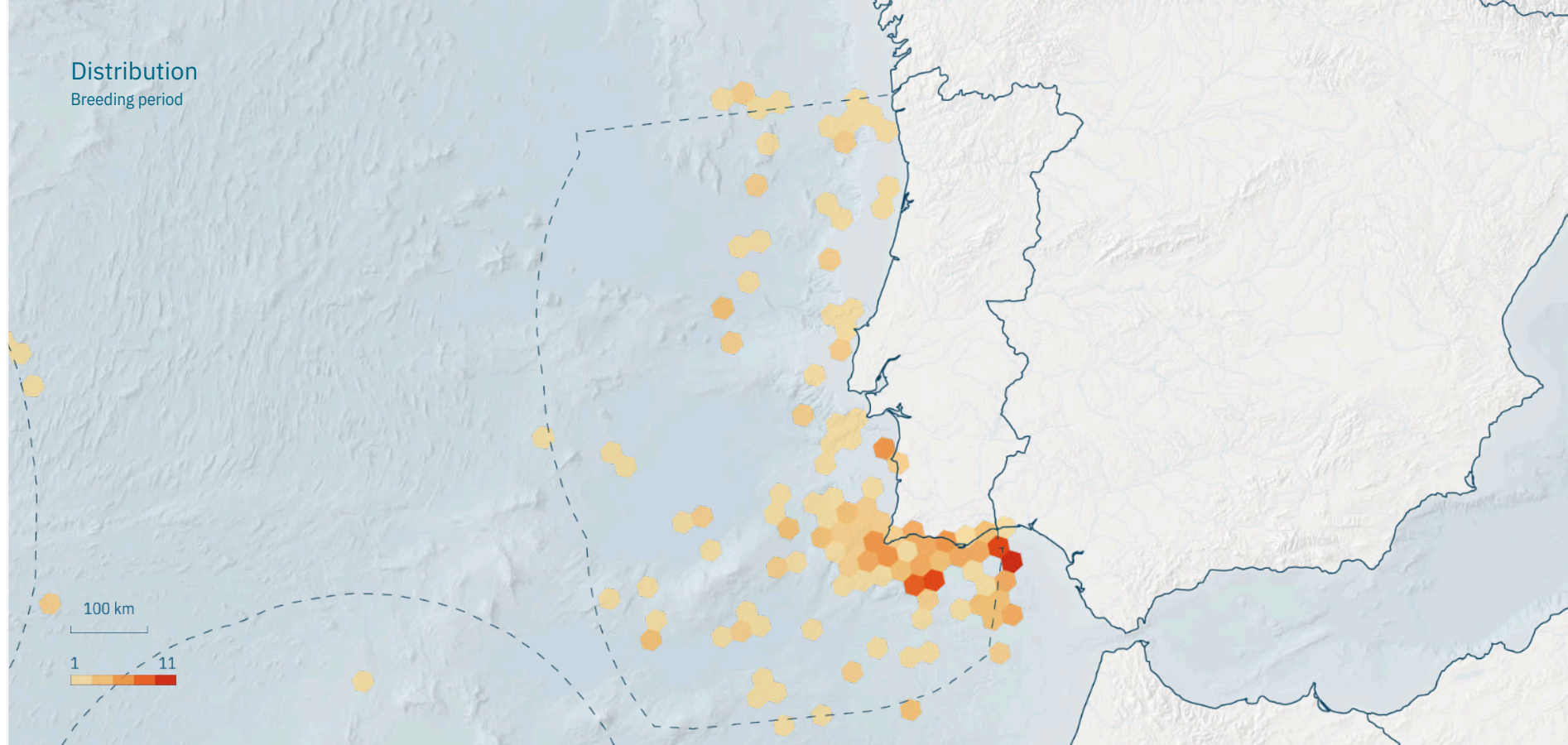
Threats and conservation

At breeding sites, invasive mammals, such as rats and feral cats, pose a significant risk of predation (Ruffino *et al.* 2009; Karris *et al.* 2024). Light pollution near colonies dazzles fledglings that have just left the nest, forcing them to ground before reaching the sea (Crymble *et al.* 2020). This increases the risk of predation, road collisions, and other hazards. The species is also exposed to bycatch in longlines and gillnets (García-Barcelona *et al.* 2010; Karris *et al.* 2013). In the marine environment, the species is exposed to pollution from inorganic and organic contaminants (Voulgaris *et al.* 2019; Michel *et al.* 2025), including plastics (van Franeker *et al.* 2026), while overfishing reduces prey availability (Arcos 2001). Finally, the species is affected by extreme weather events associated with climate change (Genovart *et al.* 2013).

Authors: Georgios Karris, Letizia Campioni
Owners/sources of tracking data: Arcos 2007, Arcos 2011, David Gremillet & Nicolas Courbin (OrnitEOF, MigraLion, PGL)

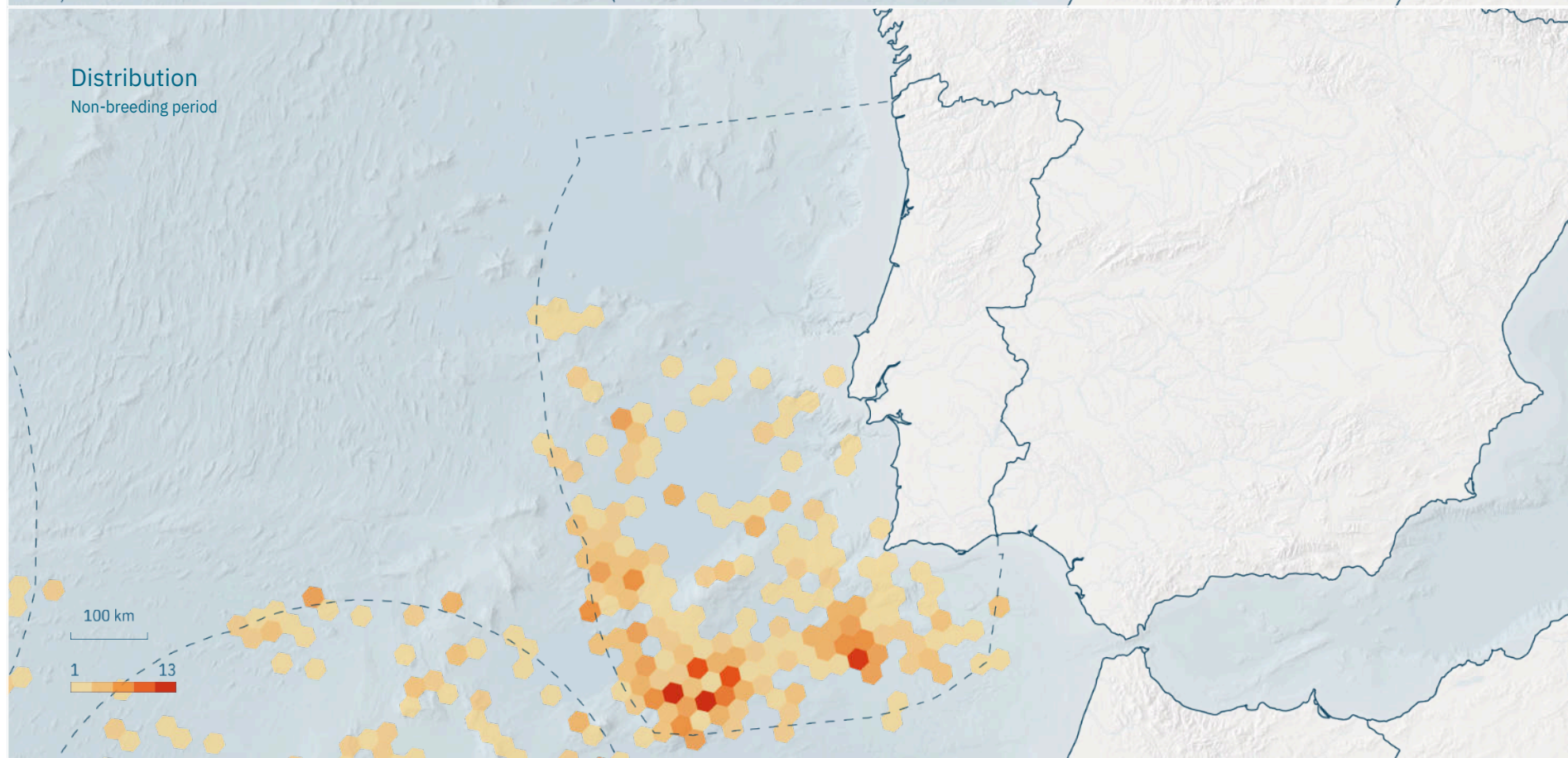
Distribution

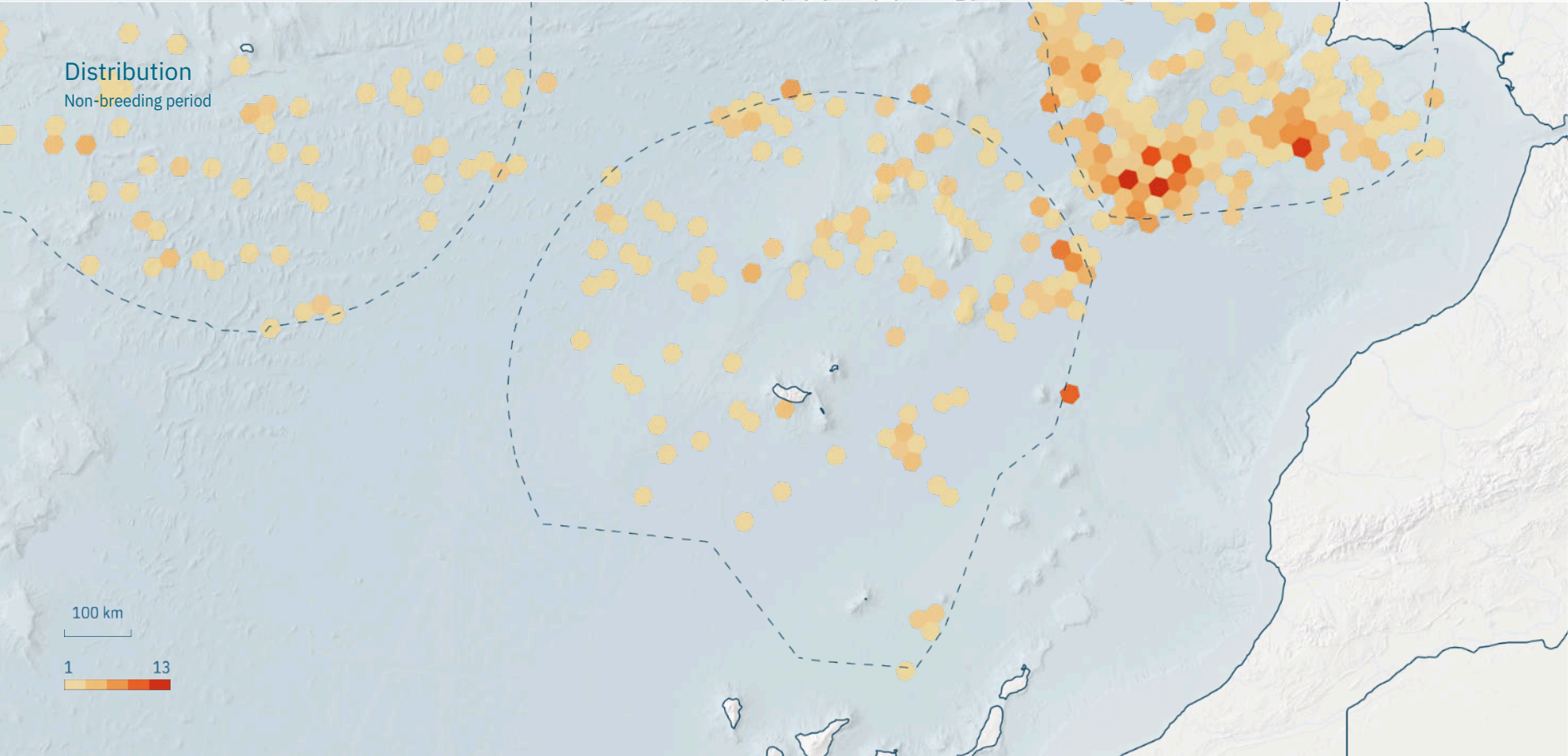
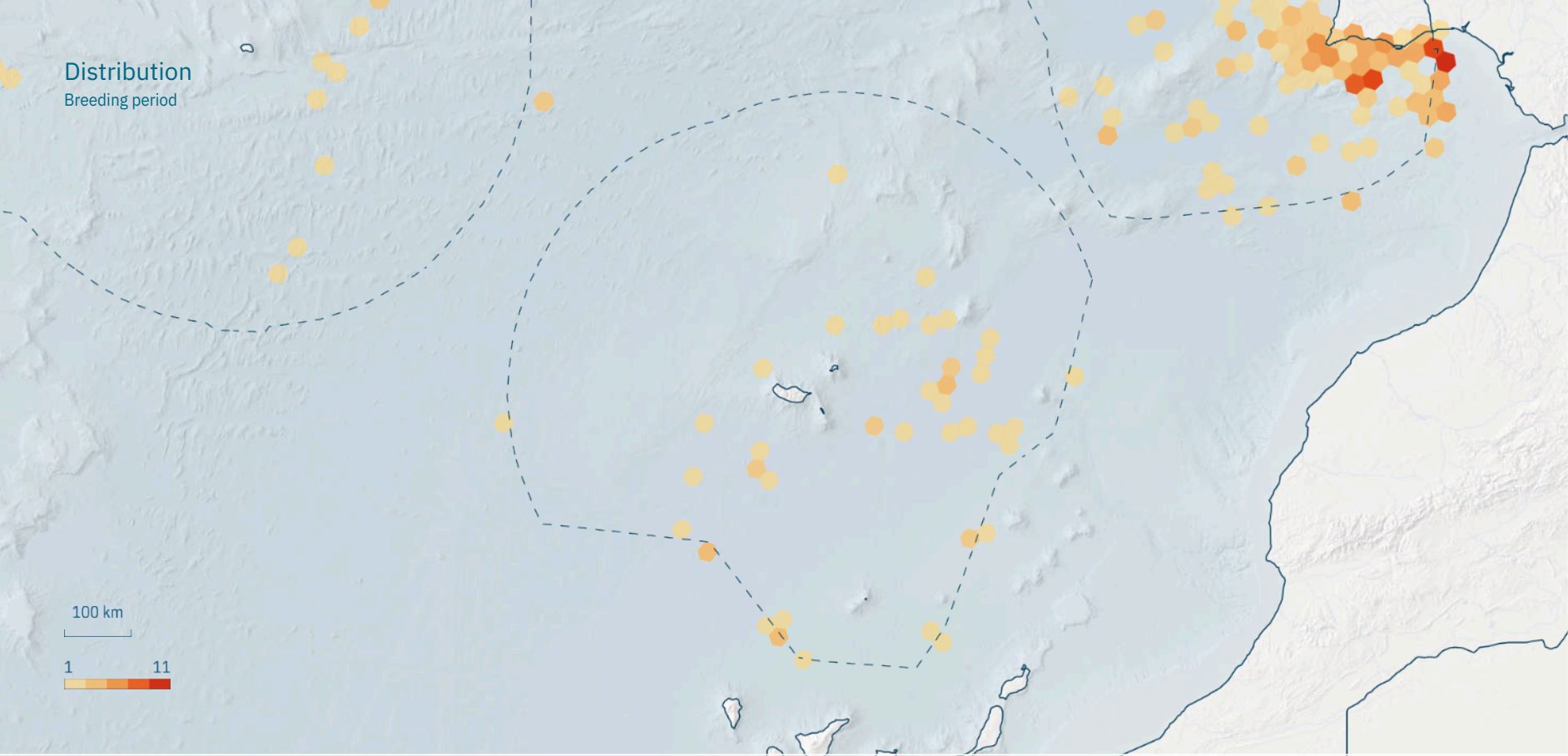
Breeding period



Distribution

Non-breeding period





Distribution

Breeding period



Distribution

Non-breeding period



Cory's Shearwater

Calonectris borealis

Phenology		Conservation status			
Mainland	Summer breeder	Mainland	Madeira	Azores	UICN Global
Madeira	Summer breeder	EN	LC	LC	LC
Azores	Summer breeder				



Distribution, movements and phenology

The Cory's Shearwater breeds in Portugal and Spain, specifically in the Azores, Madeira, Berlengas, Peniche, Canary Islands, and the islets off the Galician coast (Equipa Atlas 2022; Reyes-González 2022). The breeding range in Portugal has remained stable for over a century (Equipa Atlas 2022). During the breeding season, from March to November, the Cory's Shearwater is common throughout the Portuguese EEZ, showing seasonal variations in its spatial distribution. It subsequently migrates mainly to the South Atlantic, although part of the population remains in the North Atlantic or reaches the Indian Ocean (Catry *et al.* 2011a; Dias *et al.* 2011).

The Cory's Shearwater is one of the species whose movements have been most extensively studied. Based on the individual tracking of 529 birds from Azores, Madeira, the Berlengas and the Canary Islands, fitted with GPS and PTT devices, extensive use of the Portuguese EEZ during the breeding season is noted. Activity is concentrated both in the immediate vicinity of the colonies and in more distant areas, confirming the known distribution (Meirinho *et al.* 2014), although in the Azores it may be biased by the greater monitoring of birds from Corvo Island.

Abundance and population trends

The global population has been estimated at between 252,000 and 253,000 pairs, with an unknown trend (BirdLife International 2025). In Portugal, there is no current information for most colonies, with a few exceptions. In the Berlengas, the population has been estimated at 550 to 800 pairs (Equipa Atlas 2022). In the Azores, recent estimates are limited to a few islets with few hundreds of pairs, namely on Vila, Vila Franca do Campo, Praia and Baixo (Atchoi 2021; (Pipa & Silva 2021; Pipa *et al.* 2026). On Selvagem Grande (Madeira), 38,830 pairs were estimated (Catry *et al.* 2025).

The assessment of environmental status indicates that the species has not achieved Good Environmental Status, either in terms of the breeding success of the Mainland or for both indicators in the Azores. On the other hand, Selvagem Grande recorded an annual growth rate of 1.45% between 2009 and 2023 (Catry *et al.* 2025). This population appears to be recovering from the extensive hunting in the 1970s (Zino 1985), having achieved Good Environmental Status for both indicators.

Ecology and habitat

The Cory's Shearwater is an essentially pelagic bird that inhabits a variety of habitats, including the vicinity of colonies, seamounts, slope zones and other areas of high productivity (Paiva *et al.* 2010b; Ramos *et al.* 2013b). It feeds mainly on small epipelagic fish and cephalopods, with variations between colonies (Xavier *et al.* 2011; Alonso *et al.* 2012; Paiva *et al.* 2013; Alonso *et al.* 2018; Romero *et al.* 2021). It nests in natural cavities and beneath vegetation, being very rare to find exposed nests.

Threats and conservation

Their main threats are predation by mammals introduced into breeding areas and bycatch at sea. Other relevant threats include light pollution (Fontaine *et al.* 2011) and the potential impact of marine litter (Rodríguez *et al.* 2024). Conservation priorities include bycatch mitigation (Oliveira *et al.* 2021), the eradication of introduced predators (Hervías *et al.* 2013), the installation of artificial nests (Oliveira *et al.* 2020), the reduction of light pollution and the continuation of rescue campaigns.

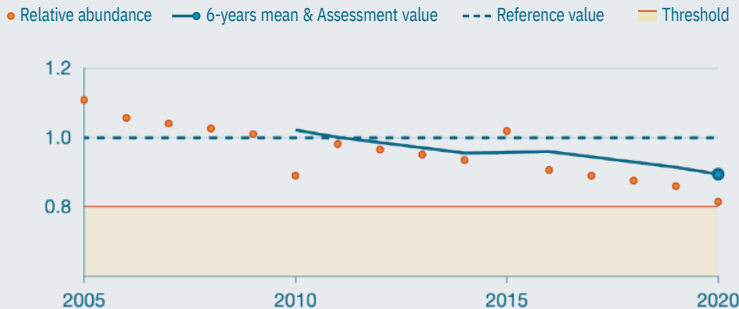
Authors: Paulo Catry, Tânia Pipa, Virginia Morera, Jose Manuel Reyes-González, Diego Vicente-Sastre, Maria P. Dias

Owners/sources of tracking data: Arcos 2006, Arcos 2010b, Catry & Granadeiro 2009, Catry & Granadeiro 2010, Catry & Granadeiro 2011, Catry & Granadeiro 2012, Catry & Granadeiro 2013, Gagliardo *et al.* 2013, Gonzalez-Solis 2015a, Gonzalez-Solis 2015b, Gonzalez-Solis 2020b, Gonzalez-Solis 2021c, Magalhães 2005, Paiva 2008, Paiva & Ramírez 2007a, Paiva & Ramos 2014a, Paiva & Ramos 2014b, Paiva & Ramos 2015a, Paiva & Ramos 2015b, Paiva & Ramos 2015c, Paiva & Ramos 2015d, Tânia Pipa (SPEA BirdLife), Tiago Dias (SPEA BirdLife)

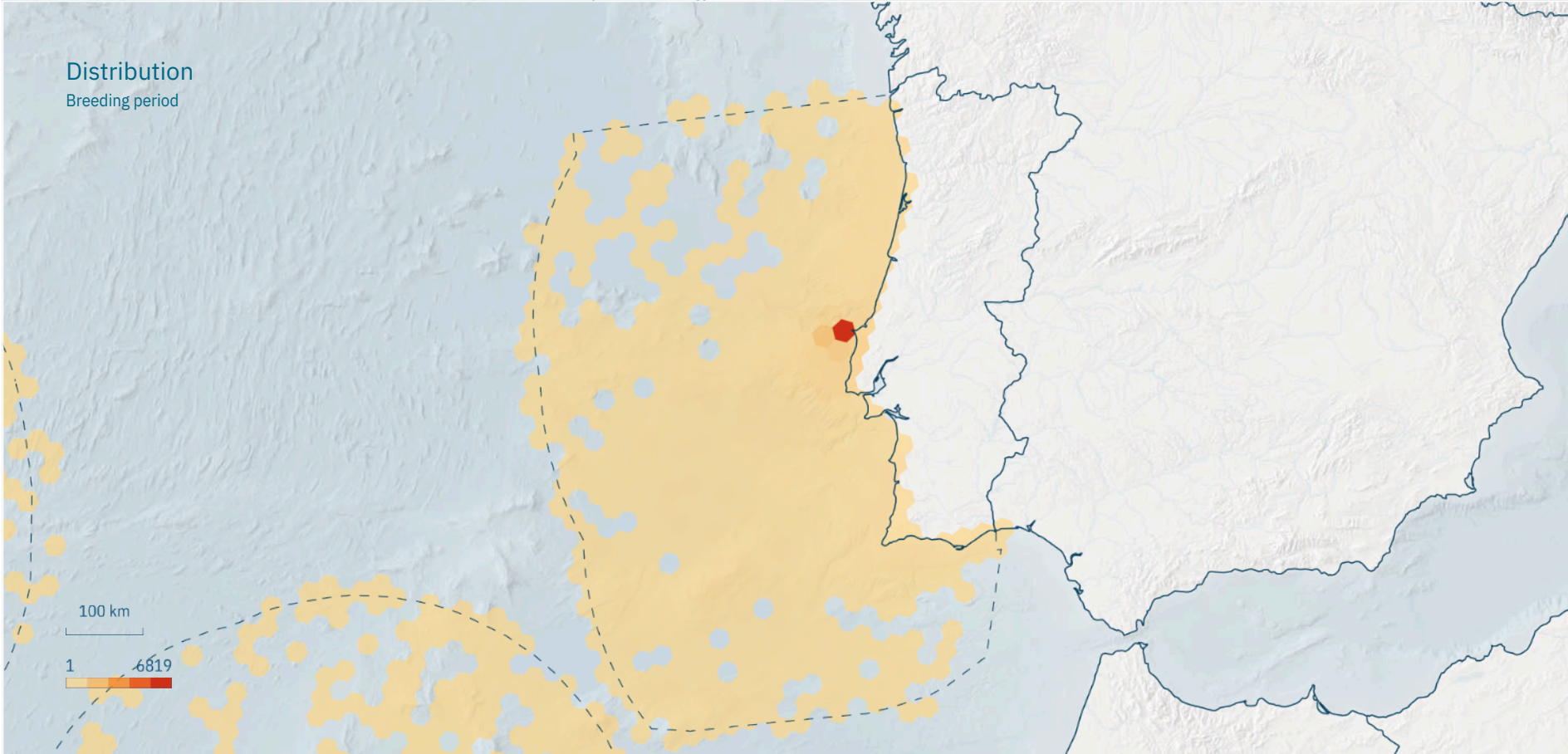
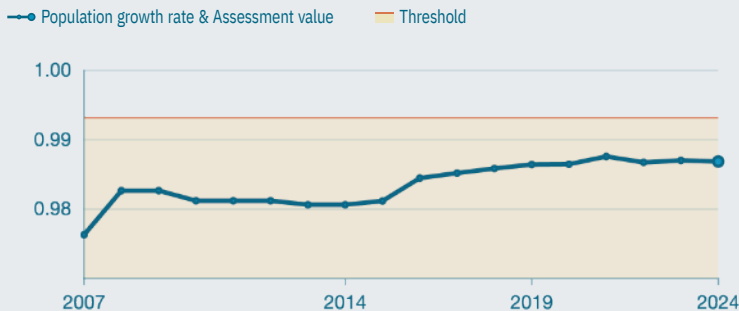
Colony(ies) of origin: Alegranza, Montaña Clara (Canary Islands, Spain), Berlengas (Mainland Portugal), Corvo, Faial, Vila, (Azores), Madeira Island, Deserta Grande, Cima, Selvagens (Madeira, Portugal) | Device: GPS, PTT
Data period / number of individuals: April-September 2007-2024 / 188 ind.



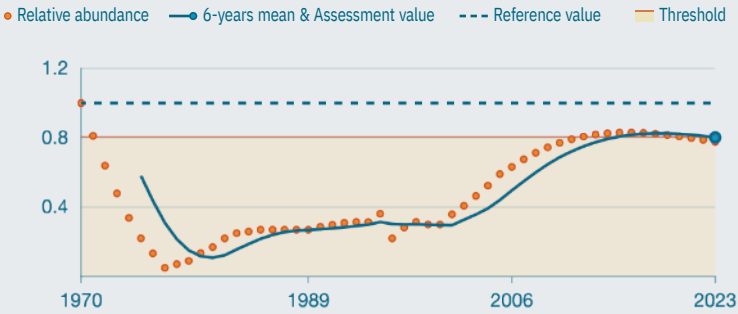
Abundance Indicator Assessment



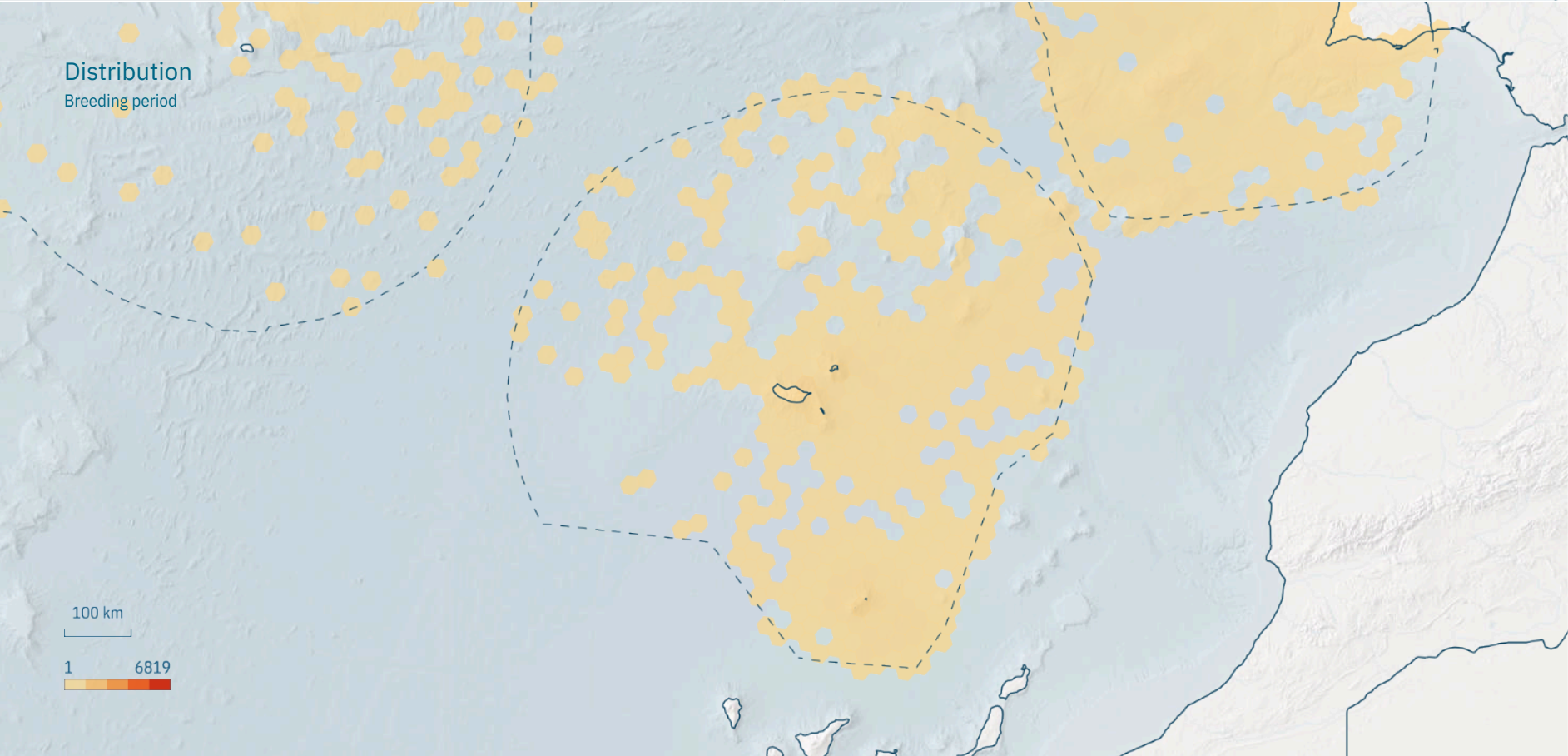
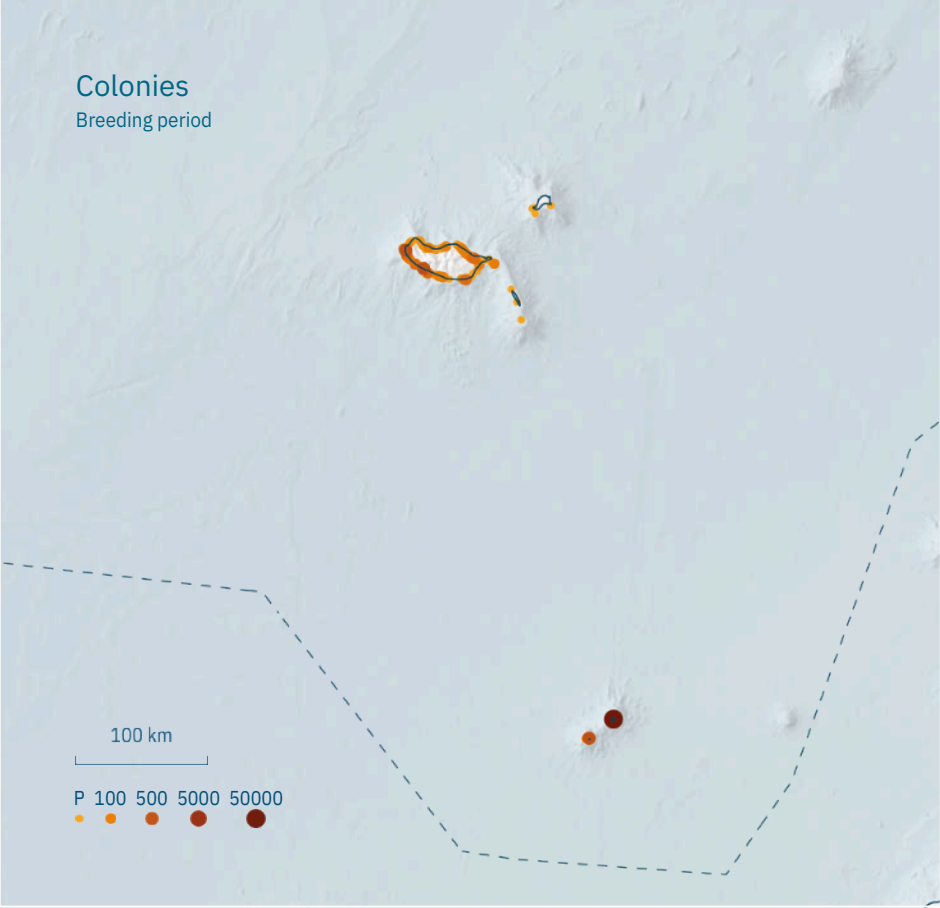
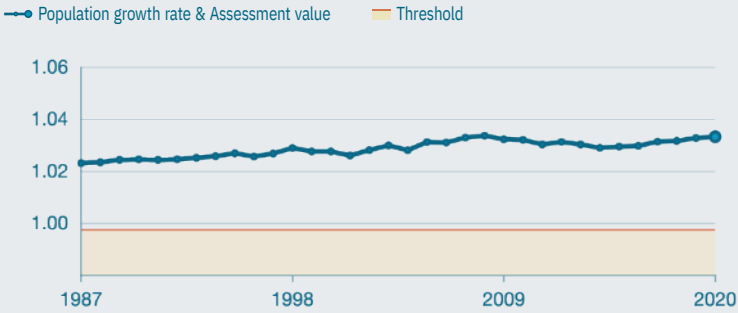
Productivity Indicator Assessment



Abundance Indicator Assessment



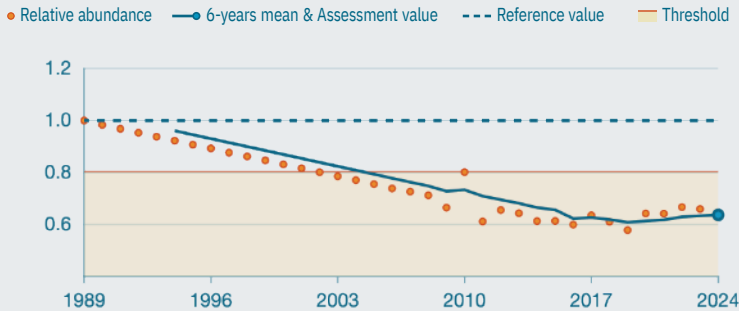
Productivity Indicator Assessment



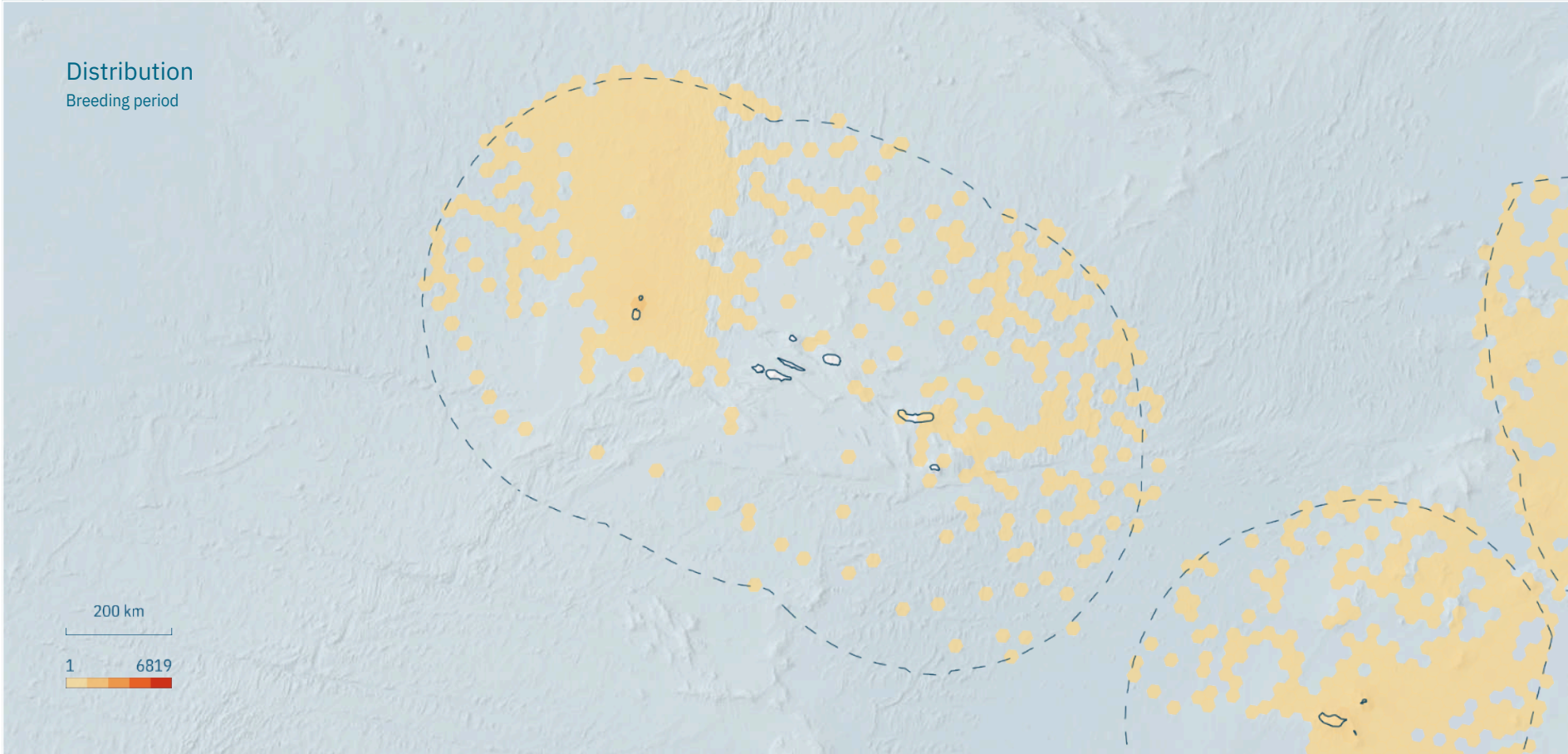
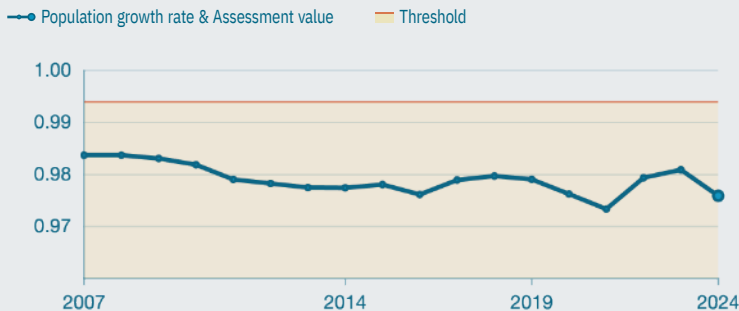
Colony(ies) of origin: Alegria, Montaña Clara (Canary Islands, Spain), Berlengas (Mainland Portugal), Corvo, Faial, Vila, (Azores), Madeira Island, Deserta Grande, Cima, Selvagens (Madeira, Portugal) | Device: GPS, PTT
Data period / number of individuals: April-November 2008-2024 / 259 ind.



Abundance Indicator Assessment



Productivity Indicator Assessment



Cape Verde Shearwater

Calonectris edwardsii

Phenology		Conservation status			
Mainland	Vagrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NA	NE	NE	NT
Azores	Passage migrant				

Distribution, movements and phenology

The Cape Verde Shearwater breeds exclusively in Cape Verde between March and November (Billerman *et al.* 2026). During the breeding season, it is mainly found in the waters between Cape Verde and the west coast of Africa, from Senegal to Mauritania . After breeding, it migrates to South America, to the waters off Brazil (González-Solís *et al.* 2009) and Uruguay, and has recently been recorded off the Atlantic coast of North America (Billerman *et al.* 2026). There are very few records of the species in the Portuguese EEZ. However, based on data from 33 birds from the island of Boavista and the islet of Raso, fitted with GLS between 2006 and 2013, the use of the Azores and Madeira sub-areas was observed throughout the breeding season, being most frequent in October and November. This latter period coincides with the final phase of feeding the chicks. The species appears to use mainly the eastern half of the Azores sub-area and the western and southern portions of the Madeira sub-area. These data suggest that the sub-area off the Mainland is not used.

Abundance and population trends

The global population was estimated at around 10,000 breeding pairs for the period 1988-1993 (Nunes & Hazevoet 2001). Although there are no more recent global estimates, the population size in the species' largest colonies (the islets of Raso and Branco) was estimated at 9,812 pairs in 2015 (Biosfera I *pers. comm.*), following the implementation of various protection measures (Semedo *et al.* 2021). However, a negative trend persists at the global population level (BirdLife International 2025).

As this is a very recently recognised species, the scarce information available regarding abundance and the limited number of records at the national level make it difficult to assess the proportion occurring in Portuguese waters. It is assumed, however, that it is a very rare species. Only three records have been submitted to the Portuguese Rarities Committee, all of them in the Madeira region (Robb *et al.* 2025). Consequently, there is no information available to assess the environmental status of the population using the Portuguese EEZ.

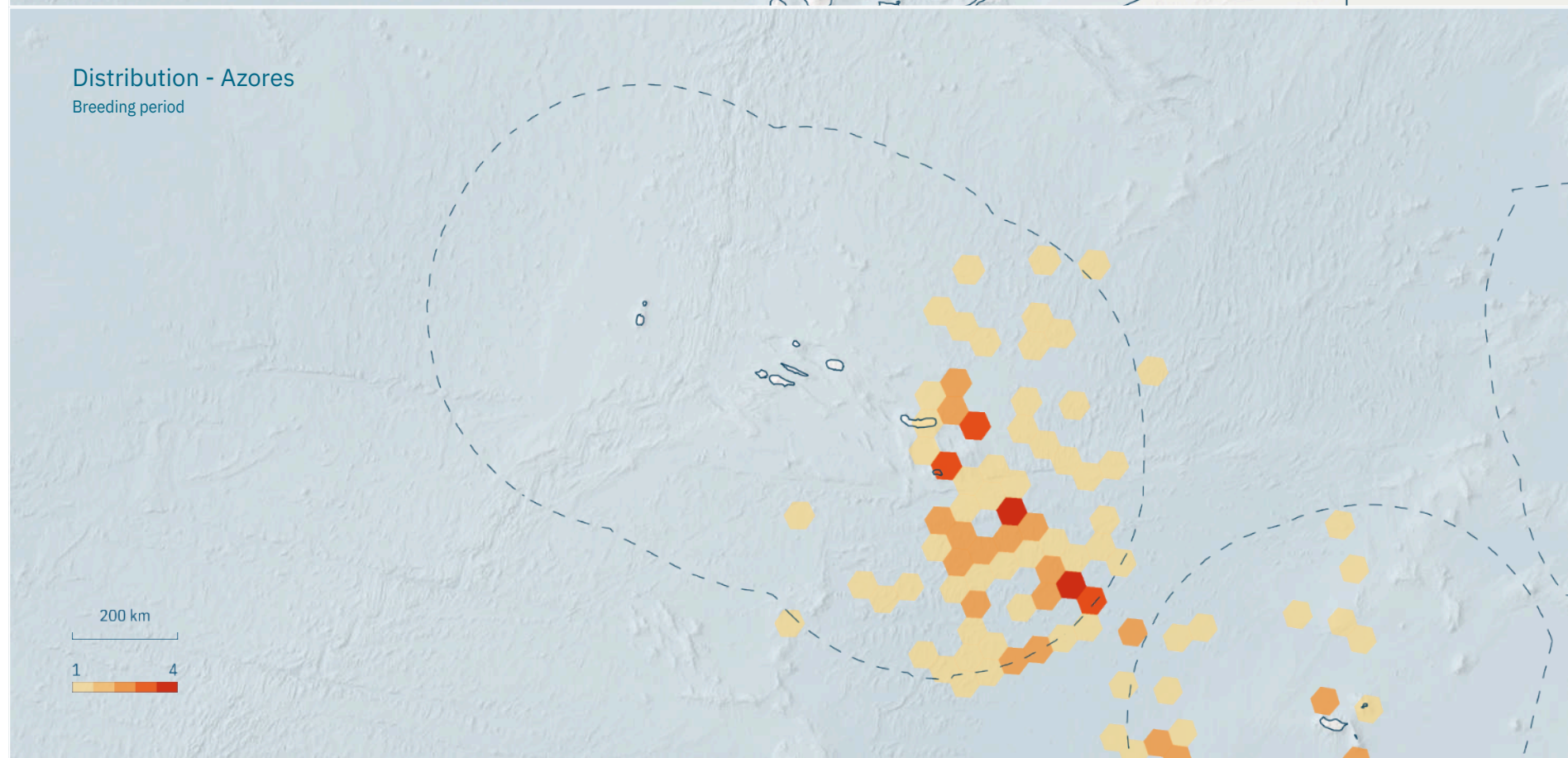
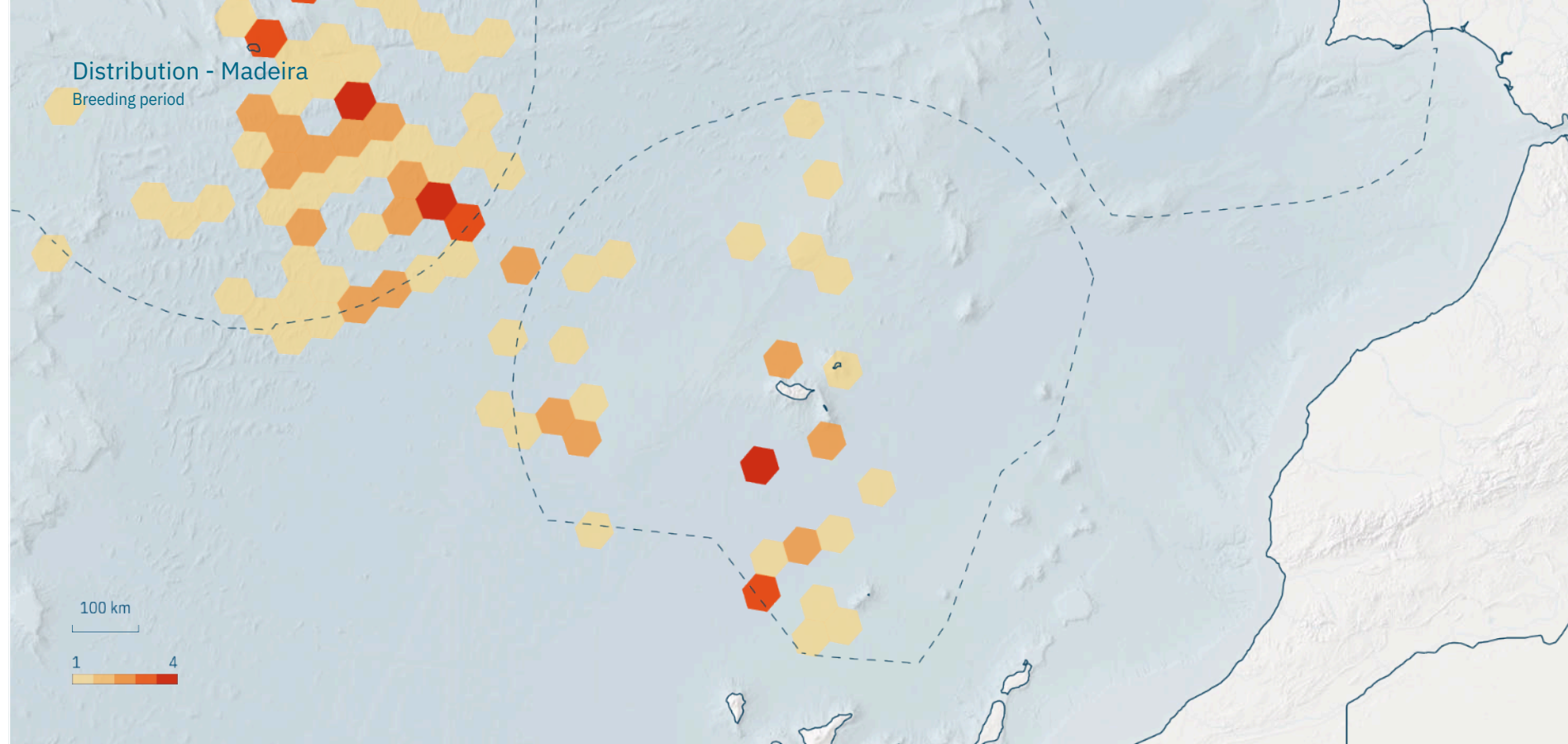


Ecology and habitat

The Cape Verde Shearwater has an ecology and diet very similar to that of the Cory's Shearwater. It is a distinctly pelagic species that feeds mainly on commercially valuable epipelagic fish and cephalopods caught at the surface or whilst diving (dos Santos *et al.* 2023; Billerman *et al.* 2026). It also frequently feeds on discards from commercial fisheries and bait used in hook fisheries. It nests in cavities in coastal cliffs and rocks, as well as under rocks (BirdLife International 2025).

Threats and conservation

The capture of non-flying juveniles has been identified as one of the main threats to this species. Although the situation appears to be under control in the two largest colonies, thanks to the legal protection of these areas, there are suspicions that capture continues to occur elsewhere (Semedo *et al.* 2021). The remaining threats on land are common to Procellariiformes species, including predation by introduced mammals or native species and light pollution. At sea, the greatest threat appears to be related to bycatch in fishing gear (Navarro-Herrero *et al.* 2025).



Manx Shearwater

Puffinus puffinus

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Summer breeder and passage migrant	NE	VU	EN	LC
Azores	Summer breeder and passage migrant				



Distribution, movements and phenology

The Manx Shearwater breeds in the North Atlantic between February and August, mainly in the United Kingdom and Ireland, with small colonies in Canada, the United States, Iceland, Spain and Portugal (Billerman *et al.* 2026). In Portugal, it breeds on the island of Madeira and on the islands of Flores and Corvo in the Azores (Equipa Atlas 2022). It has also recently been recorded on the islands of São Miguel, Santa Maria, Terceira, São Jorge and Faial, although it has not been possible to confirm breeding there. The species is most frequent and abundant in Portuguese waters during post-breeding migration, especially between August and October, when birds from the largest populations, originating from the British Isles, pass through our waters (Meirinho *et al.* 2014; Elmberg *et al.* 2020), heading towards their wintering grounds in South America (Guilford *et al.* 2009). Data from 12 birds fitted with GLS between 2006 and 2014 in Iceland show that these birds use the Azores region during both phenological periods, being particularly frequent during the breeding season. They appear to have a preference for the deep waters of the western half of the region. The species has not been recorded on the Mainland or in Madeira.

Abundance and population trends

The global population has been estimated at 680,000 to 790,000 mature birds, with an unknown trend (BirdLife International 2025). In Mainland Portugal, 16,086 birds were counted migrating southwards in autumn 2015 (Elmberg *et al.* 2020). Based on the data used for the environmental status assessment, an estimate of around 5,300 to 19,000 individuals was obtained for the continental shelf in 2024. Estimates of breeding populations in the archipelagos are very outdated and subject to a high degree of uncertainty. In the Azores, the population was estimated at 115 to 240 pairs, whilst in Madeira it was estimated at 1,250 to 5,000 pairs (Equipa Atlas 2022). The species was likely much more numerous in the Azores several centuries ago (Monteiro *et al.* 1996a).

Despite the lack of more concrete estimates, the Mainland population failed to achieve Good Environmental Status for the abundance indicator. It was not possible to carry out this assessment for the waters of the Azores and Madeira.

Ecology and habitat

Despite its typically pelagic habits, the Manx Shearwater exploits both deeper waters and areas close to the coast. It feeds on fish (mainly small pelagic species), cephalopods and crustaceans, as well as fishing discards (Billerman *et al.* 2026). In Madeira, it nests on cliffs in the interior of the island, above 500 metres in altitude, in areas of laurel forest (Nunes *et al.* 2010), appearing to breed two months earlier than in other nesting areas (Hervias *et al.* 2013). In the Azores, and particularly on Corvo and Flores, the colonies are located on steep and inaccessible cliffs.

Threats and conservation

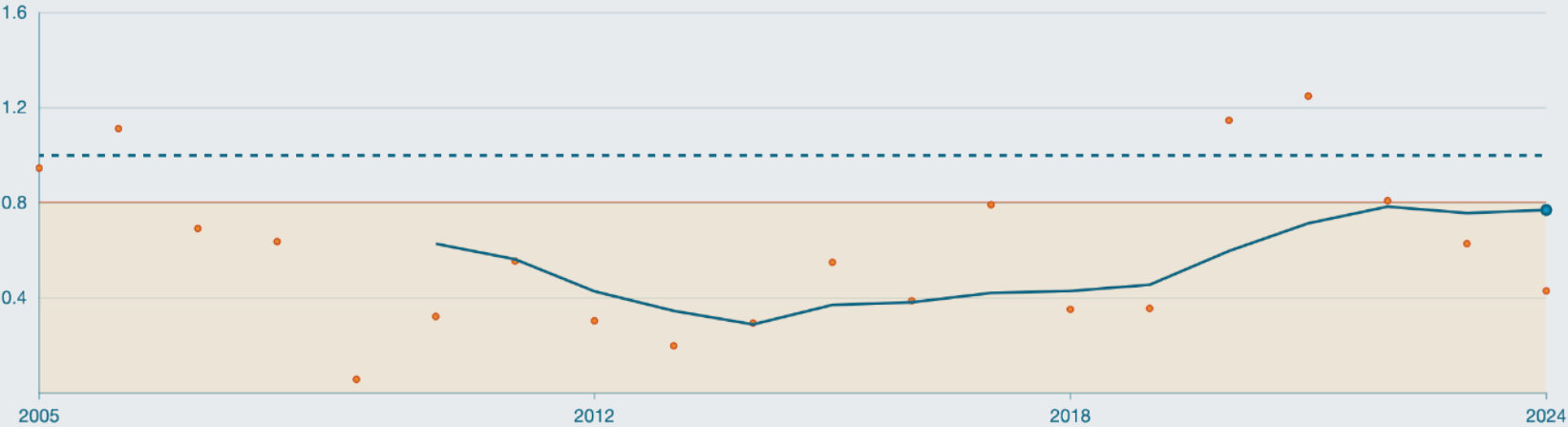
In Portugal, in the distant past, this species suffered a sharp reduction in its colonies as a result of the introduction of terrestrial predators and direct capture for the exploitation of oil, meat and feathers (Monteiro *et al.* 1999; Oliveira 1999). Currently, the most significant threat remains the presence of introduced predators in breeding areas. Light pollution is also a major threat. When fledglings leave their nests, they are dazzled and forced to ground, leaving them vulnerable to collision with vehicles or predation by dogs, cats and other mammals. Between 2009 and 2025, 125 fledglings were rescued on the island of Corvo, having become disoriented by street lighting.

Author: Tânia Pipa
Owners/sources of tracking data: Gonzalez-Solis 2014b

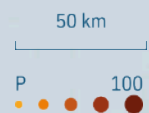
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

Mainland

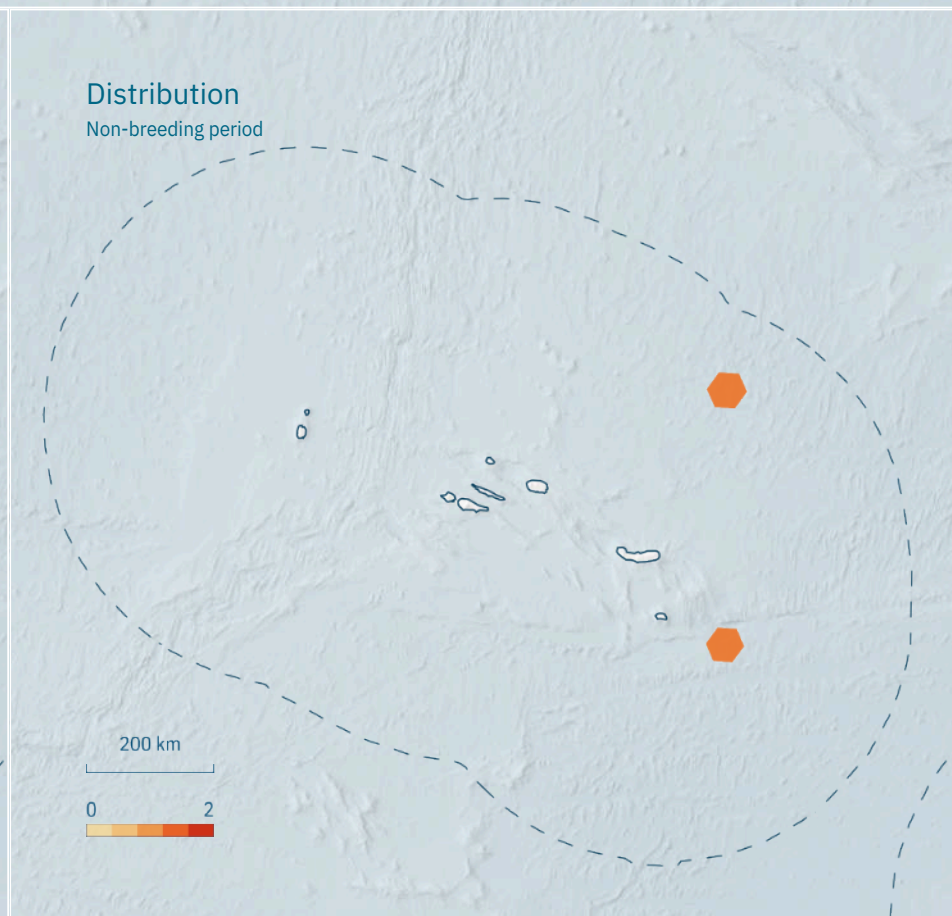
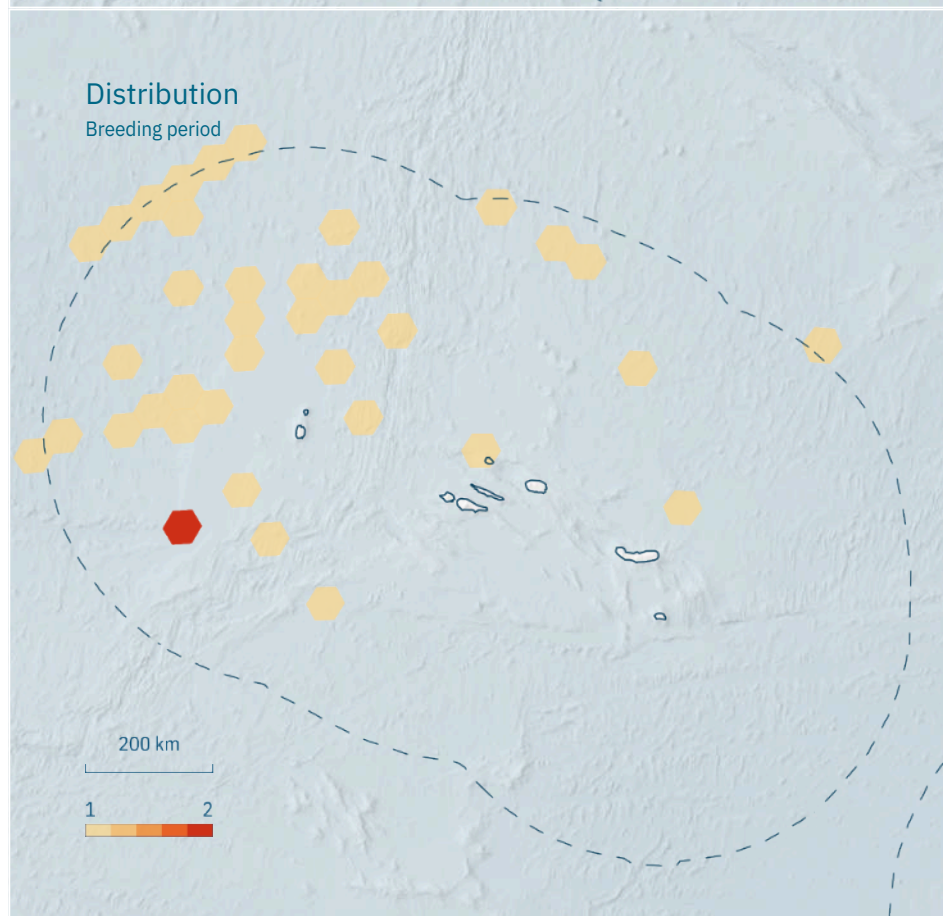


Colonies
Breeding period



Madeira

This figure shows a north arrow pointing upwards, labeled with 'N'. Below the north arrow is a small outline of the island of Madeira, which is the subject of the map.



Yelkouan Shearwater

Puffinus yelkouan

Phenology		Conservation status			
Mainland	Vagrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	NA	NA	NA	VU
Azores	Vagrant				



Distribution, movements and phenology

The Yelkouan Shearwater is a predominantly Mediterranean species, with breeding colonies concentrated on islands and coastal cliffs in the central and eastern Mediterranean, including the archipelagos of Malta, Corsica, Sardinia, Sicily, various islands in the Adriatic Sea and coastal areas of Greece and Turkey (Bourgeois & Vidal 2008; Borg *et al.* 2010). It arrives at the colonies from February onwards, beginning to lay eggs in March/April. The fledglings leave the nests in July (Raine *et al.* 2013). During the non-breeding season, the population exhibits varied movements. Some birds migrate to the Black Sea, whilst others remain near the breeding colonies or disperse across the Western and Central Mediterranean, with occasional sightings in the eastern Atlantic, including Portuguese waters (Militão *et al.* 2013; Péron *et al.* 2013; Raine *et al.* 2013). Individual tracking of birds visiting our waters remains very limited. Based on data from eight birds fitted with GLS tags in France in 2006, it was found that only two birds used the Portuguese EEZ. These visits were very sporadic and occurred in the Mainland and Azores regions during the breeding season.

Abundance and population trends

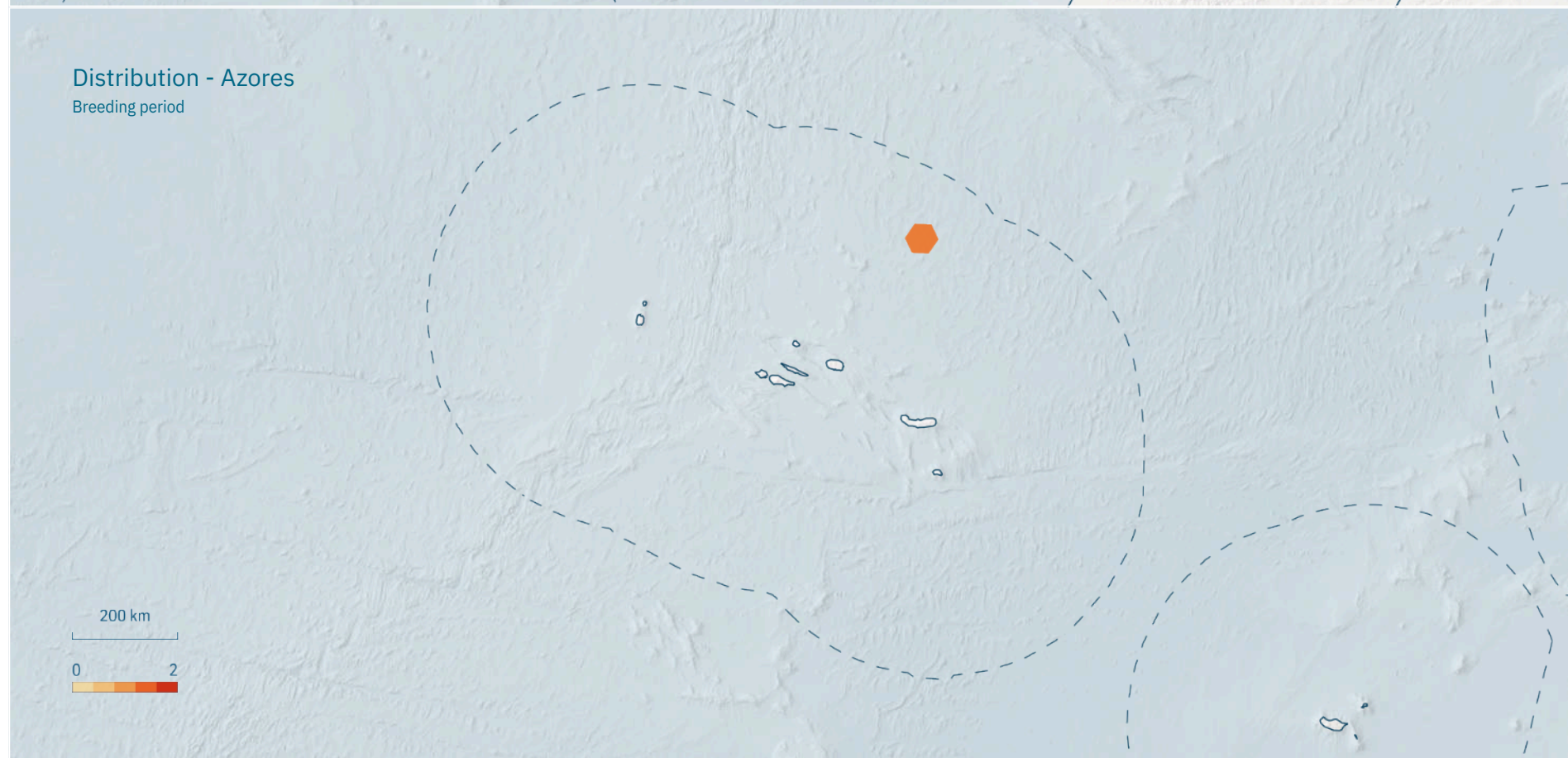
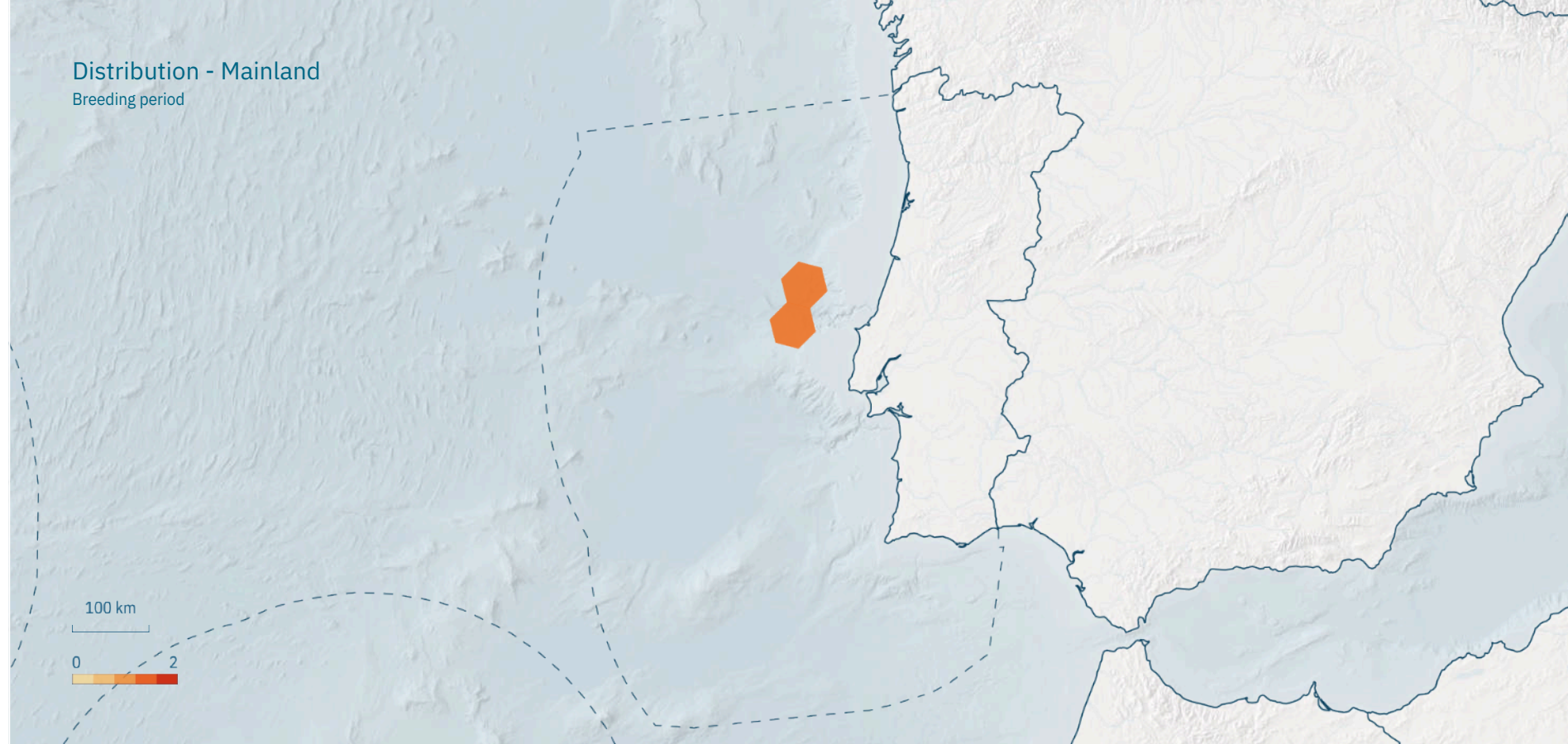
Recent estimates indicate a global population of between 15,000 and 30,000 pairs (BirdLife International 2025). Although population trends appear stable in certain colonies, some studies point to a moderate global decline over the last decade (Oppel *et al.* 2011; Sultana *et al.* 2011). In Portuguese waters, the species occurs only sporadically, with few records, mainly during post-breeding (May–June) and pre-breeding (September–October) migrations (eBird 2026). Recently, there has been an increase in records of the species along the Portuguese coast, possibly linked to greater observation efforts. However, the lack of systematic information regarding its abundance and population trends has prevented an assessment of the species' environmental status within the Portuguese EEZ.

Ecology and habitat

The Yelkouan Shearwater is a pelagic bird, generally associated with the continental shelf. It breeds on islets and coastal cliffs, nesting in rock cavities or on the ground. Its diet consists mainly of small pelagic fish and cephalopods, with some seasonal and intercolony variation, and it may also feed on fishing discards (Bourgeois *et al.* 2011; Austad *et al.* 2025).

Threats and conservation

The main threats to this species are bycatch in fishing gear (particularly longlines and gillnets) and predation by introduced mammals in the colonies, especially cats and rats (Bonnaud *et al.* 2009; Bourgeois *et al.* 2016). Added to these threats are human disturbance and light pollution associated with tourism and the development of coastal urbanisation, as well as exposure to pollutants, including plastic and other organic contaminants (Bourgeois *et al.* 2011; Codina-García *et al.* 2013). The species is protected by several international conventions and included in regional action plans. The eradication of introduced mammals and the reduction of bycatch are the main conservation priorities (BirdLife International 2025).



Balearic Shearwater

Puffinus mauretanicus

Phenology		Conservation status			
Mainland	Summering, passage migrant and wintering	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	CR	NA	NA	CR
Azores	Vagrant				



Distribution, movements and phenology

The Balearic Shearwater breeds exclusively on the Balearic Islands (Spain). Some individuals begin arriving at the colonies as early as September, with egg-laying taking place between February and March and the fledging of juveniles in June (Ruíz & Martí 2004). During the non-breeding season, it is mainly concentrated along the Atlantic coasts of South-west Europe, particularly in the waters of Spain, Portugal and France, extending also to the South-west of the United Kingdom, South-east of Ireland, North-west of Morocco and the Western Mediterranean (Arcos *et al.* 2009; Guilford *et al.* 2012; De la Cruz *et al.* 2025). The vast majority of the global population uses Iberian coastal waters as a migratory corridor. During the post-breeding migration, which takes place in summer, a large proportion of breeding adults and juveniles move along the coast of Mainland Portugal (Ruíz & Martí 2004; Guilford *et al.* 2012). Over 50% of the global population remains in the North-central region of the country to spend the winter there, specifically in the Aveiro-Nazaré SPA (Araújo *et al.* 2022a). Some birds, likely immatures and non-breeding adults, remain in the region throughout the year. In the Azores and Madeira, its occurrence is quite rare (Meirinho *et al.* 2014).

Data from 10 birds fitted with GPS between 2000 and 2023, in the Balearic Islands and at sea off France, confirm this distribution.

Abundance and population trends

Estimates from colonies indicate a population of fewer than 3,000 pairs (Arcos *et al.* 2017), but censuses from vessels and coastal counts suggest that the global population may be around 25,000 individuals (Arcos *et al.* 2012; Arroyo *et al.* 2016). The species presents a sharp reduction in its breeding population, with a projected annual decline of about 14% (Genovart *et al.* 2016; Genovart *et al.* 2019). In Mainland Portugal, the population was estimated at 9,093 to 20,436 individuals between 2010 and 2015 (Araújo *et al.* 2022a). There are regular concentrations of several hundred birds in Portuguese waters (Catry *et al.* 2010a). The negative trend of this population, combined with the fact that it has not achieved Good Environmental Status for the abundance indicator on the Mainland, appears to be in line with the global trend. There is no up-to-date information on abundance or population trends for the Azores and Madeira.

Ecology and habitat

The Balearic Shearwater is a coastal bird that does not occur beyond the continental shelf (Ruíz & Martí 2004). It generally breeds in cavities on small islets and on cliffs. It feeds on small pelagic fish (e.g. anchovies and sardines) and cephalopods, also making use of fishing discards (Navarro *et al.* 2009). In Portugal, it has been observed feeding in large groups, including on schools of sand eels (Catry *et al.* 2010a).

Threats and conservation

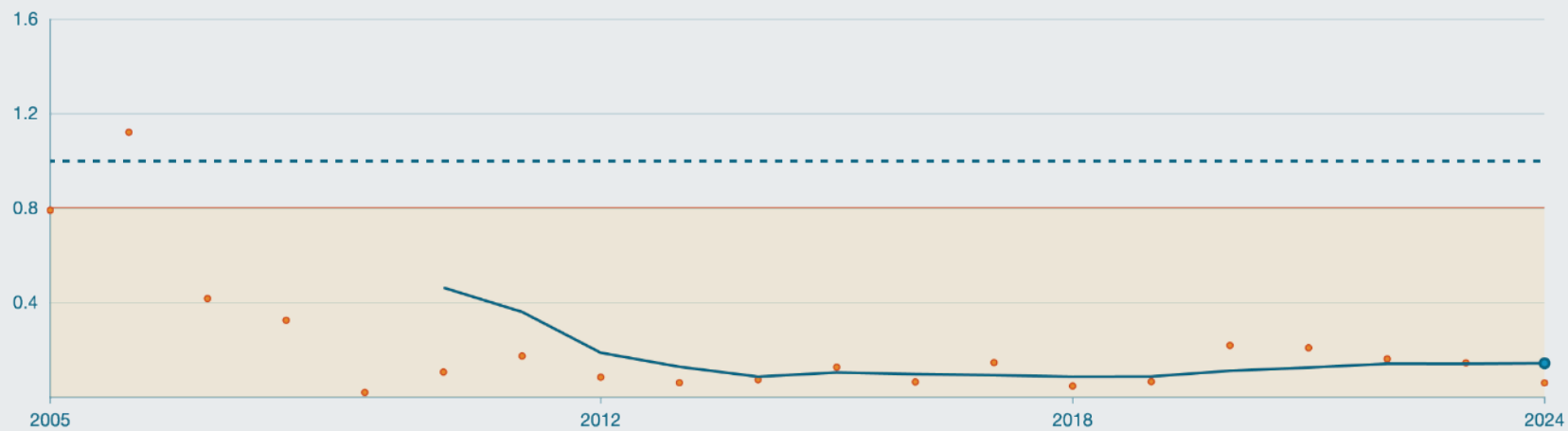
It is the most threatened seabird species in Europe. The main threats identified are predation of adults by introduced mammals (e.g. cats and rodents), disturbance from human activities, and bycatch in fishing gear, which accounts for almost 50% of mortality (Arcos 2011; Genovart *et al.* 2016). Although bycatch appears to be irregular, Balearic Shearwater bycatch events have been recorded, mainly in longlines (Arcos & Oro 2004; Cortés *et al.* 2017) and purse seines, but also in trawls and gillnets (Abelló & Esteban 2012; Oliveira *et al.* 2015), with some incidents involving over a hundred birds being caught.

Author: Ana Almeida

Owners/sources of tracking data: Arcos & Ruiz 2000a, Arcos & Ruiz 2000b, David Grémillet & Nicolas Courbin (PNA Puffin Baléares), Weimerskirch & Louzao 2012

Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold



Distribution

Non-breeding period

100 km

1 2195

Barolo Shearwater

Puffinus baroli

Phenology		Conservation status			
Mainland	Summering and wintering	Mainland	Madeira	Azores	UICN Global
Madeira	Resident	NE	VU	VU	VU
Azores	Resident				



Distribution, movements and phenology

The Barolo Shearwater occurs in the tropical and temperate waters of the North Atlantic, breeding in the archipelagos of Macaronesia. In Portugal, it breeds on islands and islets in the Azores and Madeira archipelagos between December and June (Neves *et al.* 2012; Equipa Atlas 2022). After breeding, it does not undertake large-scale migrations (Neves *et al.* 2012; Paiva *et al.* 2016; Ramos *et al.* 2020), with at least part of the population remaining in the vicinity of the colonies and even visiting them during this period (Billerman *et al.* 2026). It occurs throughout the Portuguese EEZ, with the highest density in the Madeira sub-area (Meirinho *et al.* 2014). This occurrence was confirmed by individual tracking data from 27 birds fitted with GLS devices, originating from colonies in Madeira and the Azores, indicating extensive use of all sub-areas of the EEZ, both during the breeding and non-breeding periods. It appears to avoid only the very deep waters of the westernmost part of the Azores sub-area.

Abundance and population trends

In Portugal, the population has been estimated at between 2,407 and 5,578 pairs (Equipa Atlas 2022), which is thought to account for over 83% of the global population (BirdLife International 2025). In the Azores, the species nests on several islands and islets, although not all colonies have been confirmed and there is little information on population size and trends. For the period 1996–2004, the population was estimated at between 895 and 1,741 pairs (Monteiro *et al.* 1999; Equipa Atlas 2022). Between 2018 and 2022, 23 breeding pairs were estimated on Vila Islet and 17 pairs on Praia Islet (Pipa *et al.* 2024). In the Madeira archipelago, it occurs in small numbers on the islands of Madeira, Porto Santo and the Desertas Islands, being more abundant on the Selvagens Islands. In 2013, the breeding population on Selvagem Grande was estimated at 1,383 to 3,684 pairs and, on Cima Islet (Porto Santo), between 129 and 148 pairs (Isabel Fagundes *pers. comm.*). These figures, compared with the previous census on Selvagem Grande (Oliveira & Moniz 1995; Moniz *et al.* 1997), suggest a decrease of between 24.7% and 32.6% over 20 years. Nevertheless, the lack of a minimum time series made it impossible to assess the environmental status of the Madeira population. In the Azores, however, the breeding population did not achieve Good Environmental Status for the abundance indicator.

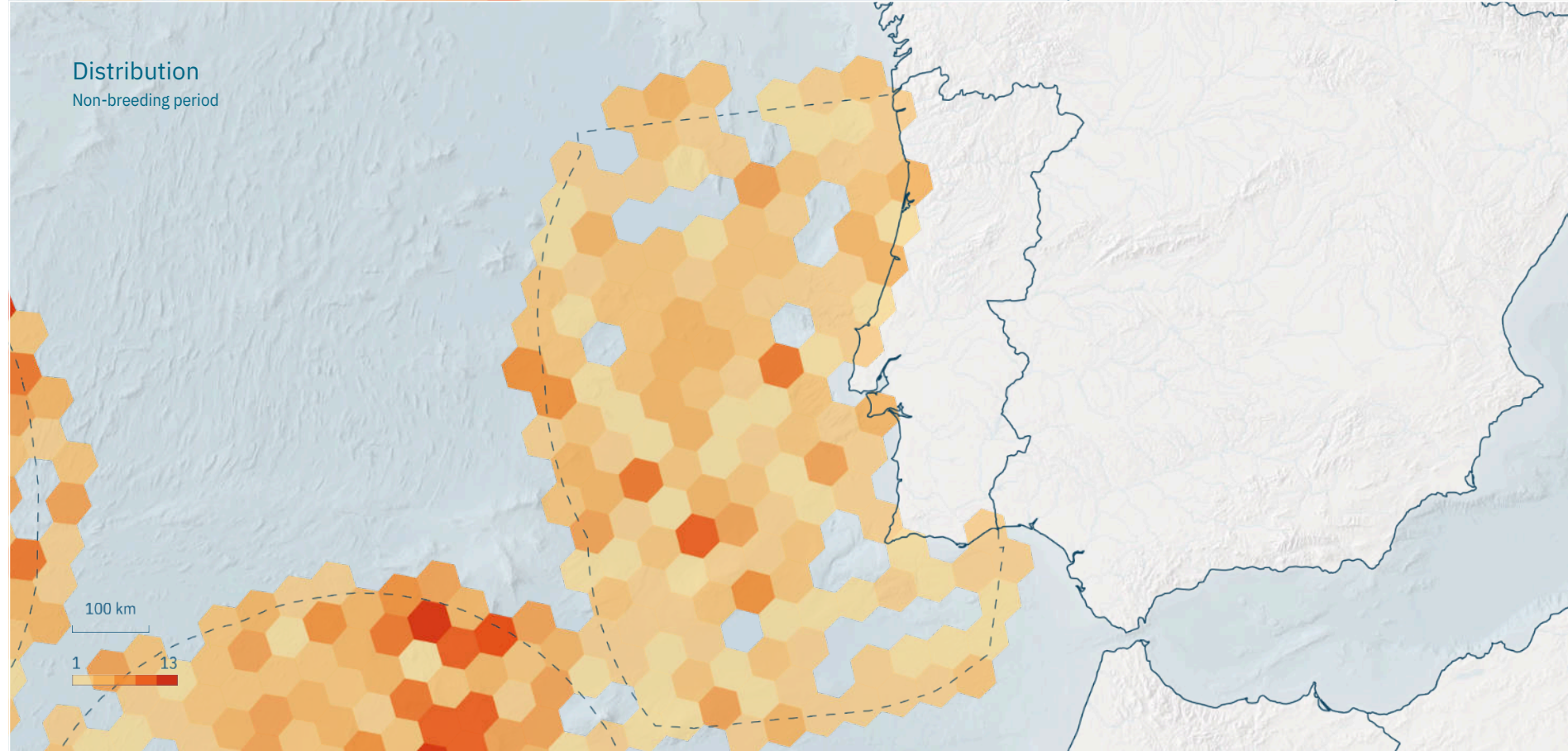
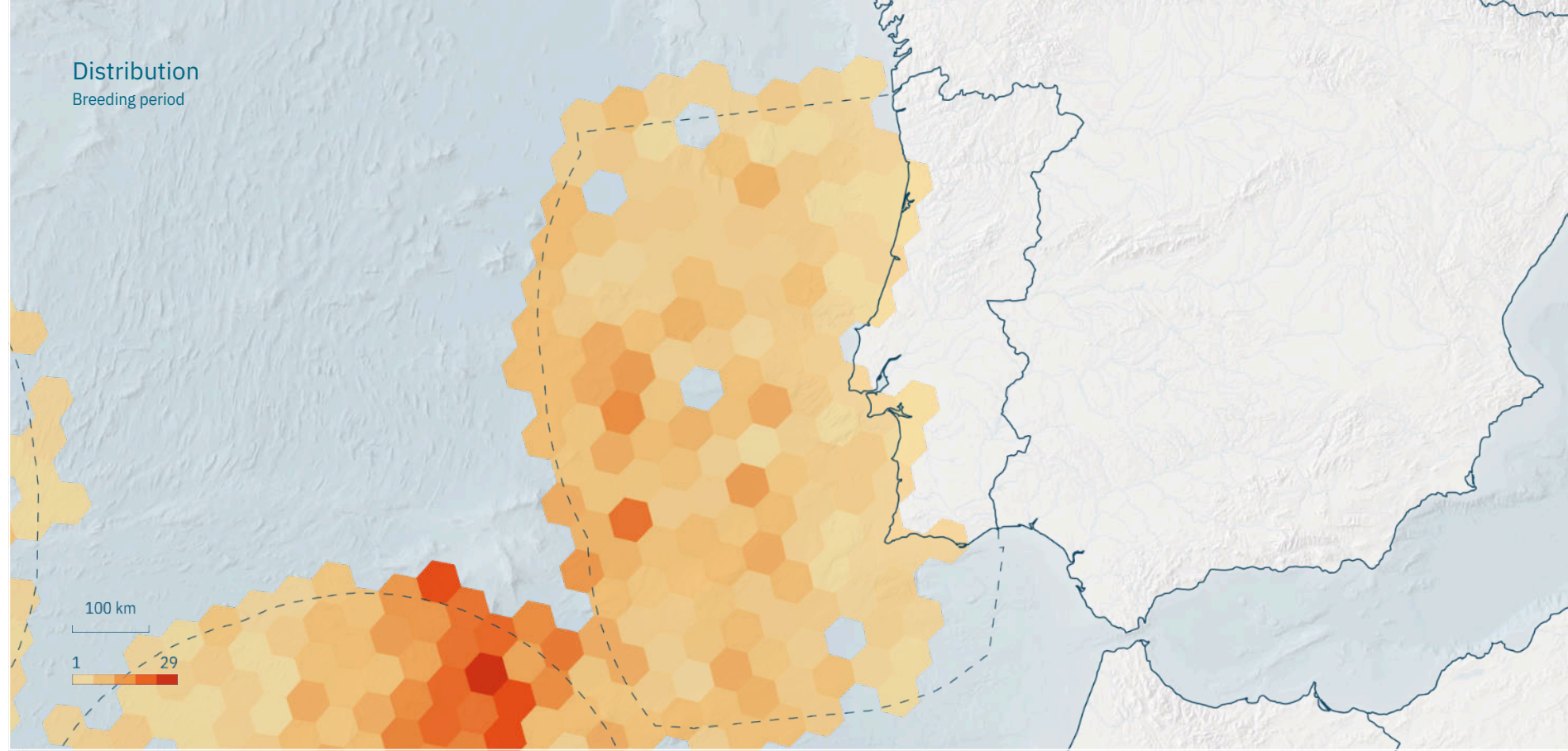
Ecology and habitat

The Barolo Shearwater is a non-migratory pelagic bird, but may disperse up to 2,500 km from its colonies (Neves *et al.* 2012). It nests in ground cavities and on inaccessible cliffs, and may share nesting areas with other seabirds. Its diet consists mainly of small cephalopods and fish, diving to an average depth of approximately 15 m (Monteiro *et al.* 1998; Neves *et al.* 2012; Ramos *et al.* 2015).

Threats and conservation

The main threats are predation by introduced mammals, reduction of nesting habitat, indigenous predators such as the Yellow-legged Gull *Larus michahellis*, light pollution and interspecific competition for nesting cavities (Monteiro *et al.* 1996a; Rodríguez *et al.* 2012). Climate change and severe weather events pose a growing threat, as the increased frequency and intensity of storms can cause changes to nesting habitat or flooding (Fagundes *et al.* 2016). Furthermore, climate change may alter oceanographic conditions, potentially leading to a decline in prey abundance (Ramos *et al.* 2015a).

Authors: Isabel Fagundes, Tânia Pipa, Zuzana Zajkova, Verónica Neves
Owners/sources of tracking data: Neves & Gonzalez-Solis 2008, Paiva 2013, Paiva 2014



Colonies

Breeding period



Distribution

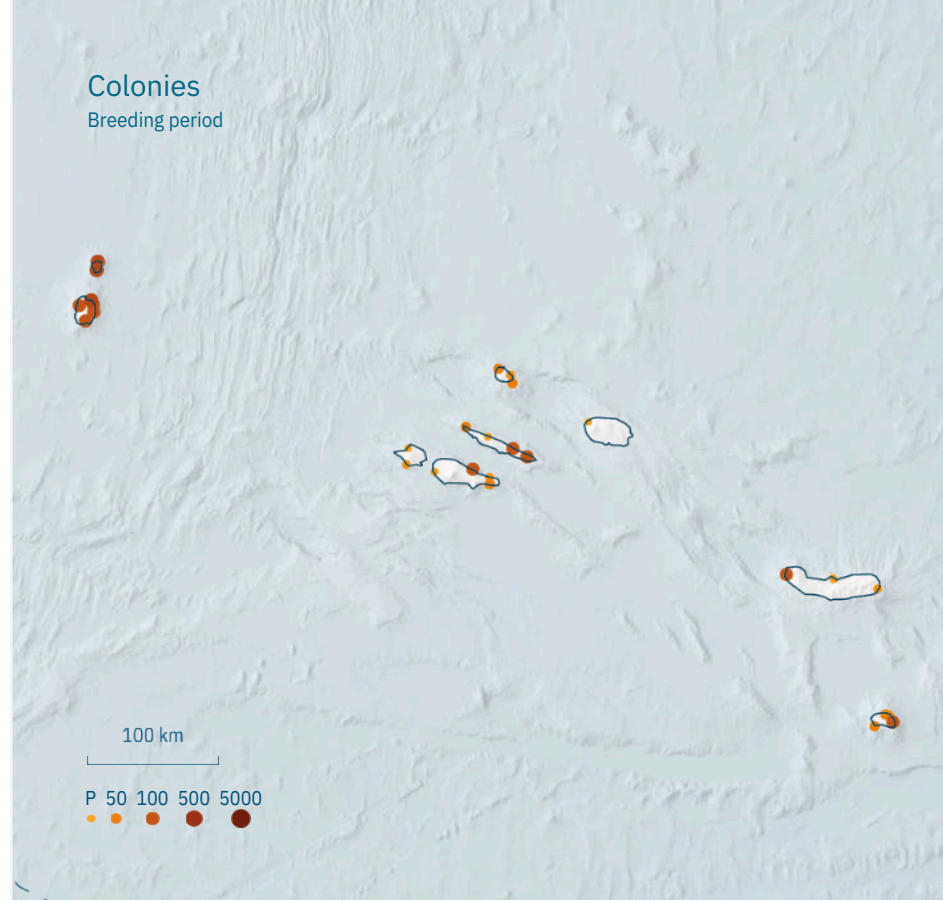
Breeding period



Distribution

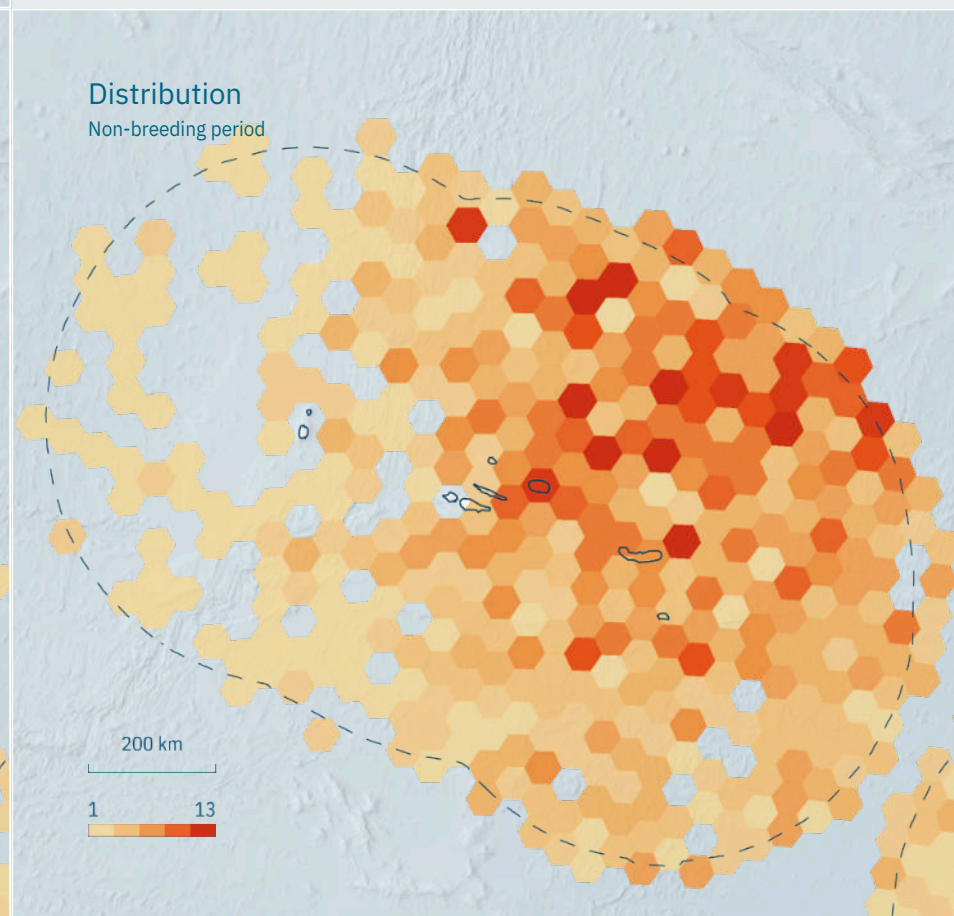
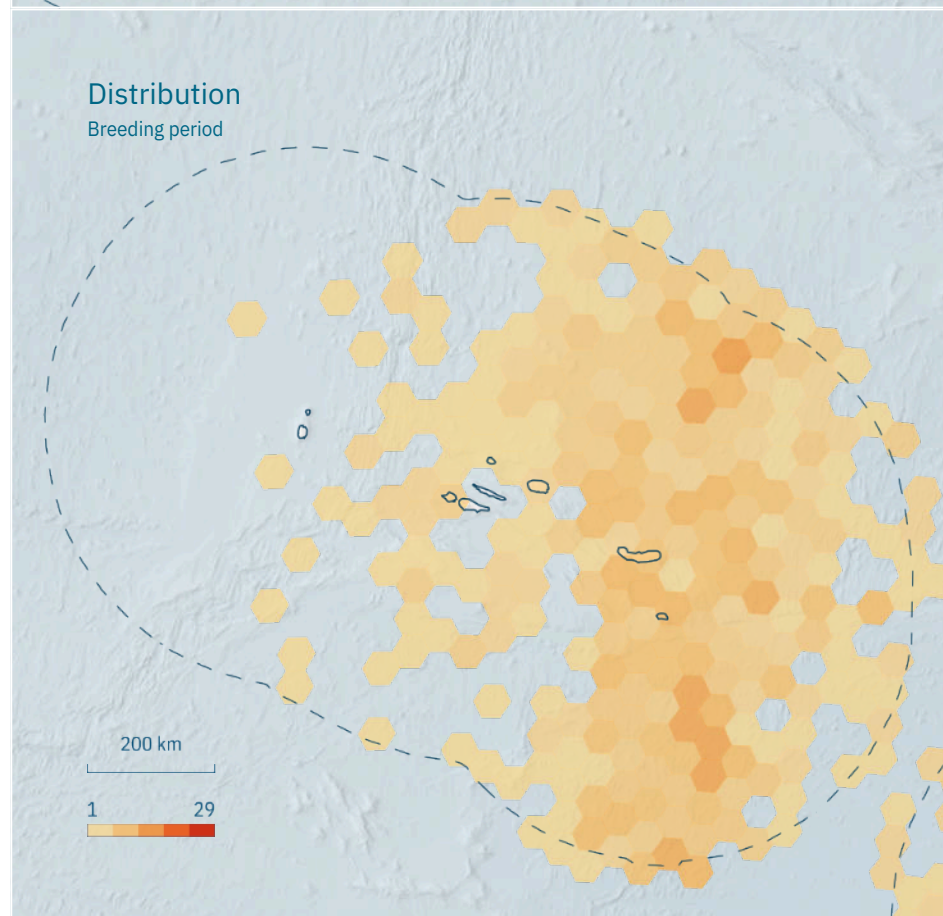
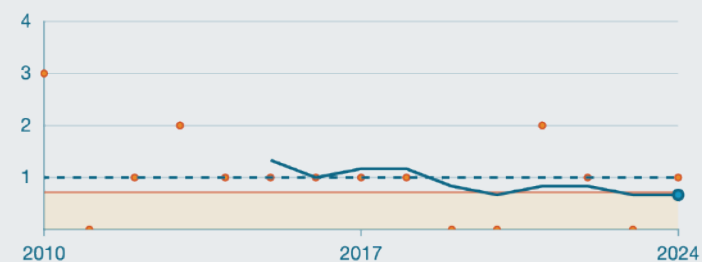
Non-breeding period





Abundance Indicator Assessment

● Relative abundance — 6-years mean & Assessment value - - - Reference value ■ Threshold



Boyd's Shearwater

Puffinus boydi

Phenology		Conservation status			
Mainland	Absent	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	NA	NA	NA	VU
Azores	Vagrant				



Distribution, movements and phenology

The Boyd's Shearwater breeds exclusively in the Cape Verde archipelago between December and May. Its colonies are distributed across the islands of Santo Antão, São Vicente, Branco, Raso, São Nicolau, Rombos, Brava, Fogo and Santiago, and the islets of Branco and Raso (Billerman *et al.* 2026). After breeding, it migrates mainly to the waters of the Central Atlantic, with some birds reaching the more coastal waters of northern Brazil (Zajková *et al.* 2017). There are records of some individuals occasionally visiting the colonies of the Barolo Shearwater *Puffinus baroli* in the Canary Islands. The fact that the species was recognised only very recently, combined with the difficulty of distinguishing it from its congener, the Barolo Shearwater, based solely on morphological characteristics, may explain the lack of records of its occurrence in Portuguese waters.

Based on data from 19 birds fitted with GLS between 2007 and 2013, the species was observed in the Azores and Madeira sub-areas of the Portuguese EEZ, mainly in the waters between the islands of the central Azores group and the island of Madeira. This area appears to be used more intensively during the non-breeding season.

Abundance and population trends

The species was recognised only very recently, and there are currently no estimates of its global population size. In the late 1980s and early 1990s, it was estimated that several thousand breeding pairs were nesting in Cape Verde. During that period, it likely occupied several islands and islets, with confirmed breeding or evidence of breeding on multiple islands (Gill & Donsker 2019). Currently, the population appears to be moderately stable, although there is a high degree of uncertainty due to the lack of systematic monitoring and the small size of the colonies. The absence of data prevents the assessment of robust population trends, and it has therefore not been possible to assess the environmental status of this population within the Portuguese EEZ.

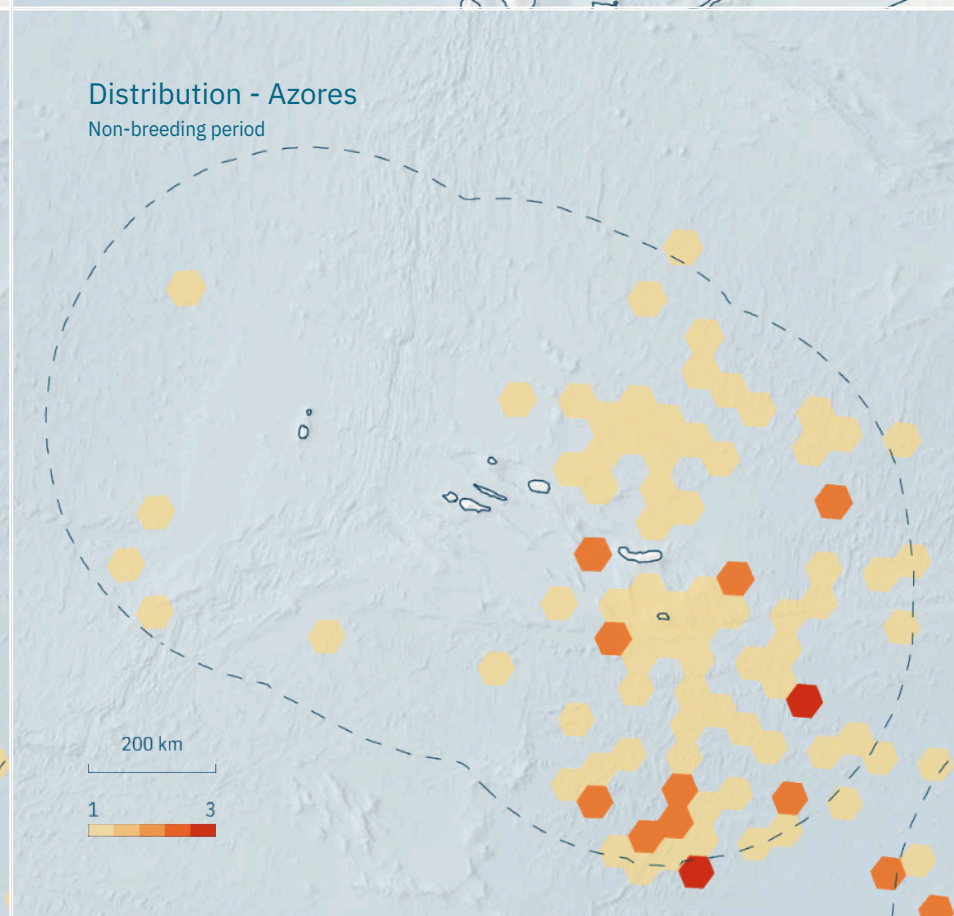
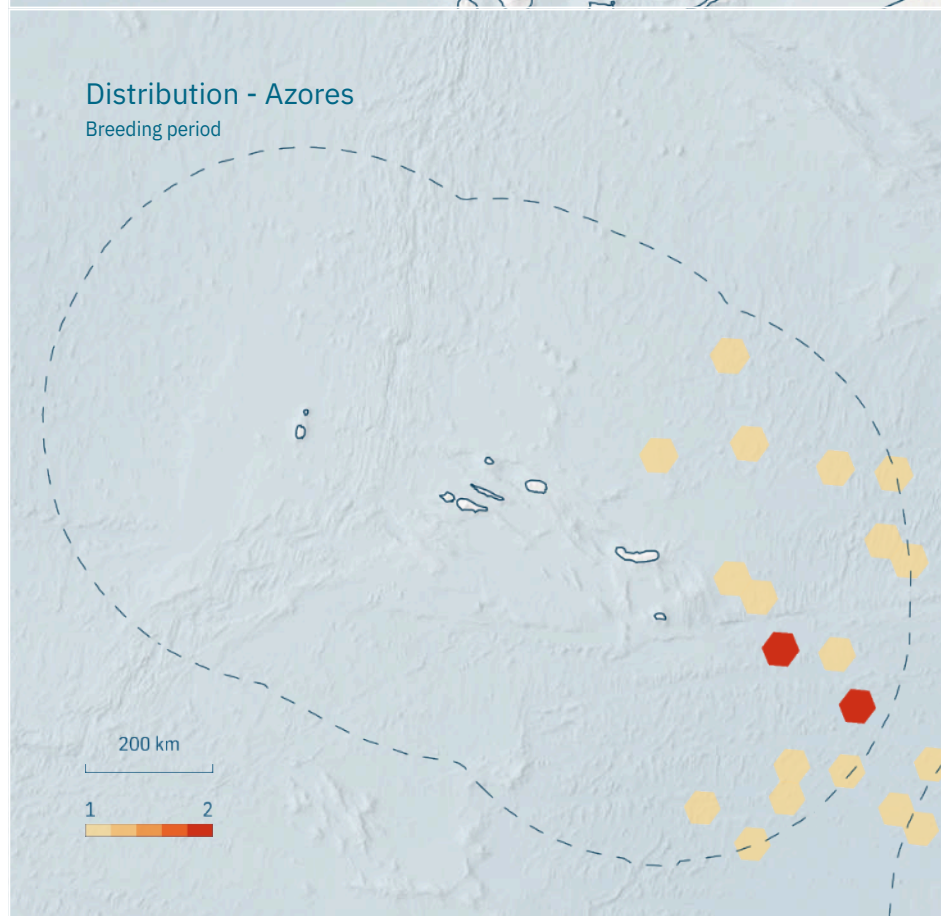
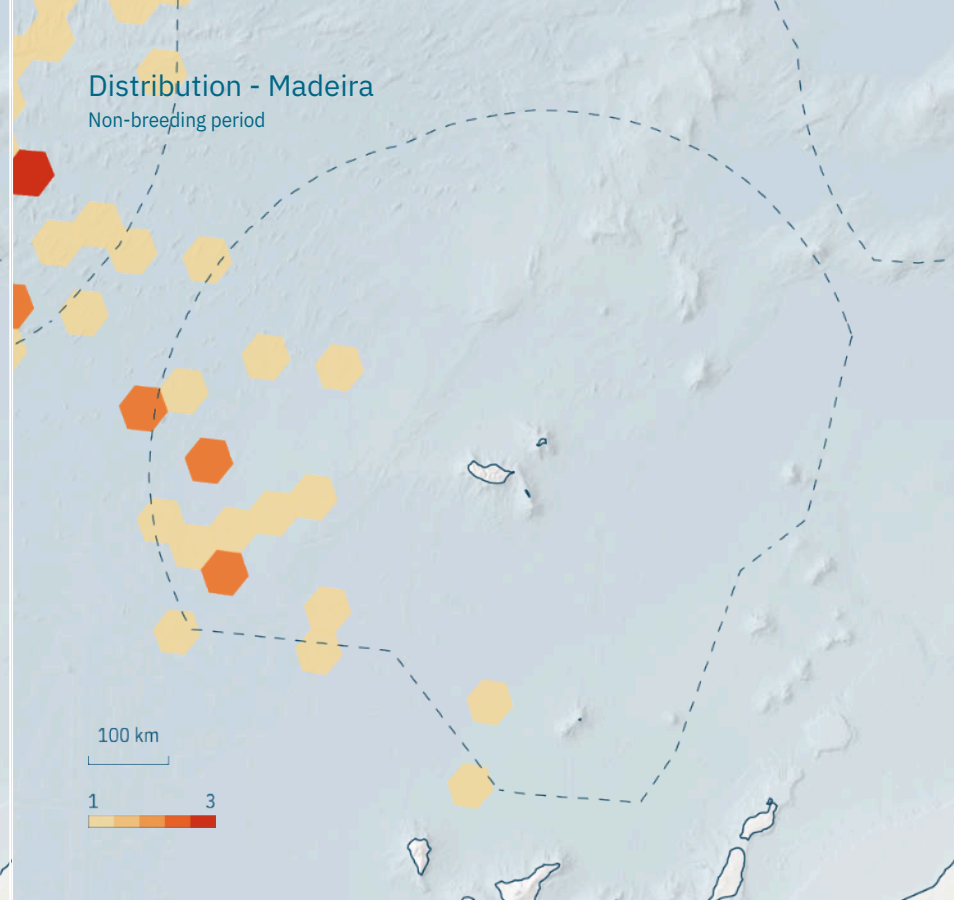
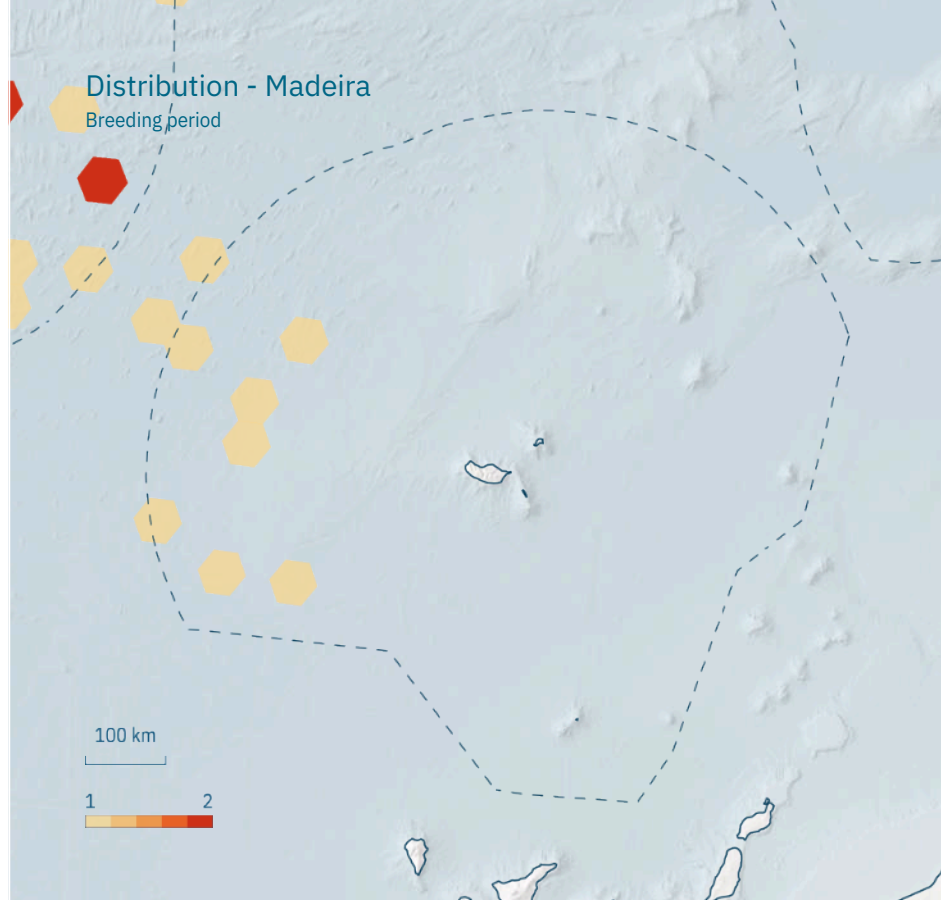
Ecology and habitat

The Boyd's Shearwater is a coastal and pelagic species that nests on islets and rocky slopes on some islands. It feeds mainly in relatively productive waters near the islands, using shallow-diving strategies. The diet consists mainly of small fish and cephalopods, and is dependent on local oceanographic conditions (Zajková *et al.* 2017).

Threats and conservation

The species has historically been exploited through the capture of adults and eggs, a pressure that still persists locally. Although its wide distribution across the Cape Verde islands suggests resilience, the colonies are small and isolated and remain highly vulnerable to any disturbances. Extreme environmental events may also reduce food availability (Pyle *et al.* 2011; dos Santos *et al.* 2022).

Author: Inês Lacerda
Owners/sources of tracking data: Gonzalez-Solis 2009b, Gonzalez-Solis 2014a



Bulwer's Petrel

Bulweria bulwerii

Phenology		Conservation status			
Mainland	Summering	Mainland	Madeira	Azores	UICN Global
Madeira	Summer breeder	NE	LC	EN	LC
Azores	Summer breeder				



Distribution, movements and phenology

The Bulwer's Petrel is pantropical, occurring in the three major oceans. It breeds in the Eastern Atlantic, between the Azores and Cape Verde, and in the Western Pacific, from Asia to Hawaii, including the Marquesas Islands (Billerman *et al.* 2026). The species makes extensive use of the Portuguese EEZ during the breeding season (April to October), occurring mainly in the open sea (Meirinho *et al.* 2014; Dias *et al.* 2016; Ventura *et al.* 2022). On the Mainland, it occurs mainly in summer and autumn, along the continental shelf, avoiding coastal areas (Catry *et al.* 2010a). Individual tracking data from 66 birds from Madeira (Deserta Grande and Selvagem) and the Canary Islands, fitted with GPS devices between 2010 and 2021, confirm this distribution, highlighting the central and south-eastern areas of the Azores and south of Madeira. During the non-breeding season, available tracking data obtained from individuals from Selvagem Grande, Vila Islet (Azores) and Montaña Clara (Canary Islands) indicate that the birds migrate southwards, heading towards deep equatorial ocean waters (Zino *et al.* 2012; Dias *et al.* 2015; Ramos *et al.* 2015b; Cruz-Flores *et al.* 2019).

Abundance and population trends

The global population has been estimated at around 500,000 to 1,000,000 mature individuals, with a stable trend (BirdLife International 2025). In Portugal, the majority of the population appears to be concentrated on the Desertas Islands, where 45,000 pairs have been estimated (Catry *et al.* 2015). There are no robust estimates for the rest of the Madeira archipelago, but it is likely that the Selvagens colony numbers several thousand pairs (Equipa Atlas 2022). In the Azores archipelago, it breeds on the islet of Vila (Santa Maria) with 65 breeding pairs, on the islet of Baixo (Graciosa) with 17 pairs (Pipa & Silva 2021; Pipa *et al.* 2024) and on the islet of Praia in very small numbers. Due to a lack of data, an assessment of environmental status was only possible for the Azores population, which shows an increase in both indicators — abundance and productivity — and has achieved Good Environmental Status.

Ecology and habitat

The Bulwer's Petrel is a pelagic bird, approaching land only during the breeding season. Nests are located in excavated burrows, small rock cavities and piles of scree (Billerman *et al.* 2026). The diet consists mainly of mesopelagic fish and cephalopods (Zonfrillo 1986; Neves *et al.* 2011a; Waap *et al.* 2017), feeding primarily at night and taking advantage of the vertical migration of prey to the surface of the water column (Dias *et al.* 2015; Dias *et al.* 2016).

Threats and conservation

Predation by introduced species, such as brown rats, cats and mustelids, is the main threat to the species, and the Bulwer's Petrel is therefore confined to islands and islets free of these predators. Adults and chicks are also preyed upon by Yellow-legged Gulls *Larus michahellis* (Matias & Catry 2010). In the Azores, the species competes directly with the Cory's Shearwater *Calonectris borealis* due to a scarcity of suitable nesting habitat (Ramos *et al.* 1997; Bried & Bourgeois 2005), leading a significant proportion of breeding individuals to fail to breed every year (Cruz-Flores *et al.* 2021). Other threats include light pollution (Rodríguez *et al.* 2012), the ingestion of marine litter (Carvalho 2012) and mercury accumulation (Furtado *et al.* 2021). Furthermore, the rise in sea surface temperature caused by climate change may negatively affect the species' survival (Cruz-Flores *et al.* 2022).

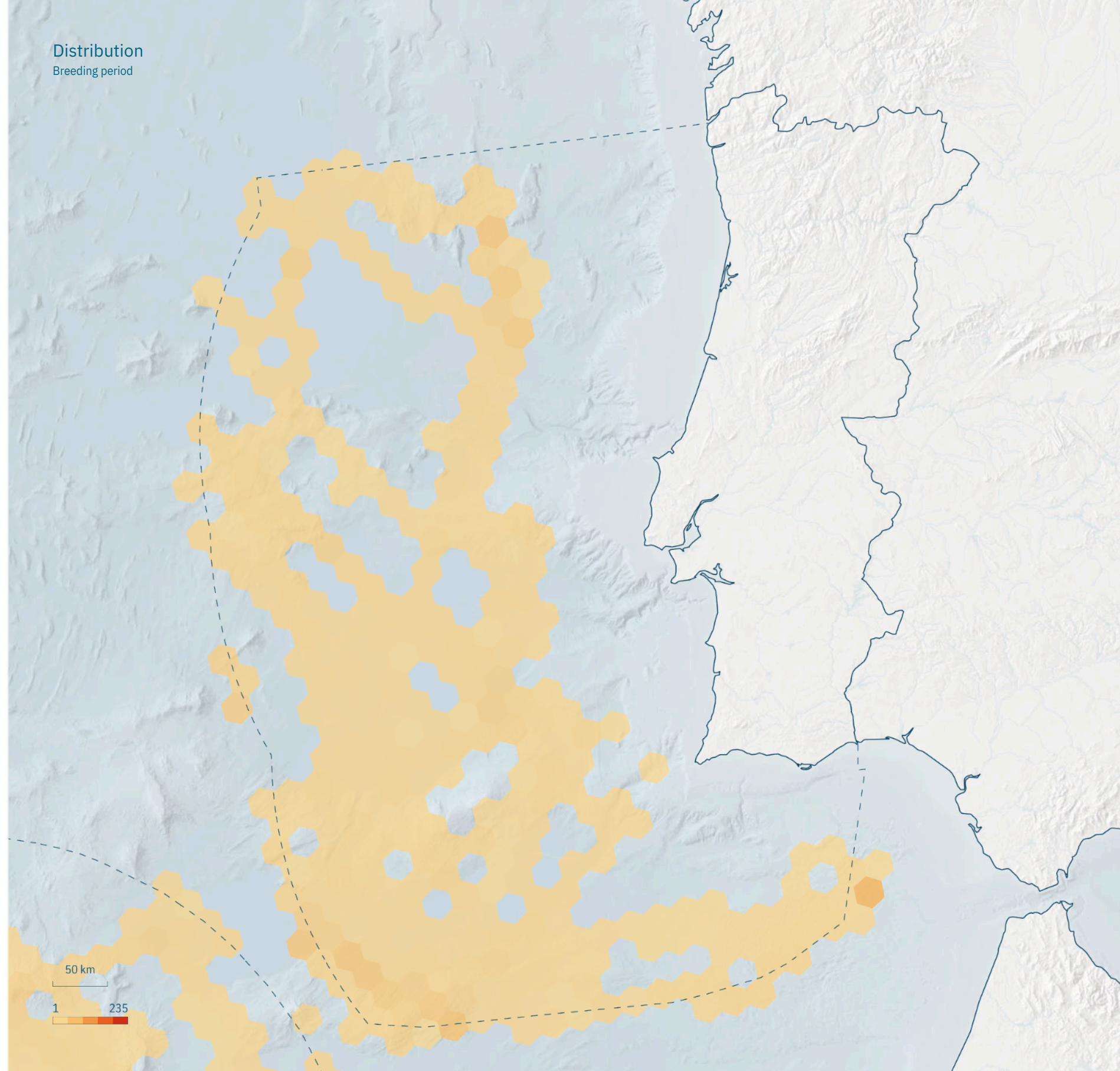
Authors: Paulo Catry, Marta Cruz-Flores, Francis Zino, Manuel Biscoito, Tânia Pipa, Maria P. Dias

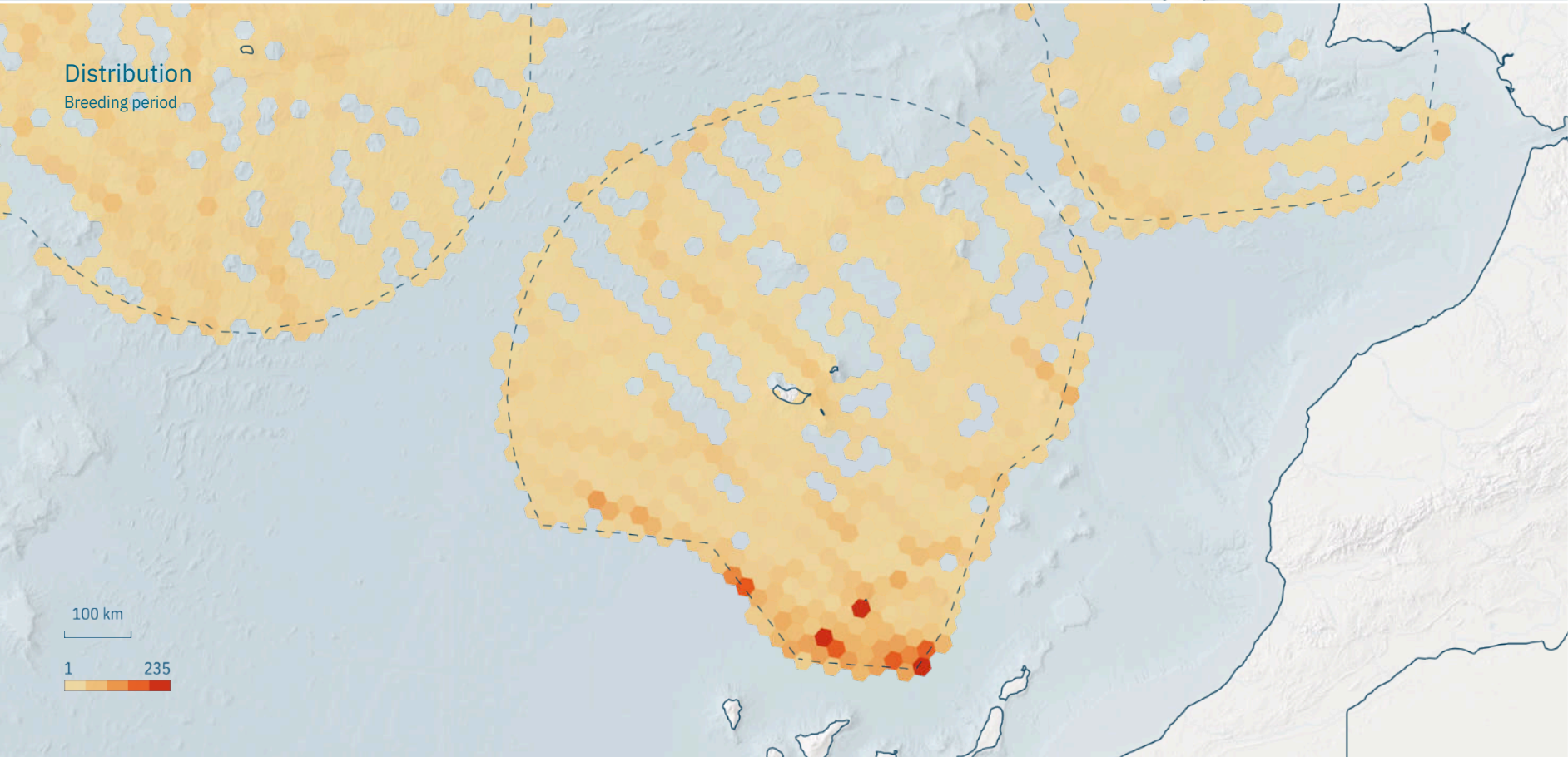
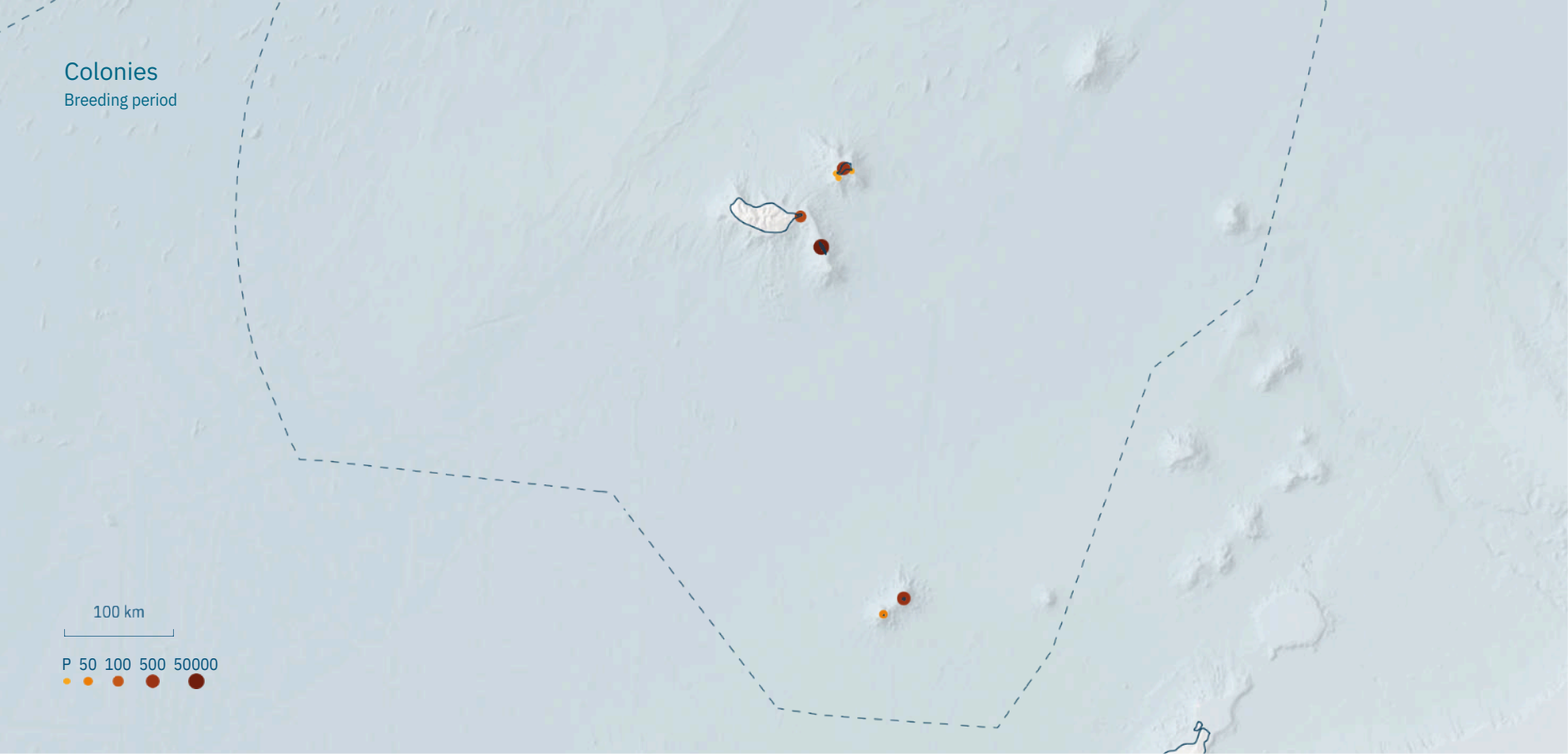
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Colony(ies) of origin: Alegranza, Montaña Clara (Canary Islands, Spain), Deserta Grande, Selvagens (Madeira, Portugal) | Device: GPS, PTT
Data period / number of individuals: June-August 2010-2021 / 19 ind.



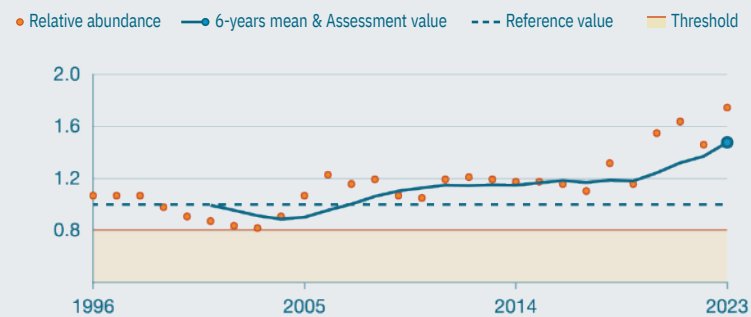
Distribution
Breeding period



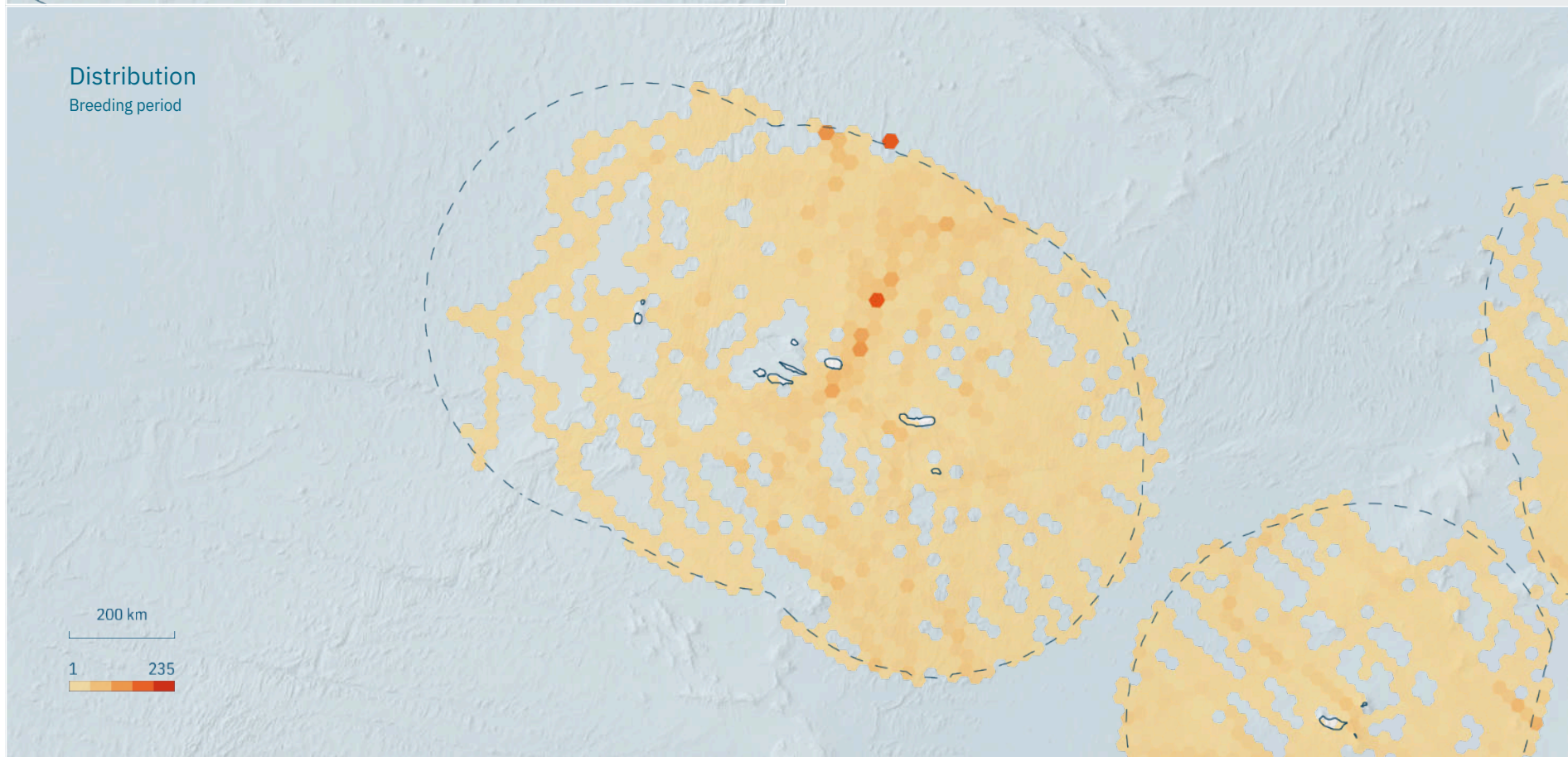
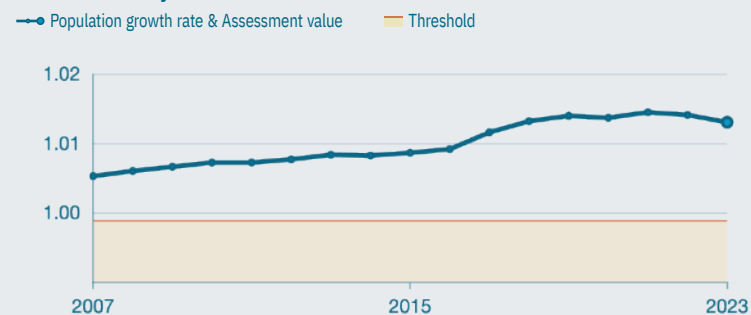




Abundance Indicator Assessment



Productivity Indicator Assessment



Northern Gannet

Morus bassanus

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Wintering and passage migrant	LC	NE	NE	LC
Azores	Wintering and passage migrant				



Distribution, movements and phenology

The Northern Gannet breeds in the North Atlantic between March and August, mainly in north-west Europe and Canada. Between September and November, the European population migrates to the coasts of West Africa and the European Atlantic, with a portion entering the Mediterranean (Billerman *et al.* 2026). They use the Portuguese Mainland coast as a migratory corridor, occurring along the entire continental shelf (Meirinho *et al.* 2014; Bernard *et al.* 2026). Furthermore, the Mainland is also an important wintering area for birds from some colonies (Grecian *et al.* 2019; Garthe *et al.* 2024). A large number of immature birds remain in these waters throughout the year (Catry *et al.* 2010a). In the Azores and Madeira, it occurs in small numbers, mainly during migration (Meirinho *et al.* 2014).

Data obtained from 15 birds fitted with GPS tags in 2018 and 2019, originating from the United Kingdom, confirm the known distribution of the species in the Mainland region. Of note is the higher concentration between Caminha and Ericeira, with some use of deeper waters. Based on these data, no occurrences were recorded in the sub-areas of the Azores or Madeira.

Abundance and population trends

The global population has been estimated at between 1.5 and 1.8 million mature individuals, showing an upward trend, of which 1.37 million breed in Europe (BirdLife International 2025). In Mainland Portugal, the Northern Gannet is one of the most abundant seabirds, particularly between September and March. Between 2010 and 2015, the population was estimated at between 79,518 and 101,700, representing up to 10% of the global population (Araújo *et al.* 2022b). Furthermore, during the post-breeding migration in 2015, more than 200,000 birds were counted passing southwards from Cape Carvoeiro (Elmberg *et al.* 2020). The highest densities of the species are recorded in the central and northern parts of the Mainland, with a moderate upward trend observed in the migratory flow during the pre-breeding season (Fagundes *et al.* 2024).

However, this population has not achieved Good Environmental Status for the abundance indicator. There is no information regarding abundance or population trends for the Azores and Madeira, making it impossible to assess the environmental status.

Author: Tânia Nascimento

Owners/sources of tracking data: Gremillet & Dossa 2011, Hamer & Lane 2019

Ecology and habitat

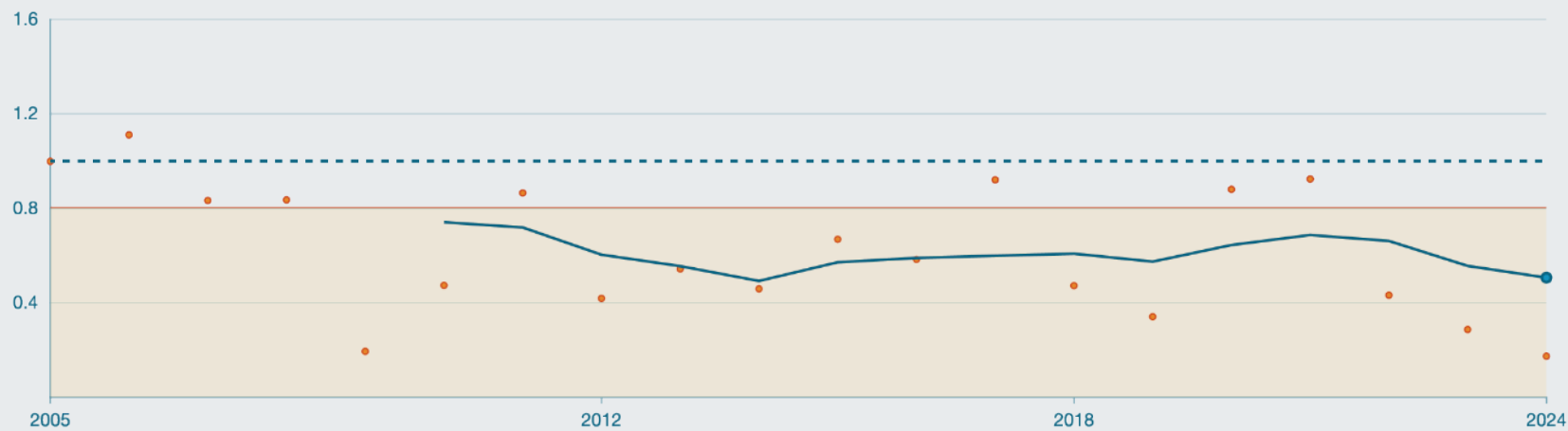
It is a marine species found in areas of the continental shelf and slope, and may be observed either alone or in large groups (Catry *et al.* 2010a). It feeds on schools of pelagic fish, such as mackerel, horse mackerel, sardines and needlefish, taking advantage of discards from commercial fishing (Billerman *et al.* 2026).

Threats and conservation

The Northern Gannet is one of the species most frequently captured as bycatch in fishing gear in Portugal, with a particular incidence in demersal longline fishing (Oliveira *et al.* 2015; Calado *et al.* 2021). The implementation of fishing methods that minimise this risk of mortality should be a priority for the conservation of the species (BirdLife International 2025). It is also particularly vulnerable to collisions with wind turbines in offshore wind farms (Bradbury *et al.* 2014), which raises further concerns at a time of rapid expansion in this sector. The impacts of marine pollution, particularly from plastics, have not yet been fully quantified, but are believed to compromise breeding success. Furthermore, outbreaks of diseases such as avian influenza have caused localised population declines and represent an emerging threat (Lane *et al.* 2024).

Productivity Indicator Assessment

Population growth rate & Assessment value Threshold



Distribution

Non-breeding period



European Shag

Gulosus aristotelis

Phenology		Conservation status			
Mainland	Resident and wintering	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	EN	NA	NA	LC
Azores	Absent				



Distribution, movements and phenology

The European Shag breeds between February and August, and is found along the European Atlantic coast, in north-west Africa, the Mediterranean and the Black Sea (Billerman *et al.* 2026). It is a predominantly sedentary species, concentrating its distribution around colonies throughout the year (Velando *et al.* 2005; Nascimento *et al.* 2023b). However, some birds undertake short-distance migrations during winter and juveniles exhibit some dispersive movements.

In Portugal, it breeds exclusively on the Mainland, in the Berlengas archipelago and on the rocky coast between Cape Carvoeiro and Albufeira (del Moral & Oliveira 2019). Individual tracking confirmed the localised distribution around breeding colonies. Juveniles undertook more extensive dispersal movements, with one reaching the coastal area between Matosinhos and Caminha during its first winter. Previous records in this part of the country were attributed to individuals originating from Galician colonies (Catry *et al.* 2010a). There are no known records of the European Shag in the Azores (Meirinho *et al.* 2014; Birding Azores 2022) and although the species is recognised as occasional in the Madeira archipelago (Correia-Fagundes *et al.* 2021), only one record of an individual was confirmed in the 1990s (Zino *et al.* 1995a).

Abundance and population trends

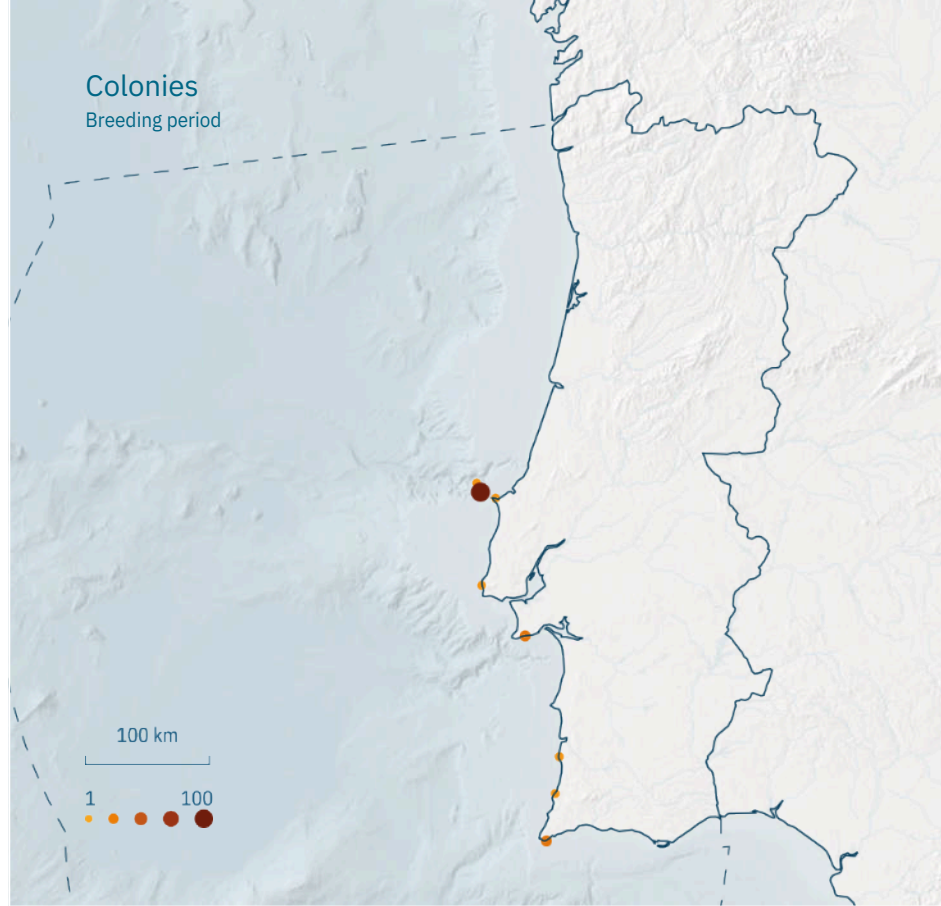
The global population has been estimated at 230,000 to 240,000 individuals (Wetlands International 2025), with a declining trend (BirdLife International 2025). In Portugal, it is a scarce species. In 2017, 101 breeding pairs were recorded along the Portuguese Mainland coast (del Moral & Oliveira 2019). The largest colony, comprising 62 pairs, was located in the Berlengas archipelago, followed by the Arrábida/Cape Espichel area, where 20 pairs were recorded. No substantial change in the species' distribution has been recorded since the last census, carried out in 2002 (Equipa Atlas 2022). However, a considerable decline in the population size of the Berlengas archipelago and the south-west coast should be noted. The assessment of environmental status is consistent with this trend, with the population failing to achieve Good Environmental Status for either indicator, abundance or productivity.

Ecology and habitat

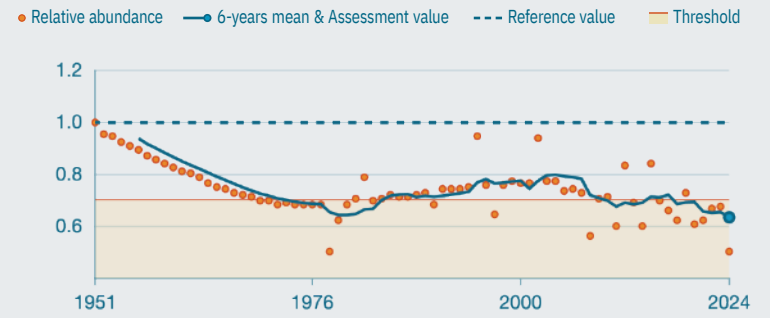
It is a coastal species that inhabits rocky habitats and does not venture out into the open sea. It feeds on a wide variety of pelagic, demersal and benthic fish, with the sand eel being the main species consumed during the breeding season in Portugal (Nascimento *et al.* 2021). Outside this period, the European Shag has an even more diverse diet, being particularly rich in gadids and sparids. It nests singly or in small colonies on coastal cliffs, islands and islets. The nest is built on ledges, in crevices and caves, which are generally sheltered.

Threats and conservation

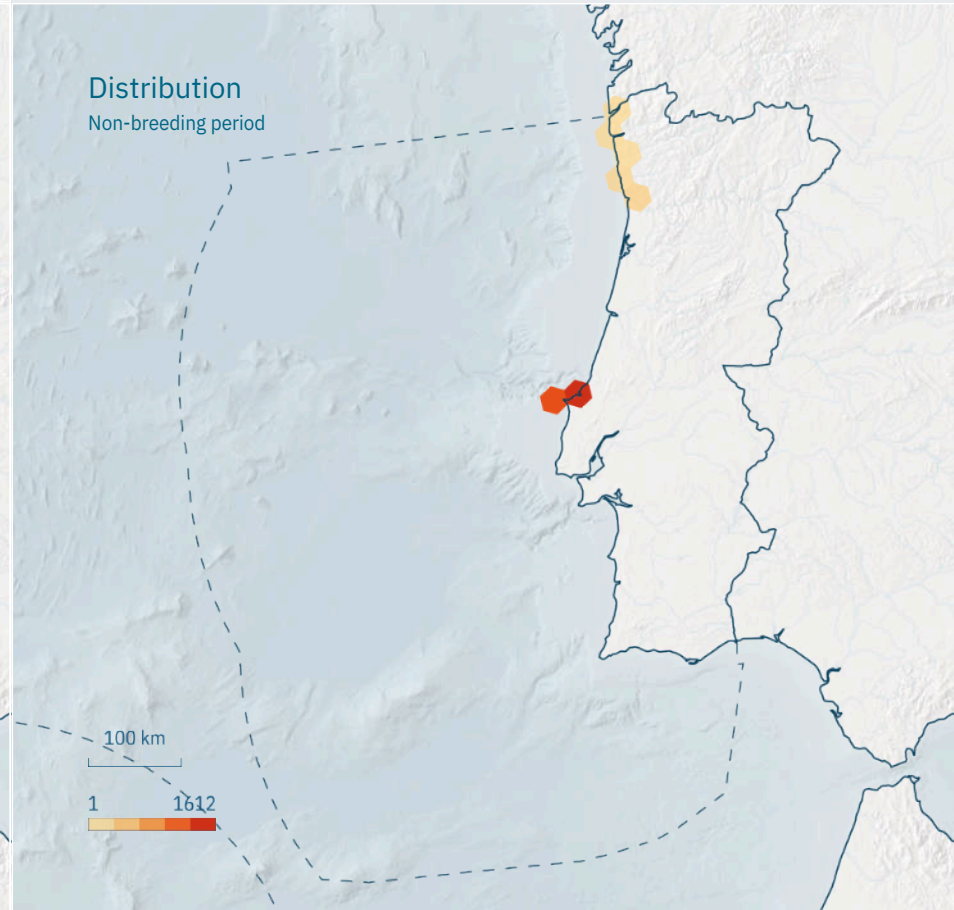
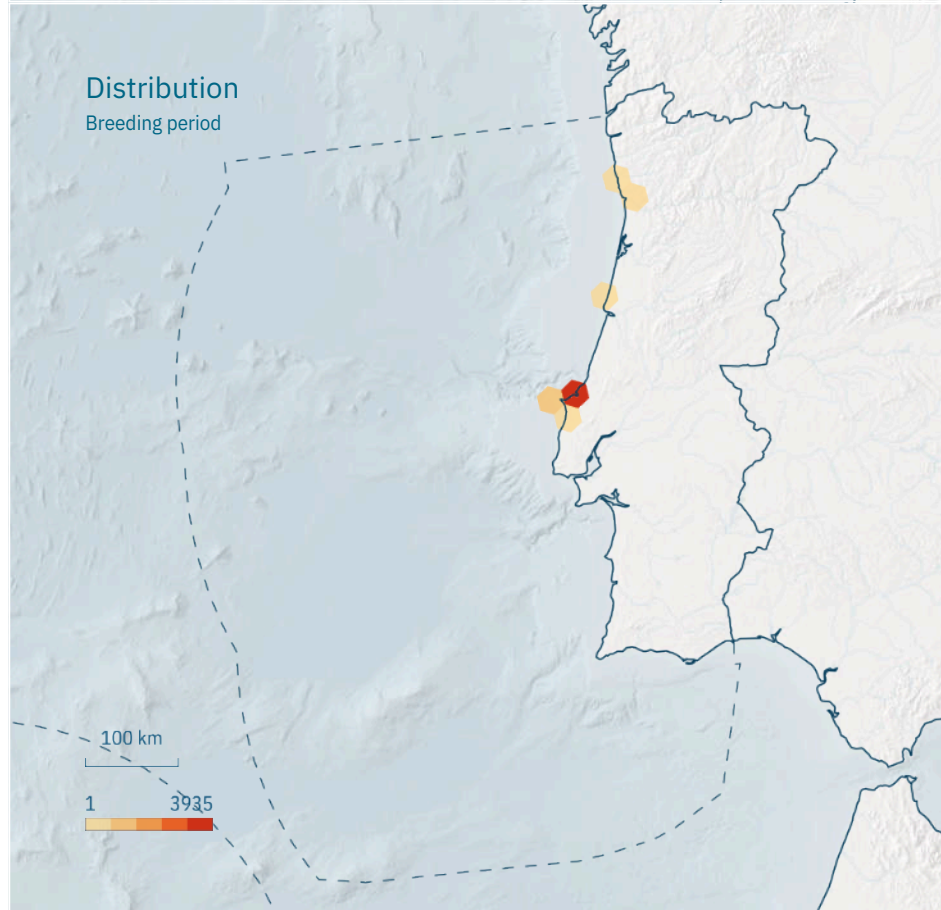
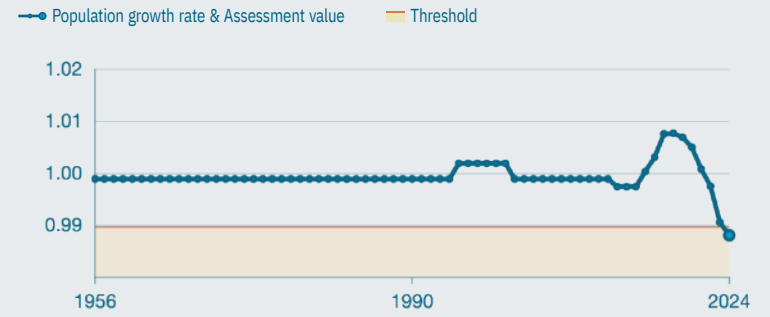
Although its diet is relatively flexible, the species depends on certain prey, and a shortage of these resources could jeopardise its survival (BirdLife International 2025). Climate change contributes to a decline in prey numbers and an increase in the frequency of extreme weather events. Oil pollution causes direct mortality and indirect ecological impacts on the habitat (Velando *et al.* 2005). The species is also vulnerable to competition with commercial fisheries as they exploit shared prey (Nascimento *et al.* 2021; Nascimento *et al.* 2023b). This trophic overlap is particularly relevant during winter, when prey availability may be lower. The species is also vulnerable to bycatch in gillnets and longlines (Oliveira *et al.* 2021).



Abundance Indicator Assessment



Productivity Indicator Assessment



Great Cormorant

Phalacrocorax carbo

Phenology		Conservation status				
Mainland	Resident and wintering	Mainland		Madeira	Azores	UICN Global
Madeira	Vagrant	NE	LC	NA	NA	LC
Azores	Vagrant	Breeding population	Wintering population			



Distribution, movements and phenology

The Great Cormorant has a wide distribution across all continents, with the exception of South America and Antarctica (Billerman *et al.* 2026). European populations breed between April and June. Some of the populations from northern and central Europe migrate and winter mainly in the south of the continent, both along the Atlantic and Mediterranean coasts (Birdlife International 2025).

In Portugal, it occurs mainly as a winter visitor from September to April, frequenting mainly coastal wetlands, but may occur across much of the Mainland (Equipa Atlas 2018). There has also been a breeding population since 2007 (Almeida 2008), located and almost entirely confined to inland Alentejo (Equipa Atlas 2022), with the main colonies situated mainly in the Guadiana River basin and, to a lesser extent, in the Sado and Tagus River basins. In the archipelagos of the Azores and Madeira, it occurs sporadically, with records mainly during autumn and winter (Meirinho *et al.* 2014).

Abundance and population trends

The global population is estimated at between 1,400,000 and 2,100,000 individuals, with the European population accounting for over 40%, showing an upward trend (BirdLife International 2025).

The breeding population in Mainland Portugal is estimated at 511 pairs (Equipa Atlas 2022). The wintering population in wetlands was estimated at around 1,000 individuals in 1981 (Teixeira 1984), 8,000–10,000 in the 1990s (Costa & Granadeiro 1997) and just over 15,000 individuals in 2013 (Leitão *et al.* 2013), with recent estimates being underestimated. Along the coast, wintering numbers show an upward trend (Alonso *et al.* 2022), with 1,425 individuals recorded in the winter of 2021–2022 (Fagundes & Catry 2022). Both the breeding and wintering populations have achieved Good Environmental Status for the abundance indicator.

Ecology and habitat

The Great Cormorant occurs in coastal and inland habitats, avoiding deep waters and rarely straying far from the coast (Billerman *et al.* 2026). In Portugal, its diet is generalist, consisting of fish such as grey mullets, Lusitanian toadfish, European eel, sand smelt and various species of annular seabream, white seabream and soles (Catry *et al.* 2010a; Dias *et al.* 2012; Granadeiro *et al.* 2013; Catry *et al.* 2017). It nests colonially in trees located on the banks of wetlands (Equipa Atlas 2022).

Threats and conservation

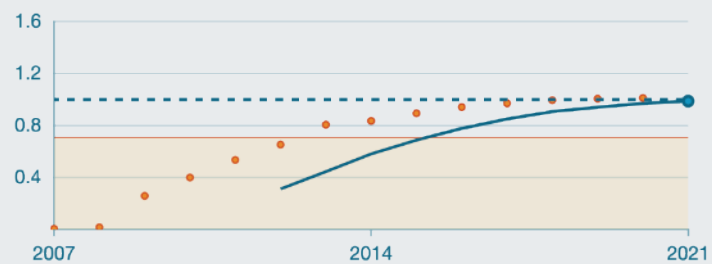
The main threat to the Great Cormorant appears to be associated with persecution resulting from conflicts with human activities. The perception that it has a negative impact on fish populations has led to conflicts with the fishing and aquaculture sectors, recently resulting in a proposal for a European management plan for the species, which includes measures such as culling. However, an approach based on local, proportionate measures adapted to each ecological and socio-economic context would be more advisable (Marzano *et al.* 2013).

In Portugal, predation on fish species of commercial value is low (Catry *et al.* 2010a; Granadeiro *et al.* 2013; Catry *et al.* 2017), although cases of interaction between Great Cormorants and aquaculture, recreational fishing and commercial fishing have been documented (Vieite *et al.* 2022). The Great Cormorant is one of the species accidentally captured as bycatch in gillnets (Oliveira *et al.* 2015), and is one of the most frequently encountered in the eastern Algarve (Pereira *et al.* 2025a).

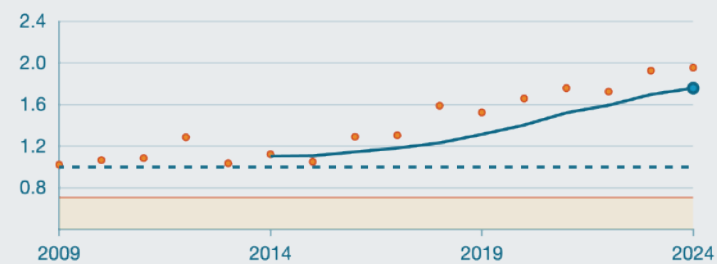
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

Breeding period



Non-breeding period



Colonies

Breeding period



Red Phalarope

Phalaropus fulicarius

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NE	LC
Azores	Wintering and passage migrant				



Distribution, movements and phenology

The Red Phalarope breeds between May and August in the high Arctic regions of Eurasia and North America (Billerman *et al.* 2026). Its wintering grounds are poorly defined, generally involving the tropical and subtropical waters of the Atlantic and Pacific. Its distribution in Portugal is not well documented; however, it is estimated that it is during migration (spring, and July to October) that our waters are likely to be of greatest importance to the species (Catry *et al.* 2010a; Meirinho *et al.* 2014). Despite the limited monitoring effort in deeper waters, the species appears to use these areas predominantly, reaching densities of over 200 birds/km² in the Mainland sub-area of the EEZ during winter. It only approaches the coast occasionally, typically when driven by adverse weather conditions. In the island regions, the distribution and phenology of this species appear to follow patterns very similar to those observed on the Mainland (Meirinho *et al.* 2014). Individual tracking of birds visiting Portuguese waters remains very limited. Based on data from just two birds fitted with GLS tags in Greenland in 2014 and 2015, an extensive spatial distribution across the Portuguese EEZ was observed during both phenological periods.

Abundance and population trends

The global population was estimated at 9,000,000 to 12,000,000 breeding individuals, with an unknown trend (BirdLife International 2025), although there are some indications of a decline (Billerman *et al.* 2026). In Mainland Portugal, the wintering and migratory population was estimated at 3,163 to 8,117 between 2012 and 2015 (Araújo *et al.* 2022a). Only a small proportion of this population appears to pass close to the coast during migration (Elmberg *et al.* 2020). The interannual variation in the number of migrating birds, as well as the difficulty in detecting individuals at sea, poses major challenges to estimating their abundance. The lack of systematic information regarding their abundance and population trends has prevented an assessment of the species' environmental status within the Portuguese EEZ.

Ecology and habitat

During migration and wintering, it is an essentially pelagic bird, being very abundant in upwelling zones associated with oceanic fronts and in very deep waters (Billerman *et al.* 2026). It feeds primarily on zooplankton, sometimes associating with marine mammals and other bird species. It nests in the tundra, usually near the coast. Like other phalaropes, this species exhibits reversed sexual roles, with the more colourful females competing for the males, who incubate the eggs and feed the chicks.

Threats and conservation

At sea, this phalarope is sensitive to shipping traffic, bycatch and the development of offshore renewable energy (Häkkinen *et al.* 2023). It is also particularly vulnerable to marine litter, as it may mistake small floating plastic particles for its natural prey (Teboul *et al.* 2021). Climate change is one of the factors that will have the greatest influence on this species, particularly in breeding areas. Its tendency to form large aggregations in relatively small areas exposes the species to extreme weather events, resulting in episodes of mass mortality (BirdLife International 2025). This species is one of the least monitored, so addressing this gap is a top conservation priority for the species.

Distribution
Breeding period

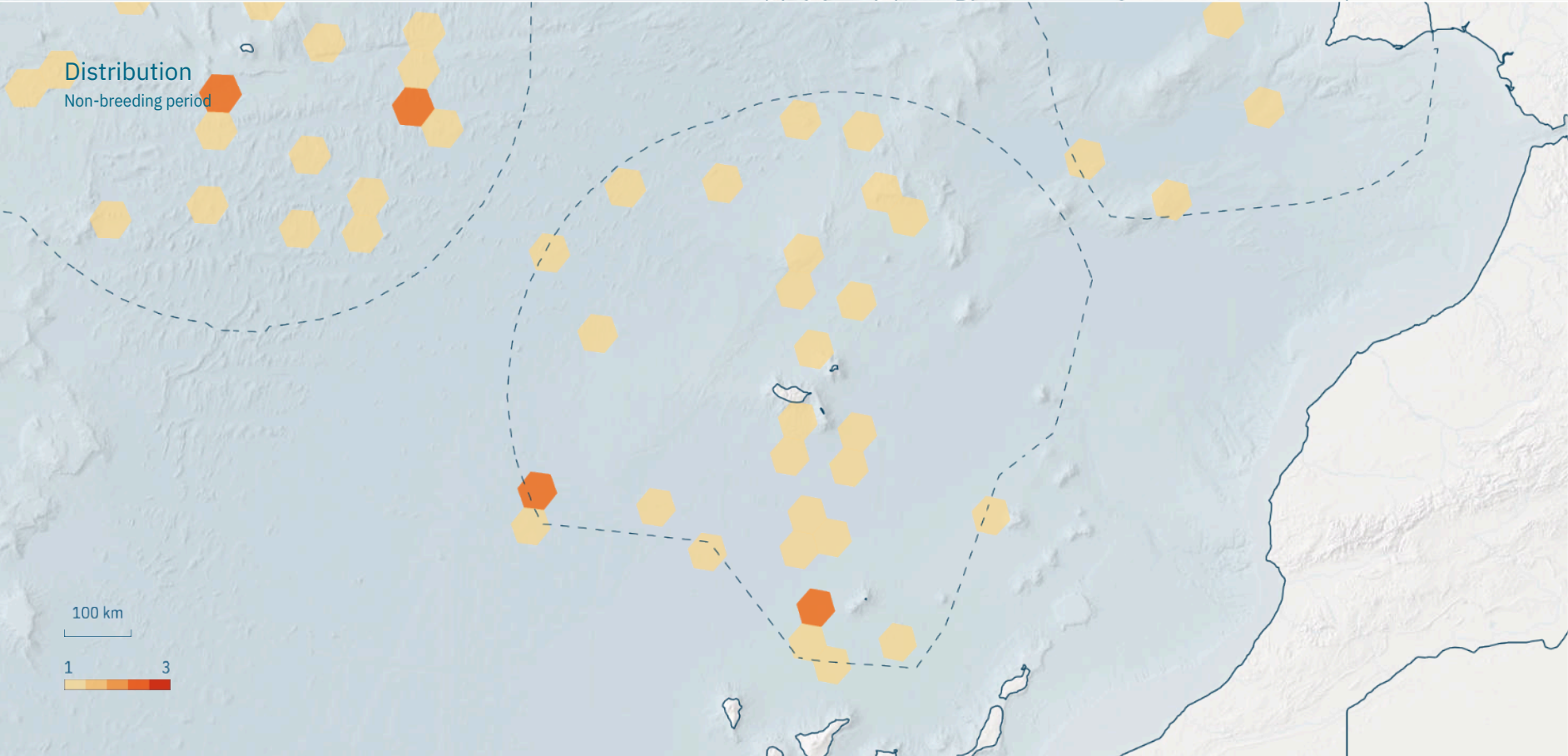
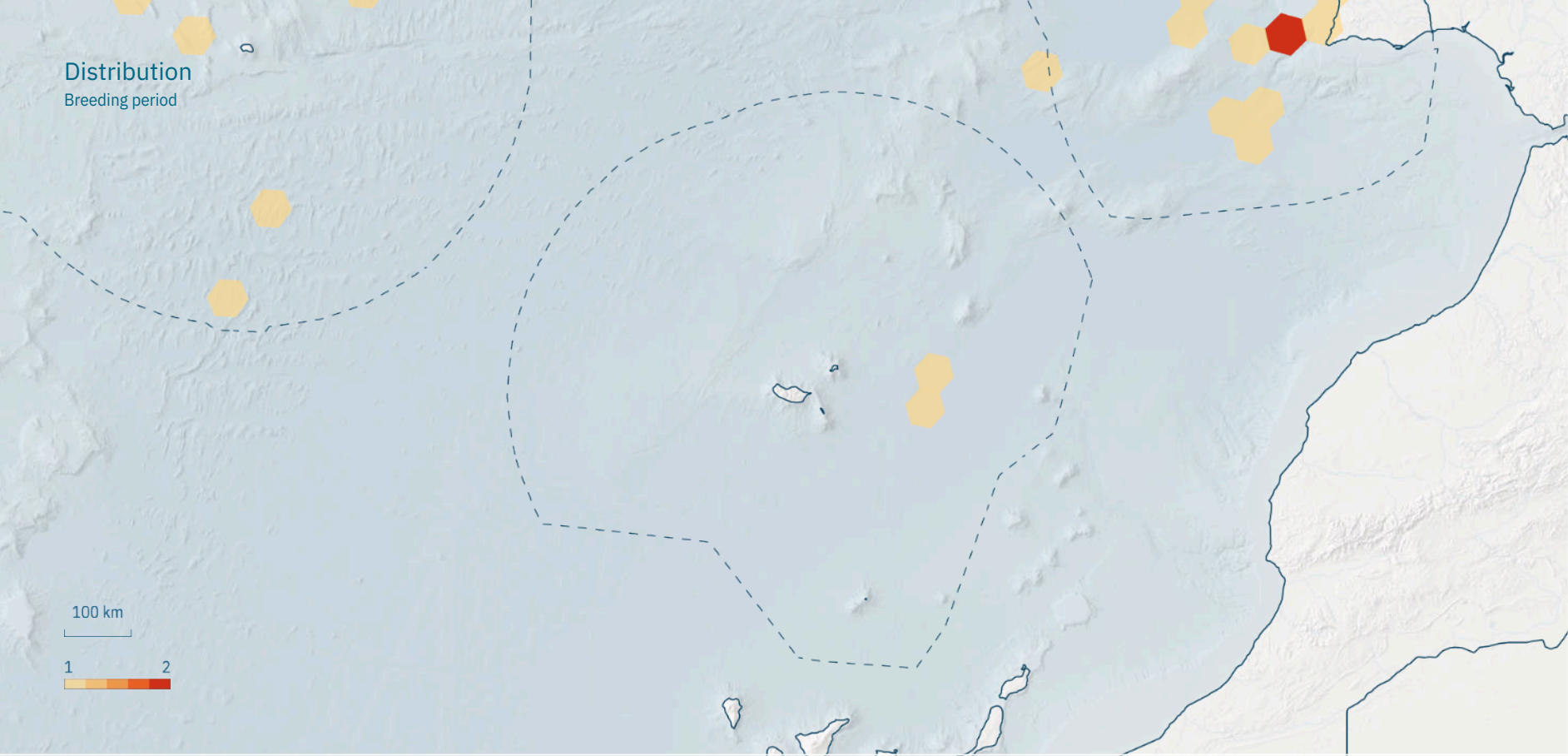
100 km



Distribution
Non-breeding period

100 km





Distribution

Breeding period



Distribution

Non-breeding period



Sabine's Gull

Xema sabini

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NE	LC
Azores	Passage migrant				



Distribution, movements and phenology

The Sabine's Gull breeds in the Arctic between late May and August, exhibiting a circumpolar distribution throughout the breeding season (Billerman *et al.* 2026). The Atlantic populations breed in Greenland and the archipelagos of Norway, migrating towards south-west Africa (Stenhouse *et al.* 2011). The species' post-breeding migration begins in August and continues until November, whilst the pre-breeding migration takes place from February to May (Catry *et al.* 2010a). It uses the Portuguese EEZ during its migratory movements, but is rarely observed near the coast (Billerman *et al.* 2026). Based on data from 12 birds fitted with GLS between 2007 and 2011, originating from Canada and Greenland, use of the Portuguese EEZ was recorded mainly between September and October, in line with land-based observations (Catry *et al.* 2010a). The species was also recorded in late spring, corresponding to the early breeding period, particularly in the Mainland and Azores sub-areas. It appears to prefer deeper waters or waters near the continental slope, as had already been noted in previous works (Meirinho *et al.* 2014; Araújo *et al.* 2022a).

Abundance and population trends

The global population shows a stable trend, estimated at around 340,000 mature individuals, of which 2,100 to 4,100 breed in Europe (BirdLife International 2025). It is regularly observed alone or in small flocks, with some exceptional records of several hundred birds (Meirinho *et al.* 2014). Between 2011 and 2015, the population using the waters off the Mainland during post-breeding migration was estimated at between 727 and 3,356 (Araújo *et al.* 2022a). Furthermore, during the post-breeding migration in 2015, only 3 birds were counted passing southwards from Cape Carvoeiro, illustrating the species' pelagic behaviour (Elmberg *et al.* 2020).

Ecology and habitat

The Sabine's Gull has markedly pelagic habits outside the breeding season (Olsen & Larsson 2004). It exploits coastal upwelling zones, feeding on zooplankton, crustaceans and fish (Billerman *et al.* 2026). It is frequently attracted to discards from fishing vessels (Valeiras 2003).

Threats and conservation

No specific threats to this species are known in Europe. However, it may be vulnerable to climate change and changes in habitat (BirdLife International 2025).

Distribution Breeding period

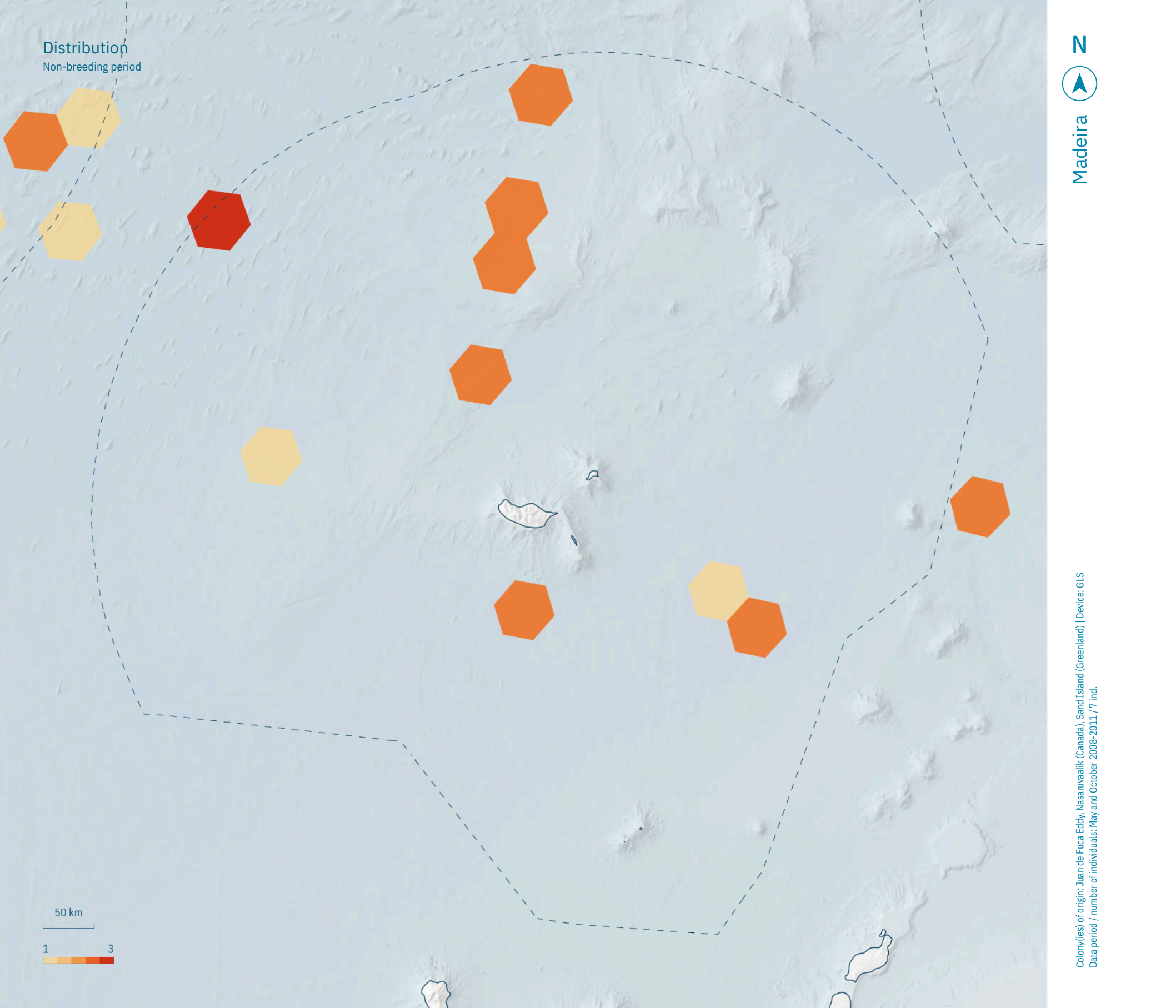
100 km



Distribution Non-breeding period

100 km





Distribution

Breeding period



Distribution

Non-breeding period



Black-legged Kittiwake

Rissa tridactyla

Phenology		Conservation status			
Mainland	Wintering	Mainland	Madeira	Azores	UICN Global
Madeira	Wintering	VU	NE	NE	VU
Azores	Wintering				



Distribution, movements and phenology

The Black-legged Kittiwake breeds from April to August in the Northern Hemisphere, in the temperate and Arctic coastal zones of the Atlantic and Pacific. Atlantic populations winter throughout the North Atlantic as far south as the Sargasso Sea and the West coast of Africa, including the entire Portuguese EEZ (Billerman *et al.* 2026). Birds wintering in our waters mainly originate from colonies in Norway, the United Kingdom and Iceland (Catry *et al.* 2010a), with some birds coming from Canada, the Faroe Islands, Greenland and Russia. It occurs regularly in the Azores and Madeira, although it is less abundant in the latter archipelago (Meirinho *et al.* 2014).

Individual tracking data for 368 birds from the colonies mentioned above confirm the extensive use of the Portuguese EEZ across its three sub-areas, with the highest concentration in the Mainland region, followed by the Azores and Madeira. The majority of the birds used these areas during their wintering period, between October and March.

Abundance and population trends

The global population has been estimated at 14.6 to 15.7 million individuals, of which 3,460,000 to 4,410,000 mature individuals occur in Europe (BirdLife International 2025). This population has declined sharply since the 1980s by >40% over three generations.

The species nested in Portugal, in the Berlengas archipelago, between the late 1970s and early 1980s, as a result of a natural expansion that led to the colonisation of other areas along the Iberian coast (Catry *et al.* 2010a). The size of the wintering population in Portuguese waters is very poorly documented, but appears to be related to weather conditions in more northerly regions and on the open sea. Based on the data used for the environmental status assessment, an estimate of between 3,100 and 10,700 individuals was obtained for the continental shelf in 2024. Despite the lack of more concrete estimates, this population appears to be in Good Environmental Status for the abundance indicator. There is no information on abundance or population trends for the Azores and Madeira.

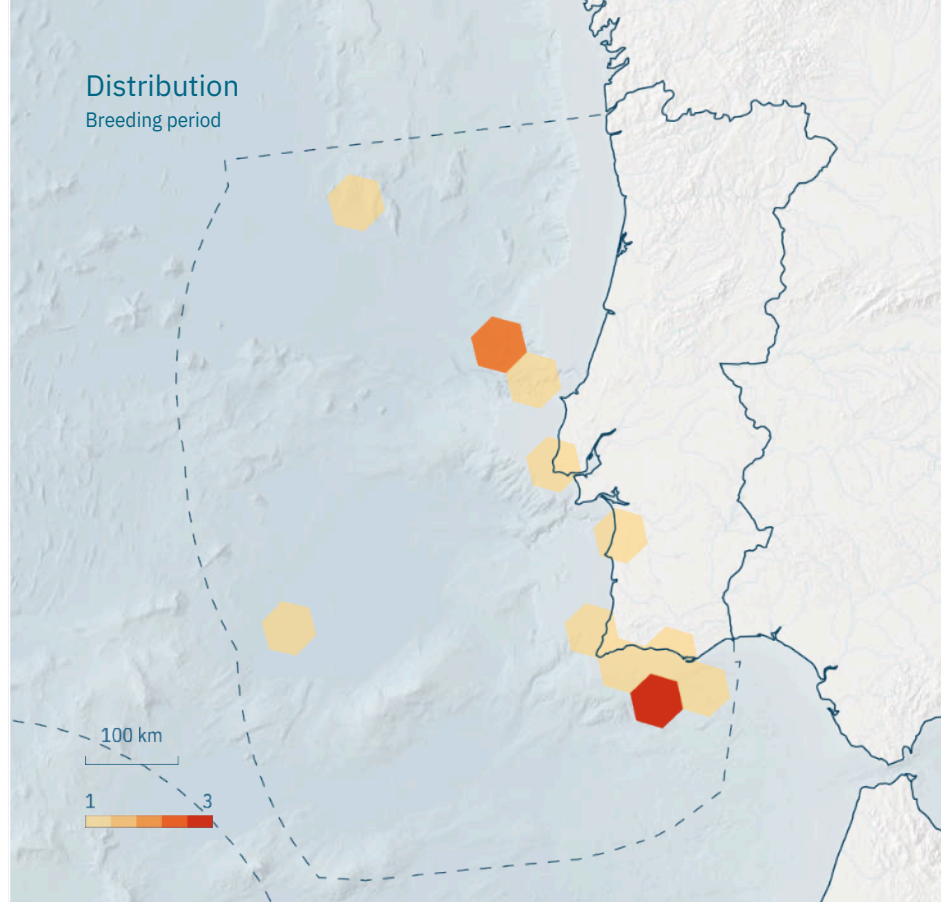
Ecology and habitat

The Black-legged Kittiwake is a migratory bird that leaves the colonies after breeding, dispersing to the open sea from July and August (Olsen & Larsson 2004). It is mostly observed at sea, either alone or in small groups (Snow & Perrins 1998), and may congregate in productive areas such as continental shelves, upwelling zones and fish shoals. Its diet consists mainly of fish and marine invertebrates (including plankton), but it also feeds on discards from fishing vessels (Billerman *et al.* 2026).

Threats and conservation

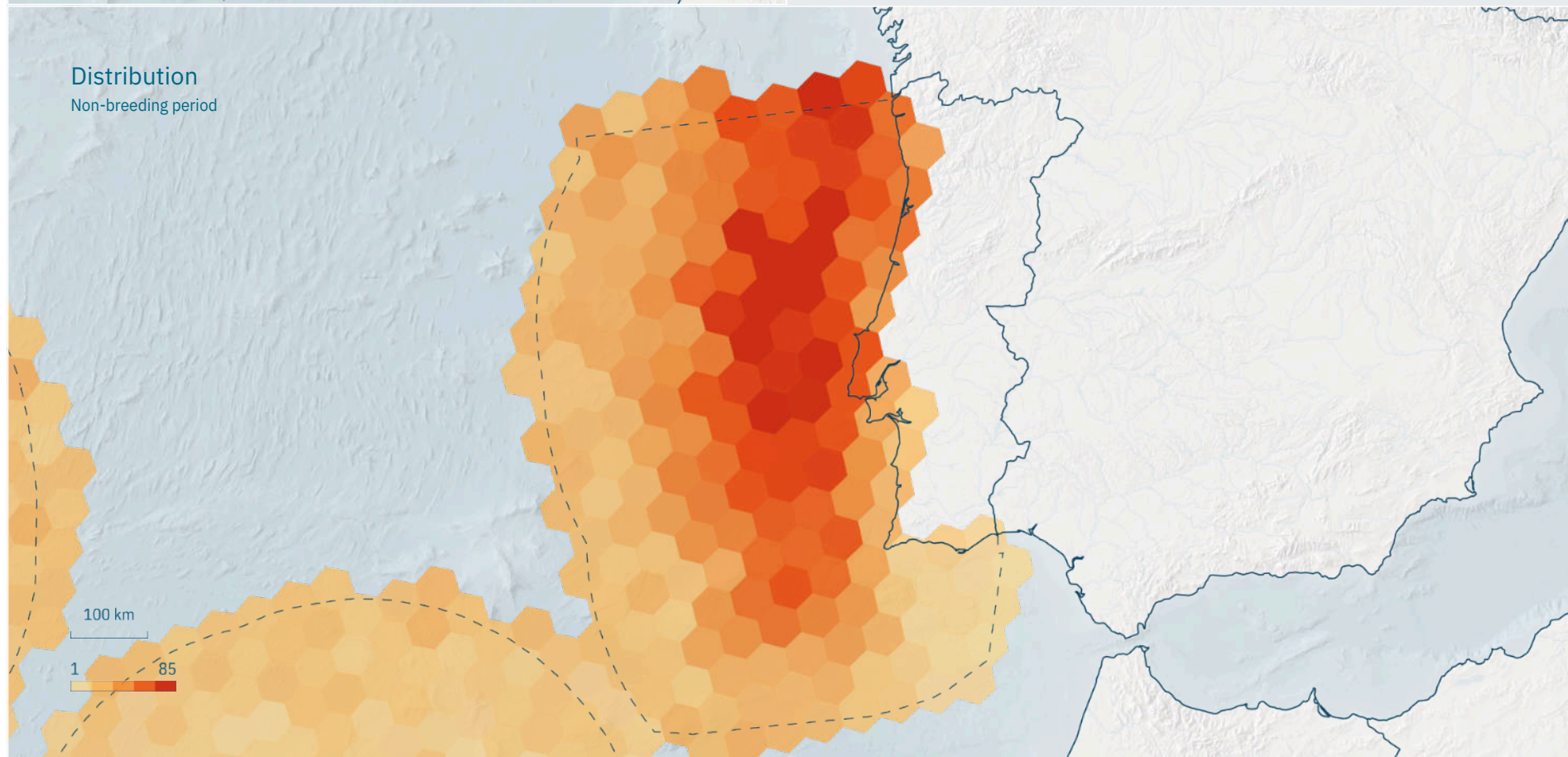
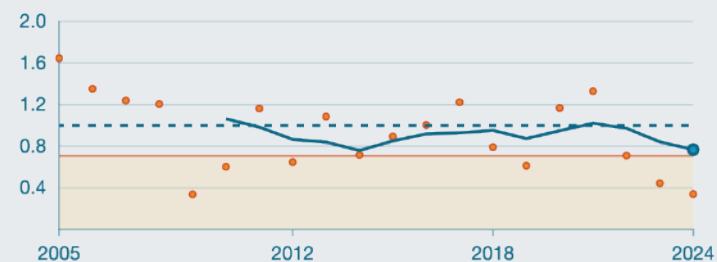
Black-legged Kittiwake populations have been affected by reduced prey availability in the Atlantic, primarily due to climate change and, in part, to targeted industrial fishing (Frederiksen *et al.* 2012). Increased foraging effort and nutritional stress result in higher mortality and breeding failure (Paredes *et al.* 2014). The species suffers bycatch in longline fisheries, particularly in the Gran Sol bank, although the impact is low in other areas of the North Atlantic (BirdLife International 2025). Oil pollution contributes to a decline in the physical condition of adults and reduced breeding success (Nikolaeva *et al.* 2006). The species may also be vulnerable to outbreaks of avian influenza.

Authors: Tânia Nascimento, Nadine Pires
Owners/sources of tracking data: Daunt 2008, Daunt 2010, SEATRACK, Thorarinsson 2011



Abundance Indicator Assessment

● Relative abundance — 6-years mean & Assessment value - - - Reference value ■ Threshold



Distribution

Non-breeding period

50 km

1 85



Colony(ies) of origin: Witless Bay (Canada), Faroe Islands (Denmark), Kippaku (Greenland), Hafnarholmi, Skjálafandi (Iceland), Ålesund, Anda, Røst, Runde, Svalbard, Sklinna (Norway), Canna, Isle of May (UK), Cape Krutik, Franz Josef Land, Hornøya, Kara Gate, Russkaya Gavan (Russia) | Device: GLS
Data period / number of individuals: September-March 2008-2023 / 146 ind.



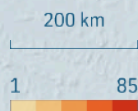
Distribution

Breeding period



Distribution

Non-breeding period



Black-headed Gull

Larus ridibundus

Phenology		Conservation status				
Mainland	Summer breeder, wintering and passage migrant	Mainland		Madeira	Azores	UICN Global
Madeira	Wintering	DD	LC	NE	NE	LC
Azores	Wintering	Breeding population	Wintering population			



Distribution, movements and phenology

The Black-headed Gull breeds between April and July in north-east North America and most of Eurasia, excluding the northernmost regions and southern Asia (Billerman *et al.* 2026). Most Eurasian breeders migrate to the southern coast of Eurasia and the northern and central coasts of Africa, although some birds are resident. In Mainland Portugal, most individuals occur during autumn and winter, heading north in March and April. There is a small breeding population, and some non-breeding individuals remain in Portugal throughout the year (Leitão *et al.* 1997; Catry *et al.* 2010a). The Black-headed Gull is found mainly in the major coastal wetlands, notably the Tagus estuary (Equipa Atlas 2018). It also occurs along the entire coastline, in salt pans and other inland wetlands. At sea, it appears to occur mainly during winter, using almost exclusively the coastal strip between Cascais and Caminha (Meirinho *et al.* 2014). In the Azores and Madeira, it is a regular winter visitor (Equipa Atlas 2018; Correia-Fagundes *et al.* 2021).

Data from 15 birds fitted with GLS in 2022 and 2025 in Spain confirm its known distribution on the Mainland, with particular note of the dispersal of one bird into deeper waters, reaching the Madeira region.

Abundance and population trends

The global population has been estimated at 4.8 to 8.9 million individuals, with the European population showing a moderate decline (BirdLife International 2025; Wetlands International 2025). In Portugal, breeding is relatively recent and is limited to the Mainland, with an estimated 10 to 40 breeding pairs (Equipa Atlas 2022). During winter and autumn, it is one of the most common gulls on Mainland Portugal. Its main concentration area is in the Tagus estuary (Equipa Atlas 2018), where several tens of thousands of individuals were recorded in the past (Meirinho *et al.* 2014). However, there is no information on its current status. On the Mainland's non-estuarine coast, the most recent count was 1,338 wintering individuals in 2021 (Projeto Arenaria 2022). In the Azores and Madeira, they are regular winter visitors. The wintering populations on the Mainland and in the Azores have achieved Good Environmental Status for the abundance indicator, unlike the situation observed in Madeira.

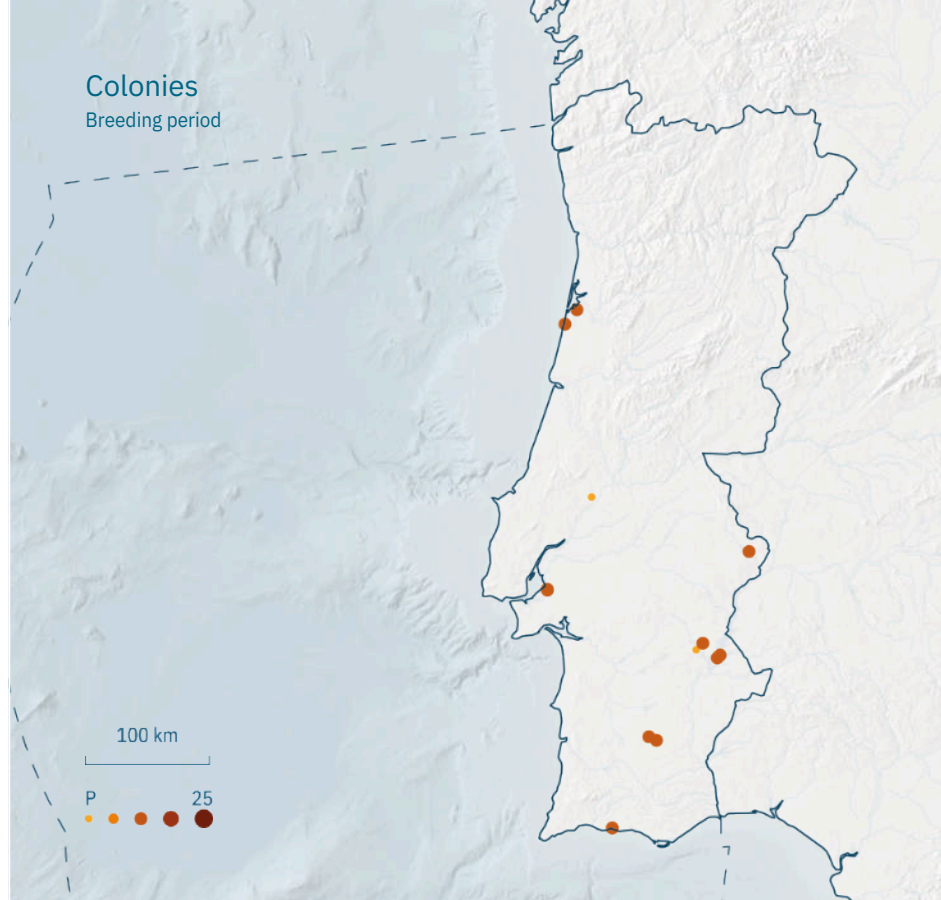
Ecology and habitat

The Black-headed Gull mainly winters in coastal habitats, favouring estuaries and lagoons, salt pans, aquaculture sites and beaches near river mouths (Catry *et al.* 2010a). Inland, it is found at reservoirs, weirs, pastures, agricultural land, landfill sites and wastewater treatment plants (Elias *et al.* 1998; Catry *et al.* 2010a; Martín-Vélez *et al.* 2024). In Portugal, it nests inland, in artificial water bodies created by reservoirs and dams. On the islands, the species appears to prefer the areas around harbours. It is an opportunistic species that feeds mainly on aquatic invertebrates (e.g. Diptera and molluscs) as well as terrestrial (particularly earthworms and insects) and occasionally on fish (Lourenço 2019; Billerman *et al.* 2026).

Threats and conservation

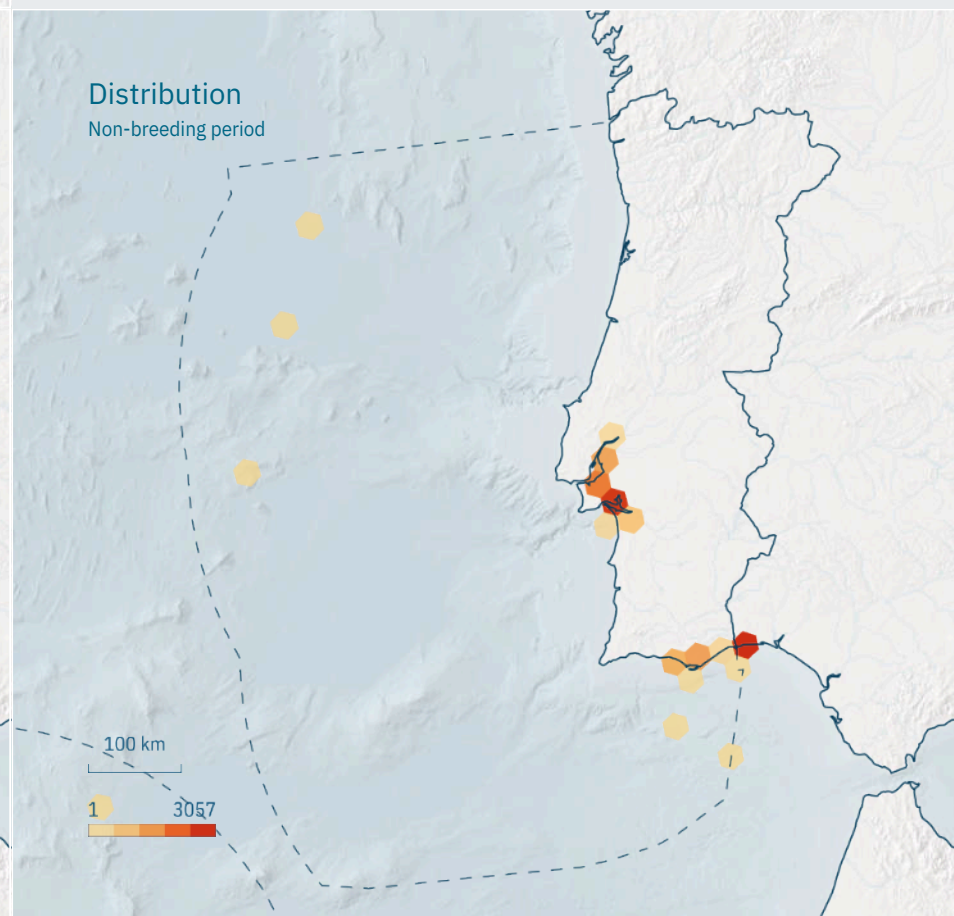
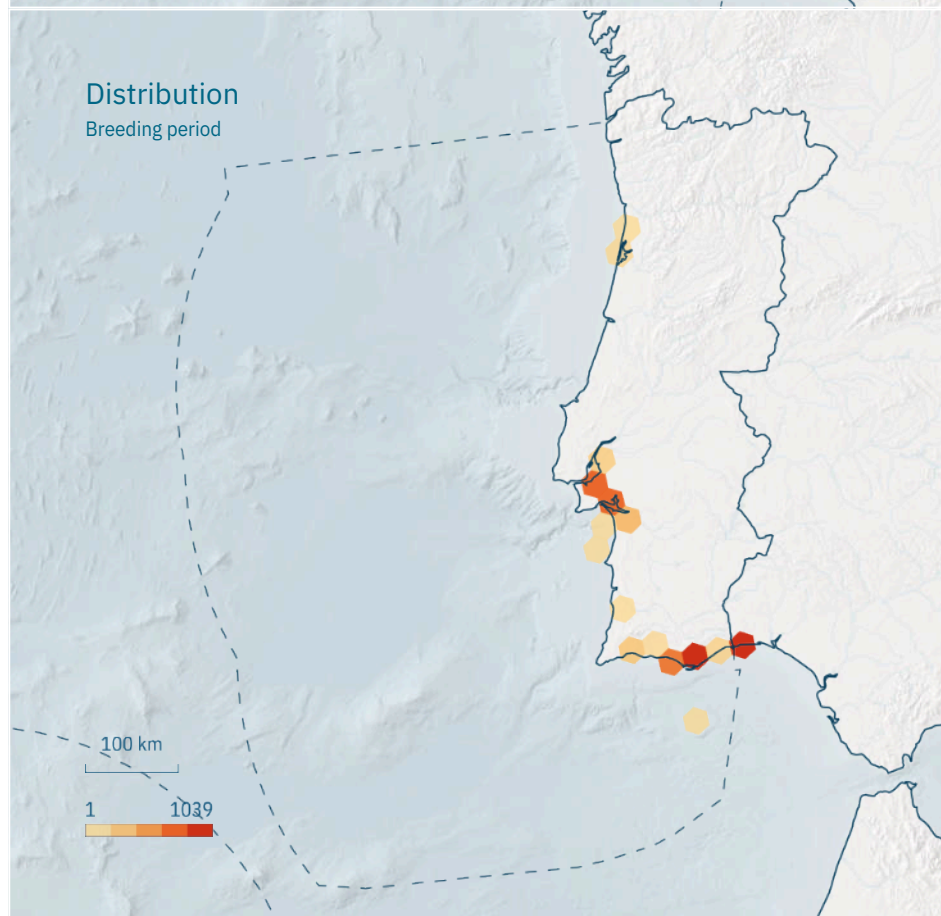
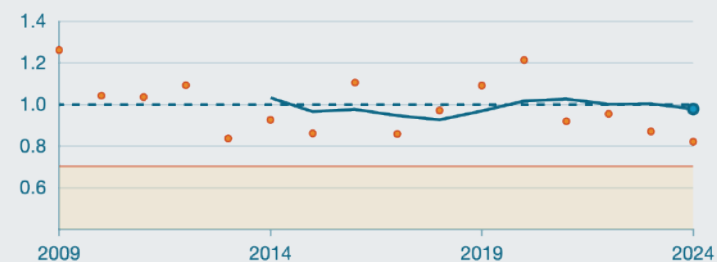
The most significant threats to the species relate to disturbance, predation, avian influenza, periods of severe drought and contamination in nesting areas. It is one of the few examples of seabirds with a Data Deficient conservation status for its breeding population (Equipa Atlas 2022), and it is urgent to address this gap.

Authors: Víctor Martín-Vélez, Andy J. Green
Owners/sources of tracking data: Víctor Martín Velez, Andy J. Green (CSIC)



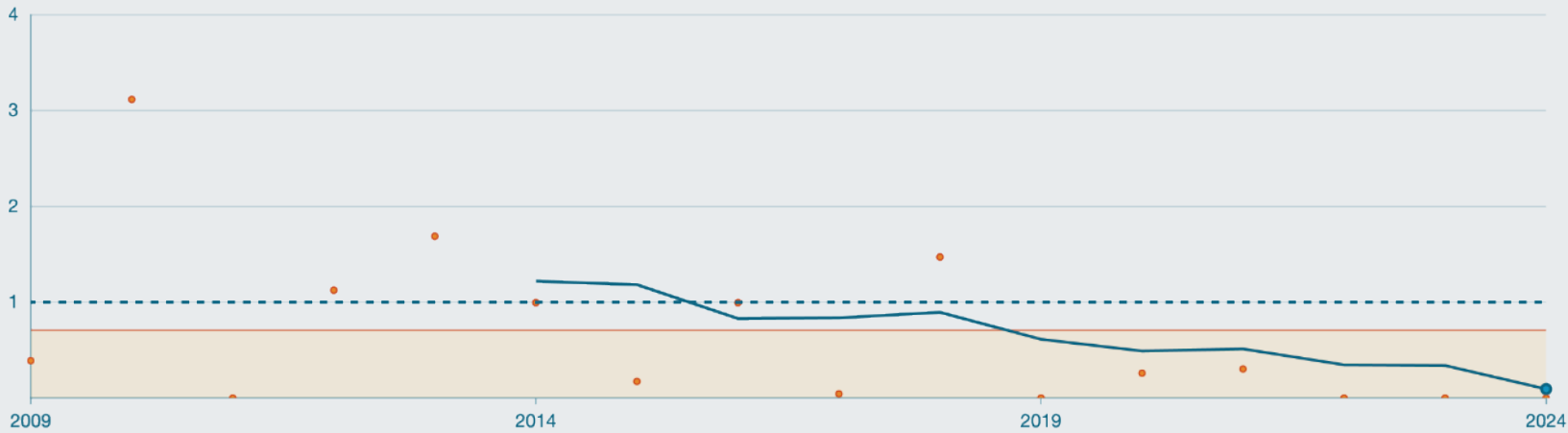
Abundance Indicator Assessment

● Relative abundance — 6-years mean & Assessment value - - - Reference value ■ Threshold



Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold



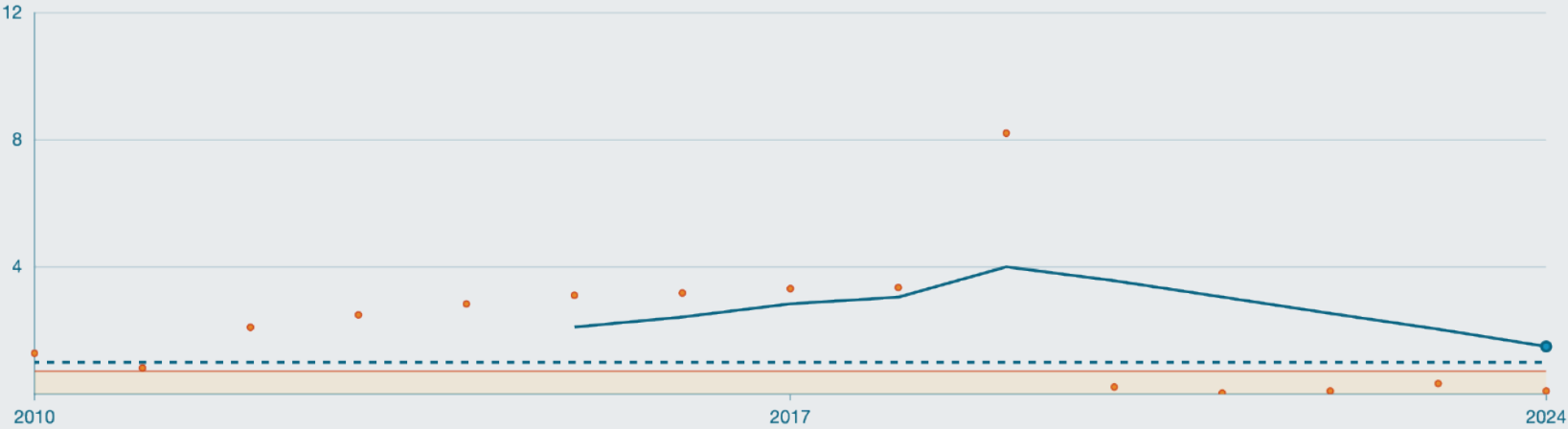
Distribution
Non-breeding period



Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

Azores



Mediterranean Gull

Larus melanocephalus

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	LC	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Mediterranean Gull has a predominantly European range, breeding between April and June from eastern Europe to southern France and Spain, with populations scattered across central Europe and the Mediterranean. During the winter, it is found along the coasts of the Black Sea, the Mediterranean, the European Atlantic and north-west Africa (Billerman *et al.* 2026).

In Mainland Portugal, it occurs along the entire coastline (Equipa Atlas 2018). It ventures out to sea, as far as the continental slope, but with higher concentrations near the mouths of the Tagus and Mira rivers and in the eastern Algarve (Meirinho *et al.* 2014). Post-breeding migration takes place between mid-June and November and pre-breeding migration between February and April, involving individuals from much of the breeding range (Moore 1992; Poot & Flamant 2006). In the Azores and Madeira, there are some records of isolated birds or small numbers in harbours and sheltered coastal areas between November and March.

Individual tracking of birds visiting the Portuguese coast is still very limited. Based on data from just two birds fitted with GPS in Italy and Belgium, but over several years, the preference for areas already known to the species is confirmed.

Abundance and population trends

The European population has been estimated at between 118,000 and 328,000 breeding pairs, and appears to be expanding its range, although the population size is declining (Keller *et al.* 2020; BirdLife International 2025). In Portugal, the latest known estimates indicated more than 7,000 individuals during the winter (Poot & Flamant 2006). Based on the data used for the environmental status assessment, an estimate of around 500 to 4,500 individuals was obtained for the continental shelf in 2024. This population has not achieved Good Environmental Status for the abundance indicator, in line with the global trend. Conversely, the population inhabiting the non-estuarine coastal zone appears to have been increasing in recent years (Velde 2025). In the case of Madeira and the Azores, there is no information on population trends, thus preventing an assessment of their environmental status.

Ecology and habitat

The Mediterranean Gull is relatively common along the coast, where it uses the shoreline primarily for resting, particularly on beaches, in fishing harbours, estuaries and salt pans. It feeds mainly in coastal waters up to the edge of the continental shelf, and may also be found locally near submarine outfalls (Poot & Flamant 2006). During the winter, its diet consists of fish, molluscs, insects, earthworms, berries and seeds (Billerman *et al.* 2026). It is also associated with fishing vessels (Poot 2003), feeding on discards. It is occasionally observed feeding on refuse.

Threats and conservation

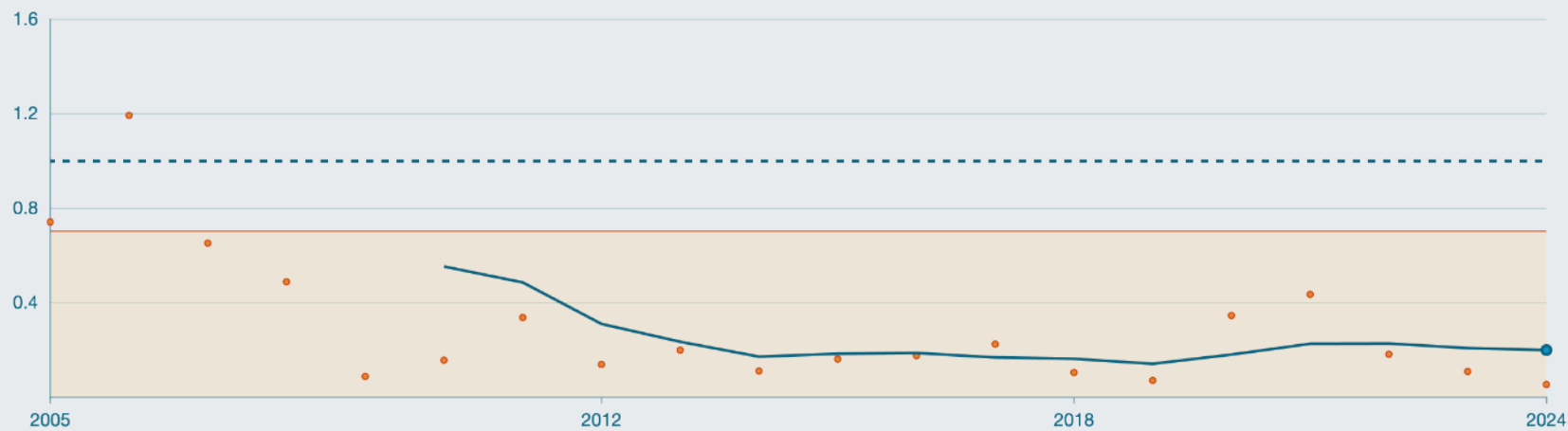
The main threats to this species are felt in breeding areas due to predation and disturbance (Billerman *et al.* 2026; BirdLife International 2025). In Portugal, the greatest threat appears to be related to disturbance caused by the significant increase in human use of beaches and other habitats typically used by the species for wintering. The degradation of wetlands may also have a negative impact on the Mediterranean Gull. There are no known incidents of bycatch in fishing gear.

Authors: Eric Stienen, Tânia Nascimento

Owners/sources of tracking data: Lorenzo Serra, Simone Pirrello & Jacopo G. Cecere (ISPRA & Ministero dell'Ambiente e della Sicurezza Energetica), Stienen *et al.* 2022

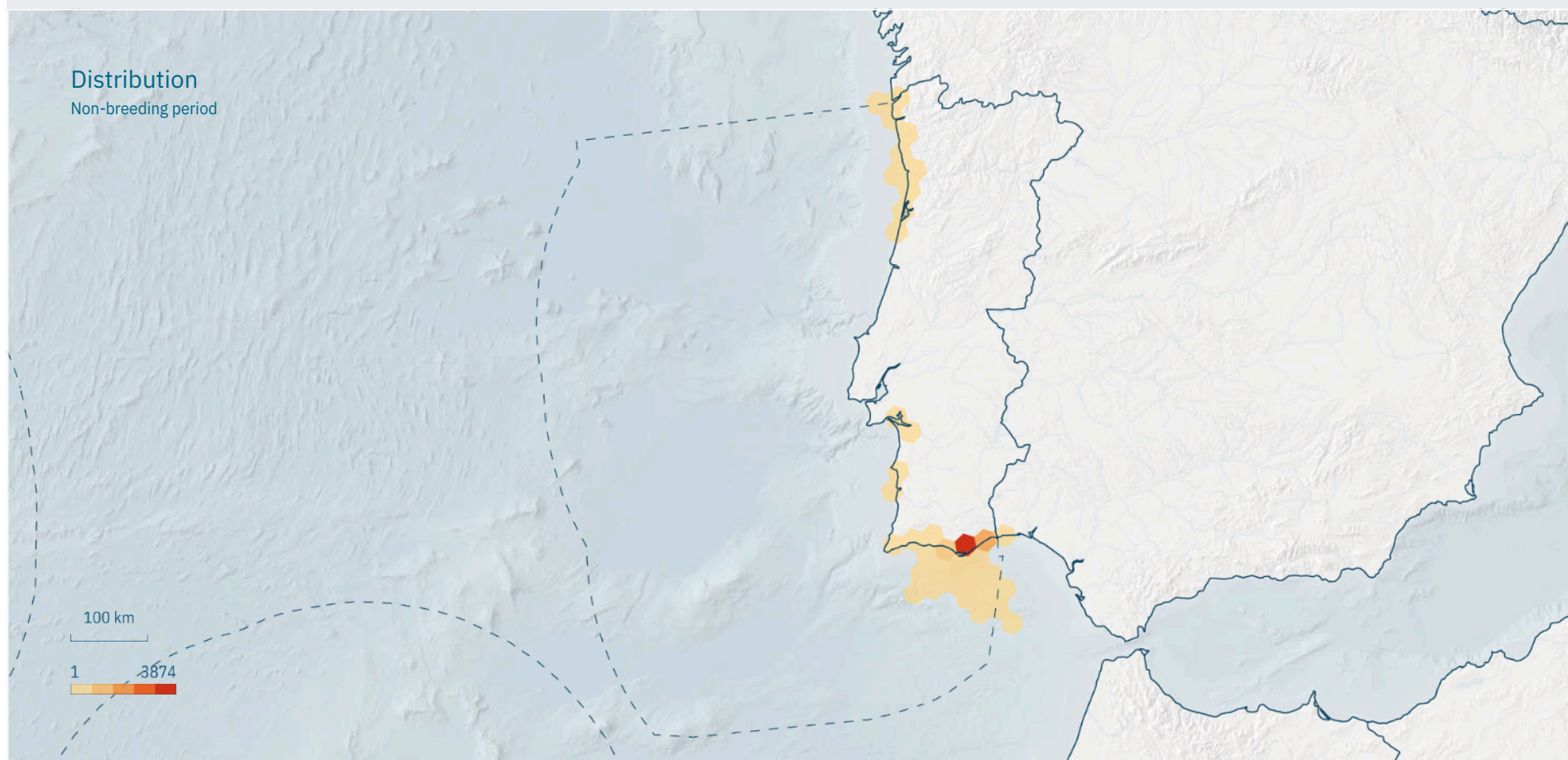
Abundance Indicator Assessment

● Relative abundance — 6-years mean & Assessment value - - - Reference value ■ Threshold



Distribution

Non-breeding period



Audouin's Gull

Larus audouinii

Phenology		Conservation status			
Mainland	Summer breeder, wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Absent	VU	NA	NA	VU
Azores	Vagrant				



Distribution, movements and phenology

The Audouin's Gull breeds between April and August, from the Atlantic coast of Morocco to Mainland Portugal and in various Mediterranean countries. It is a partially migratory species, wintering in the Mediterranean and along the north-west African coast as far south as Senegal (Billerman *et al.* 2026).

Although there are historical records (Leal & Lecoq 2006; Catry *et al.* 2010a), the species only became permanently re-established in Portugal from 2008 onwards, on Deserta Island in Faro (Moniz 2015). In the Algarve, the species is most common from March to October, with several hundred individuals remaining throughout the winter. Breeding adults in the Algarve forage in deep, productive waters up to approximately 100 km from the colony during incubation (Pereira *et al.* 2025b). After hatching, most adults remain near the colony, although some move north to Morocco and the Mediterranean. Individual tracking data from 76 birds fitted with GPS, from colonies in Portugal and Spain, indicate year-round use of the continental sub-area of the EEZ. The distribution of the birds was concentrated mainly south of the Algarve, although use has also been recorded along the south-west coast, between Setúbal and Sagres. No occurrences were recorded in the Azores and Madeira, which explains the scarce or non-existent observations of the species in these regions (Correia-Fagundes *et al.* 2021; Birding Azores 2022).

Abundance and population trends

The global population has been estimated at around 20,000 pairs (Oliveira *et al.* 2025b), with a declining trend (BirdLife International 2025). In Portugal, the species began nesting again in the early 2000s in the salt pans of Castro Marim, albeit irregularly and with very low or zero productivity, due to heavy predation pressure (Leal & Lecoq 2006). From 2008 onwards, it became a regular resident on Deserta Island, where the population grew steadily and spread to Culatra Island. In 2024, 5,591 breeding pairs were recorded on Barreta and 1,701 on Culatra. In recent years, an expansion of the breeding population towards the west coast of the Mainland has also been noted (Equipa Atlas 2022). Consequently, this population has achieved Good Environmental Status for the abundance indicator.

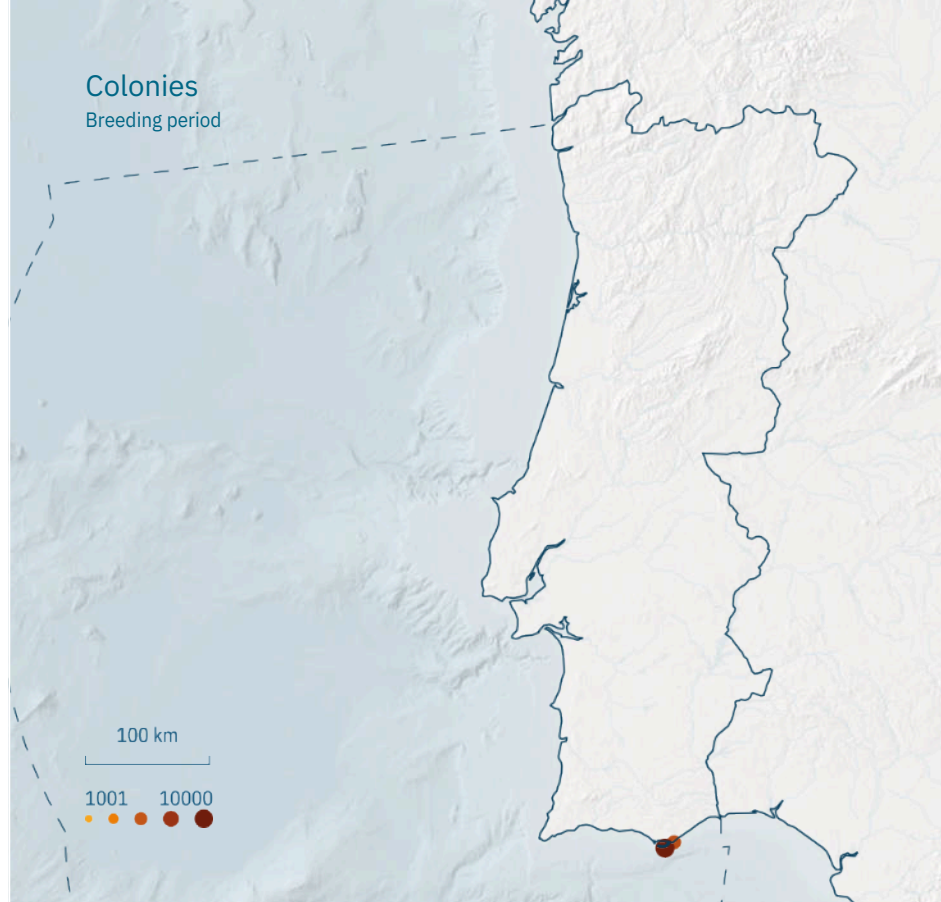
Ecology and habitat

The Audouin's Gull is generally found near the coast, though it may also frequent the continental slope. Its diet consists mainly of epipelagic fish, but also includes demersal and benthic species (Matos *et al.* 2018). It also feeds heavily on discards from commercial fisheries, particularly trawlers and purse seiners (Bécares *et al.* 2015; Matos *et al.* 2018). It nests colonially on rocky or sandy islands, sandy peninsulas and salt pans. With the collapse of some historic colonies, the Audouin's Gull has demonstrated an ability to colonise new sites, including less traditional environments such as harbours and urban areas (Oliveira *et al.* 2025b).

Threats and conservation

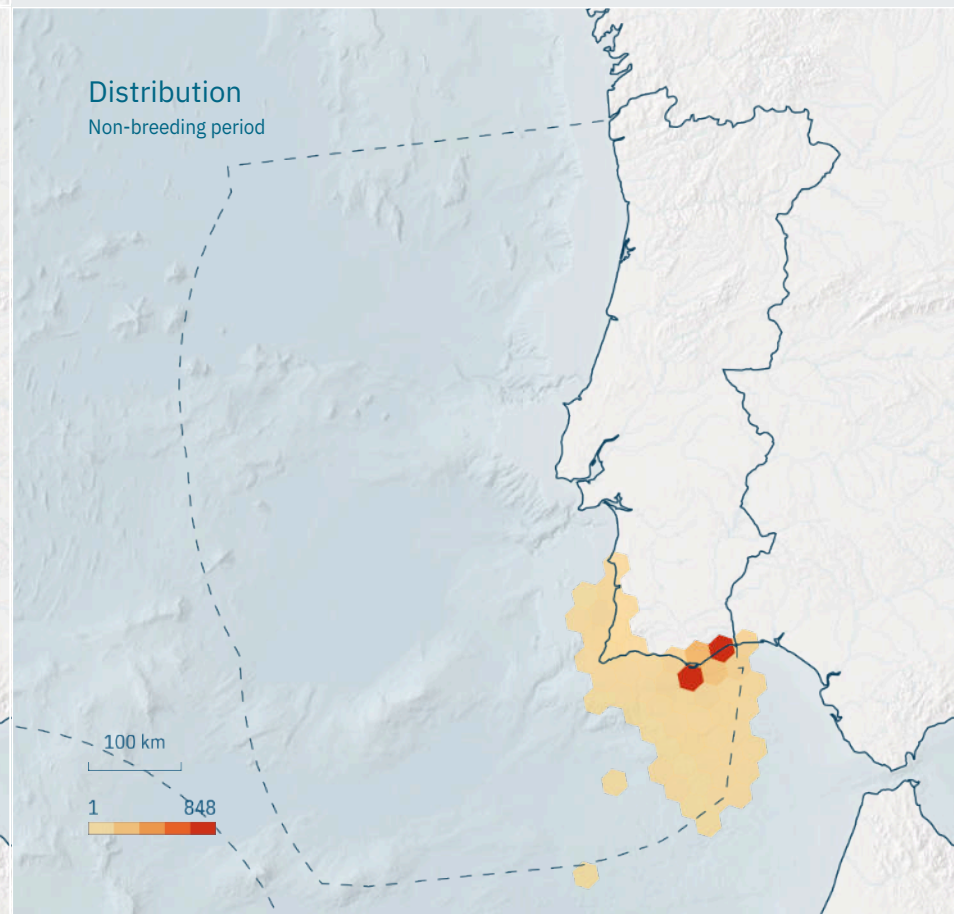
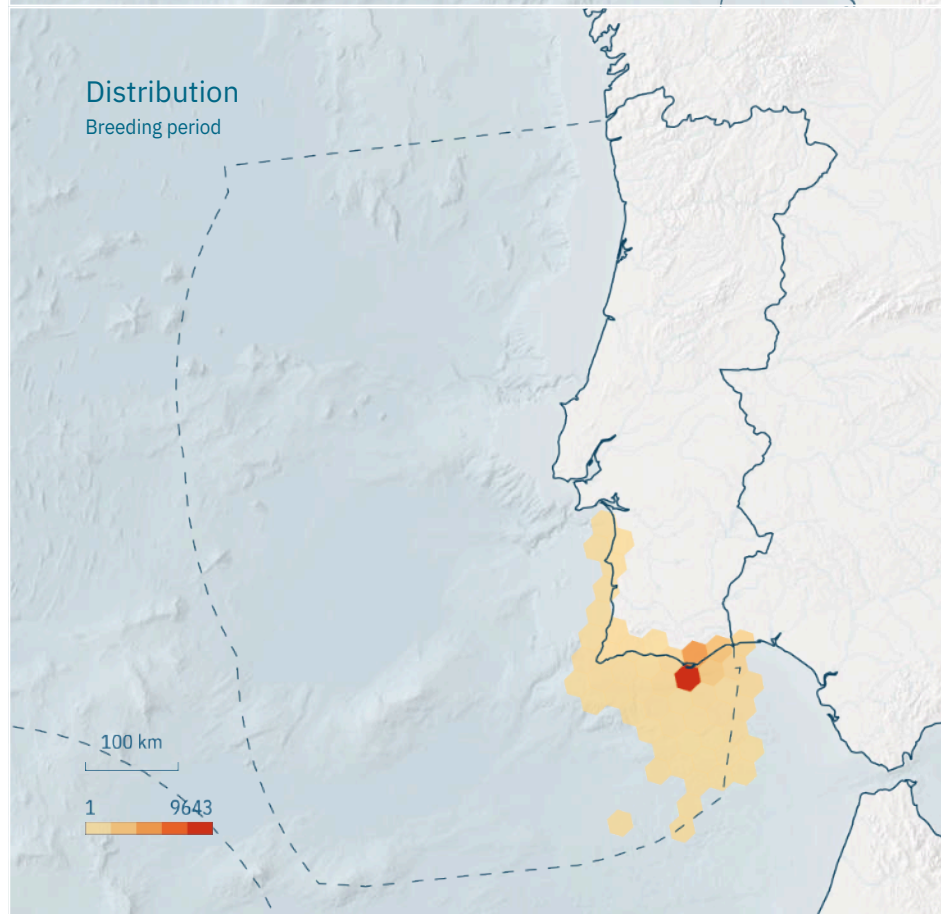
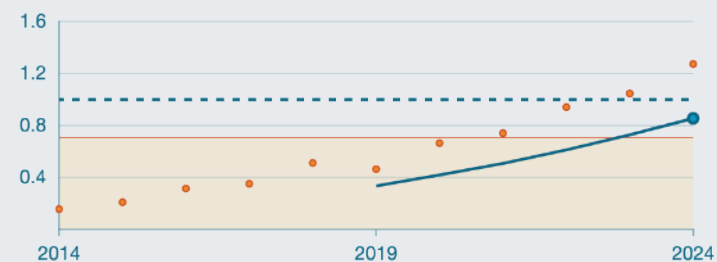
The Audouin's Gull is particularly sensitive to a reduction in fishing discards and the intrusion of predatory mammals into colonies, factors which have led to population declines and dispersal to other areas (Oro *et al.* 2004). Human presence, both in nesting areas and foraging grounds, constitutes another significant threat, as it can significantly disturb the birds, forcing them to abandon their sites and compromising breeding success. The species is also susceptible to habitat loss and degradation, bycatch, competition with other species, marine pollution, offshore energy structures, disease outbreaks and the increasing effects of climate change (Oliveira *et al.* 2025b).

Author: Tânia Nascimento
Owners/sources of tracking data: Gonzalez-Solis 2016j, Ramos 2021a, Vitor H. Paiva (MARE-UCoimbra)



Abundance Indicator Assessment

● Relative abundance — 6-years mean & Assessment value - - - Reference value ■ Threshold



Lesser Black-backed Gull

Larus fuscus

Phenology		Conservation status				
Mainland	Summer breeder, wintering and passage migrant	Mainland		Madeira	Azores	UICN Global
Madeira	Wintering and passage migrant	VU	LC	NE	NE	LC
Azores	Wintering and passage migrant	Breeding population	Wintering population			



Distribution, movements and phenology

The Lesser Black-backed Gull breeds between April and July in Europe, from Russia to the Iberian Peninsula, including Iceland. In winter, it is widely distributed along the coasts of south-western Europe and North Africa (Billerman *et al.* 2026). A substantial proportion of the Western European population winters in Portugal, occurring mainly along the Mainland coastline (Catry *et al.* 2010a). At sea, it is concentrated mainly on the continental shelf and slope (Meirinho *et al.* 2014). Immature birds usually remain in Portugal throughout the year. The breeding population is restricted to the metropolitan area of Porto and the islands of Berlenga and Deserta (Ria Formosa). In the Azores and Madeira, the species is most common between September and February, with nesting attempts occurring on the islands of Terceira and São Miguel in the Azores, and on the islet of Desembarcadouro in Madeira (Equipa Atlas 2022).

Individual tracking data from 112 birds fitted with GPS, originating from Germany, Belgium, the Netherlands and the United Kingdom, confirm intensive use of the Portuguese EEZ, particularly the Mainland coastal zone, with significantly less occurrence in Madeira. No records were obtained for the Azores.

Abundance and population trends

The global population has been estimated at between 940,000 and 2,070,000 individuals, with an upward population trend, although some European populations are declining (BirdLife International 2025). In Portugal, the breeding population is small, with fewer than 100 pairs and an upward trend. Of particular note is the recent colonisation of Deserta Island (Ria Formosa), where no breeding had been confirmed until 2005 (Equipa Atlas 2008; Equipa Atlas 2022), and which now hosts more than 50 pairs. Outside the breeding season, it is the most abundant gull on the Mainland, particularly along the coastline, although there has been a sharp decline in the population using the non-estuarine coastal area (Velde 2025). The assessment of environmental status indicates that the breeding population has achieved Good Environmental Status on the Mainland, mainly due to the growth of the Ria Formosa colony. Conversely, the non-breeding population in the same region has not achieved Good Environmental Status, in line with the declines reported for this same population at some of its source sites (BirdLife International 2021).

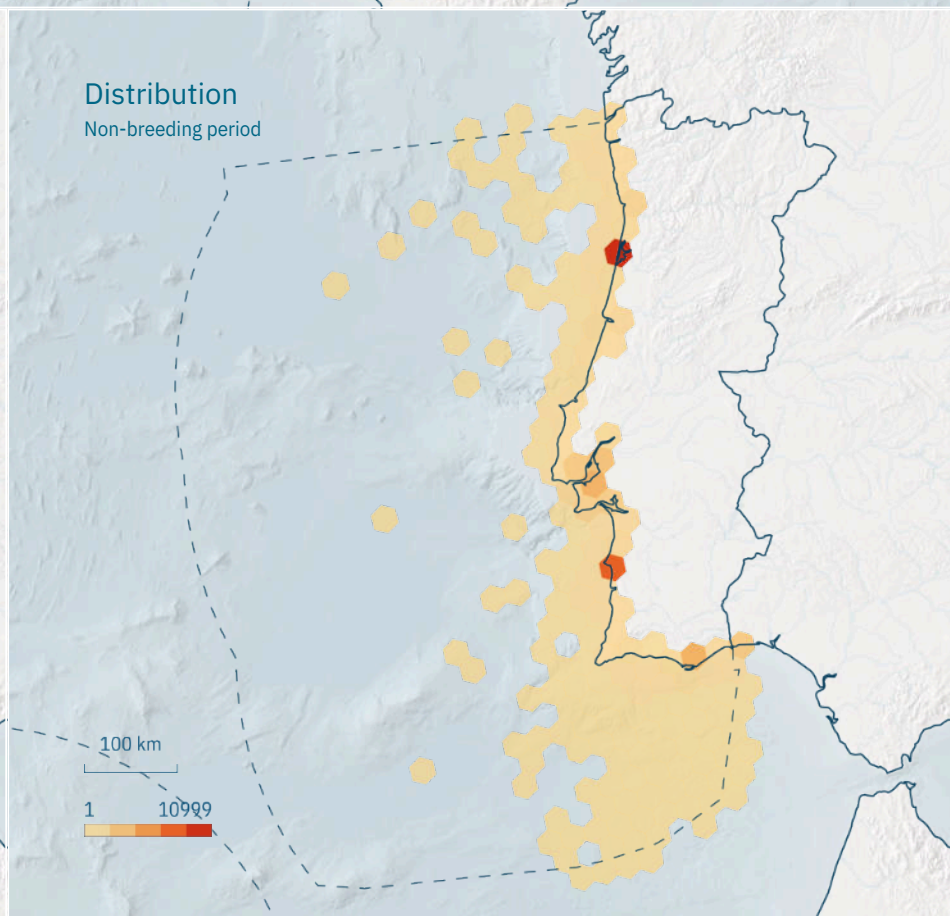
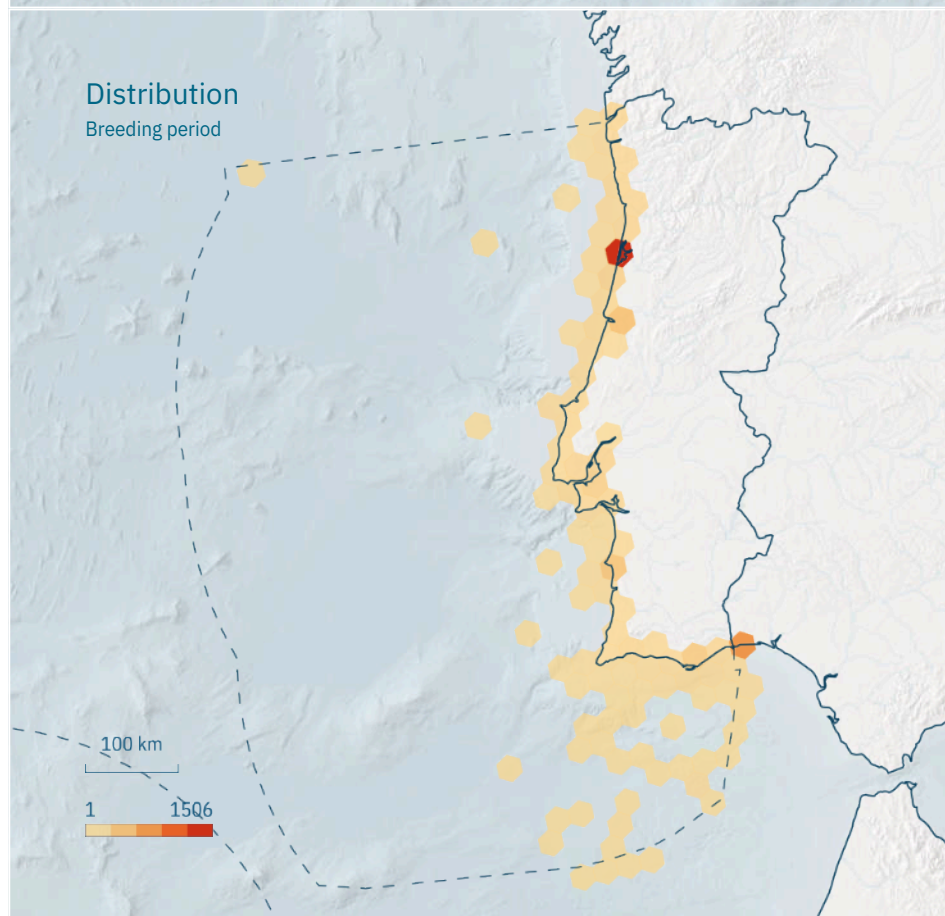
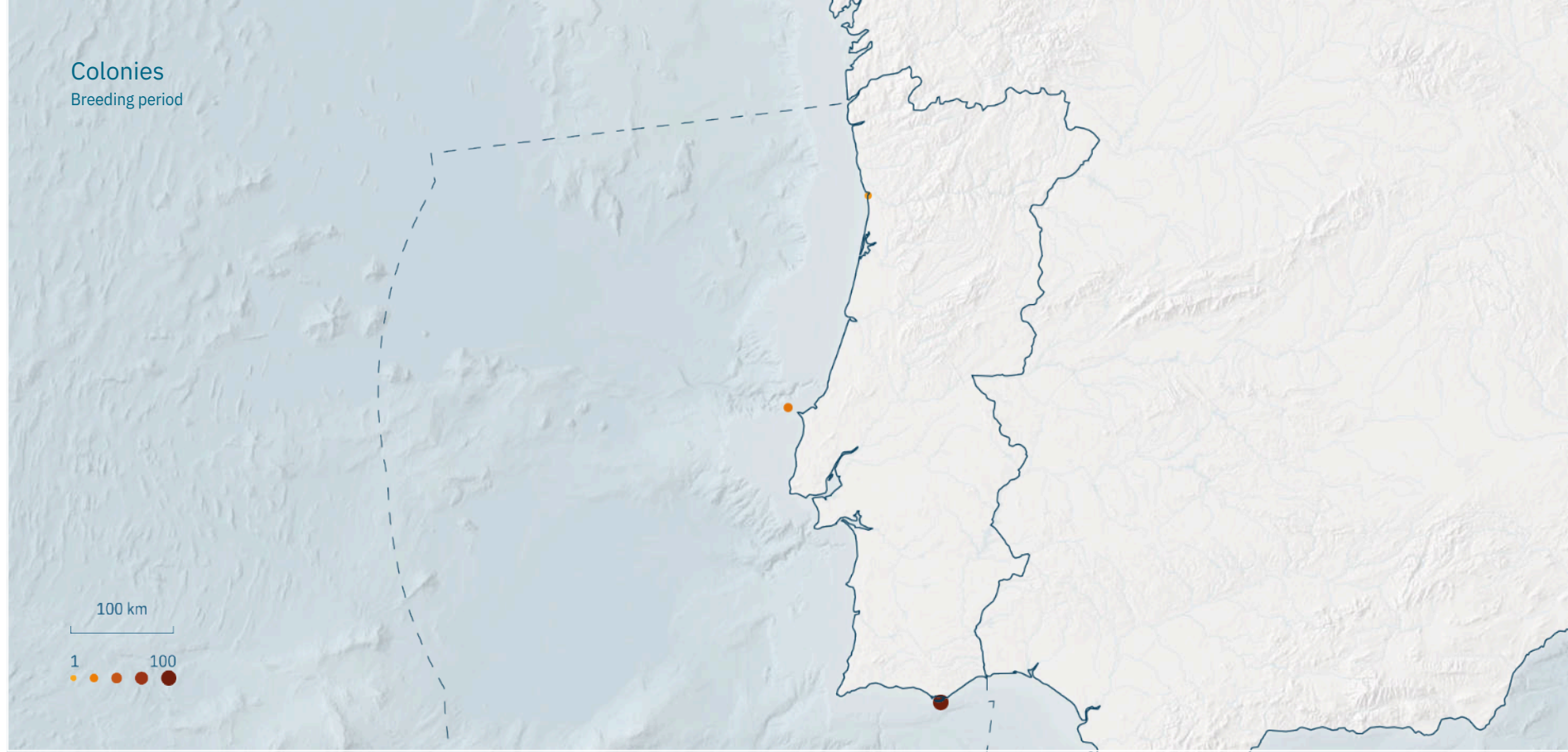
Ecology and habitat

In Portugal, it nests on both rocky and sandy islands, as well as in urban areas, usually in mixed colonies with Yellow-legged Gulls *Larus michahellis*. Wintering birds typically roost at sea, in coastal lagoons and in wetlands, whilst feeding takes place mainly on land, where the gull utilises a wide variety of habitats, including sewage treatment plants, landfill sites, urban areas, coastal lagoons, reservoirs, flooded rice paddy stubble and large rivers (Catry *et al.* 2010a). Their diverse diet includes fish, fishing discards, invertebrates (marine and freshwater crustaceans, and bivalves), detritus from landfill sites and sewage outlets, and even other birds, such as the Domestic Pigeon (Catry *et al.* 2010a; Lourenço 2019).

Threats and conservation

Declines in some European colonies of the Lesser Black-backed Gull have been attributed to environmental pollutants (Bustnes 2006; Hario *et al.* 2000). In Portugal, the species is primarily affected by bycatch in fishing gear (Calado *et al.* 2021).

Authors: Eric Stienen, Tânia Nascimento
Owners/sources of tracking data: Corman *et al.* 2016, Hayley Douglas, SEATRACK, Stienen *et al.* 2019, Stienen *et al.* 2021, Stienen *et al.* 2023



Distribution
Breeding period



Madeira

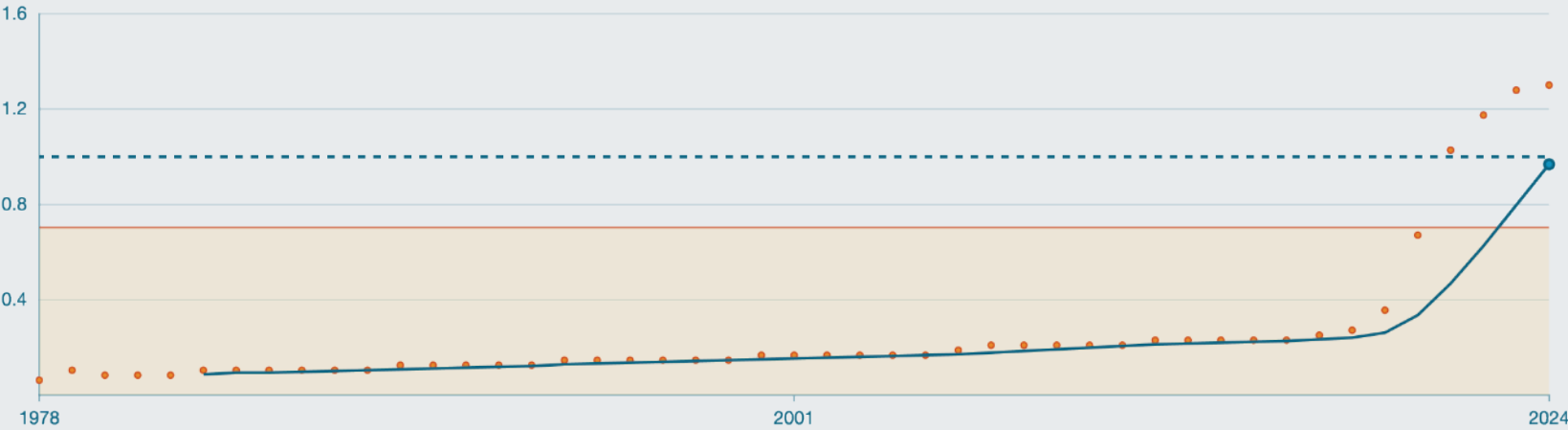
A north arrow pointing upwards, enclosed in a circle, with the letter 'N' above it.

Colony(ies) of origin: Amrum (Germany), Zeebrugge (Belgium), Neeltje Jans (Netherlands), Clyde Muirshiel (UK) | Device: GPS
Data period / number of individuals: April 2017 / 1 ind.

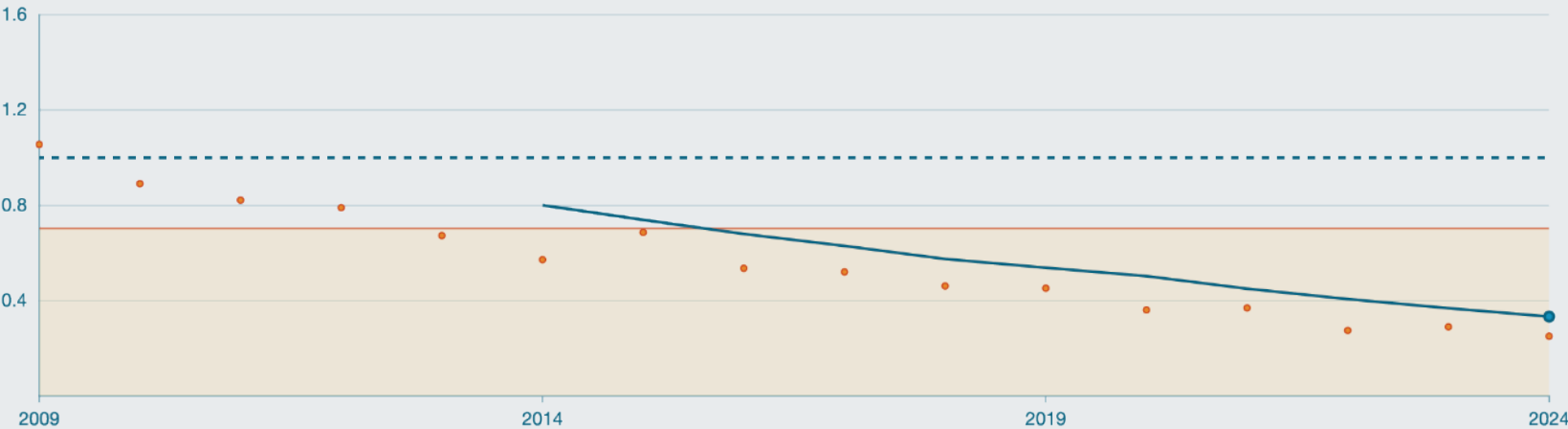
Abundance Indicator Assessment - Mainland

Relative abundance 6-years mean & Assessment value Reference value Threshold

Breeding period



Non-breeding period



Yellow-legged Gull

Larus michahellis

Phenology		Conservation status			
Mainland	Resident	Mainland	Madeira	Azores	UICN Global
Madeira	Resident	LC	LC	LC	LC
Azores	Resident				



Distribution, movements and phenology

The Yellow-legged Gull breeds between April and August in Europe, the Middle East and North Africa, and is resident mainly in the coastal areas of the Iberian Peninsula and France, the Mediterranean, the Black Sea and the Caspian Sea, as well as in the Azores, Madeira and the Canary Islands. In winter, it is distributed along the European Atlantic and Mediterranean coasts, from Denmark to Western Sahara (Billerman *et al.* 2026). In Portugal, it nests mainly along the entire Mainland coast and on most of the islands and islets of the Azores and Madeira (Oliveira *et al.* 2023b). Although sedentary, some individuals undertake wider dispersal movements along the entire Portuguese Mainland coast (Fernandes *et al.* 2025), in Spain and Morocco, and occasionally to more distant countries in northern Europe and the Mediterranean. At sea, it has a distinctly coastal distribution, rarely venturing beyond the continental shelf (Meirinho *et al.* 2014; Romero *et al.* 2019).

Based on the individual tracking of 201 birds from colonies on Mainland Portugal and in Spain, the known distribution for the Mainland region is confirmed. This type of information was not made available for the colonies in the Azores or Madeira.

Abundance and population trends

The European population has been estimated at between 409,000 and 534,000 pairs, with a growing population trend (BirdLife International 2025).

Currently, the Portuguese population numbers between 7,350 and 8,000 pairs, with the largest colonies on the Mainland (Oliveira *et al.* 2023b). The latter reached a peak in the 1990s, with 45,000 individuals on the island of Berlenga alone (Catry *et al.* 2010a). Since then, control measures in this colony have contributed to a reduction in the population, reaching 2,200 pairs in 2022 (Ceia *et al.* 2023). Despite the decline in the Mainland population abundance, there has been an expansion in its distribution, mainly due to the occupation of urban areas. In other regions, a reduction in population numbers has also been recorded in recent decades, with currently 1,606 to 1,712 pairs in the Azores and 52 to 105 pairs in Madeira (Oliveira *et al.* 2023b).

The Mainland and Azores populations have achieved Good Environmental Status for the abundance indicator, unlike the Madeira population, reflecting the sharp decline in its abundance.

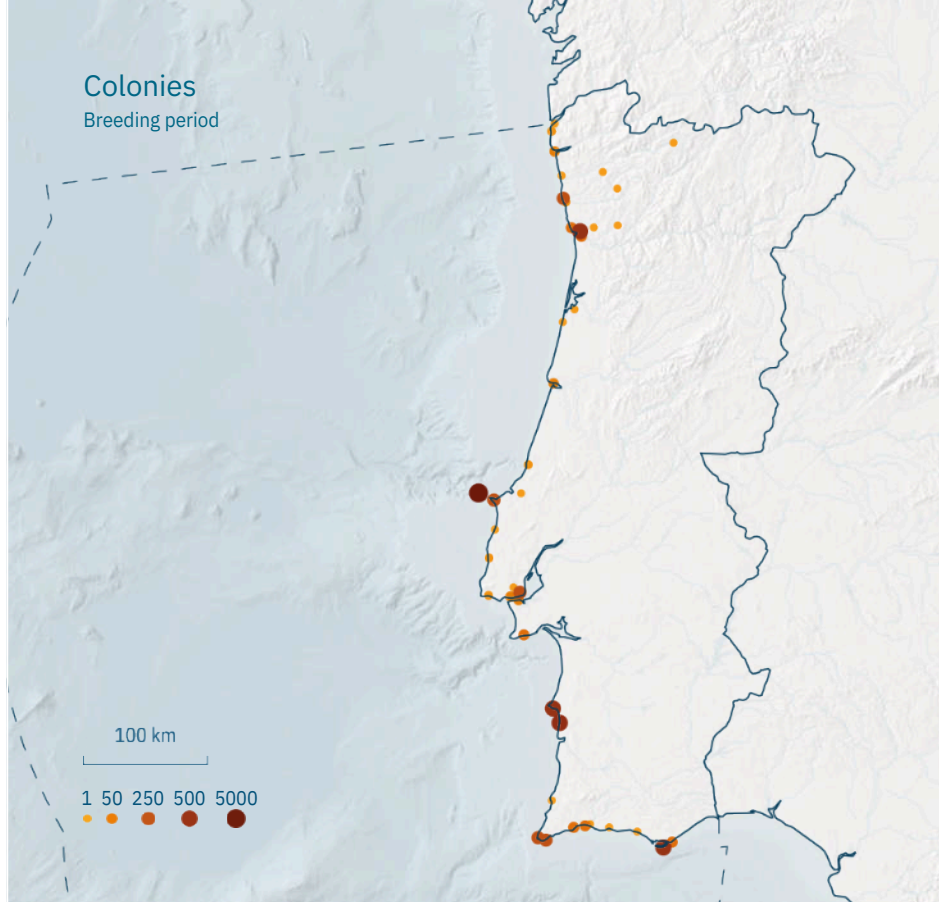
Ecology and habitat

This gull utilises a variety of coastal habitats, such as beaches, fishing harbours, agricultural fields, urban areas, salt pans and landfills (Matos *et al.* 2018; Mendes *et al.* 2018). The distribution of this species appears to be linked to the high availability of food, obtained at landfills, near boats and in fishing harbours (Pereira *et al.* 2025b). Its generalist diet includes fish, pelagic crabs, insects and waste generated by human activities (Lopes *et al.* 2021). It is also a known predator of other seabirds. It nests preferentially on islands, islets, coastal cliffs and in urban areas.

Threats and conservation

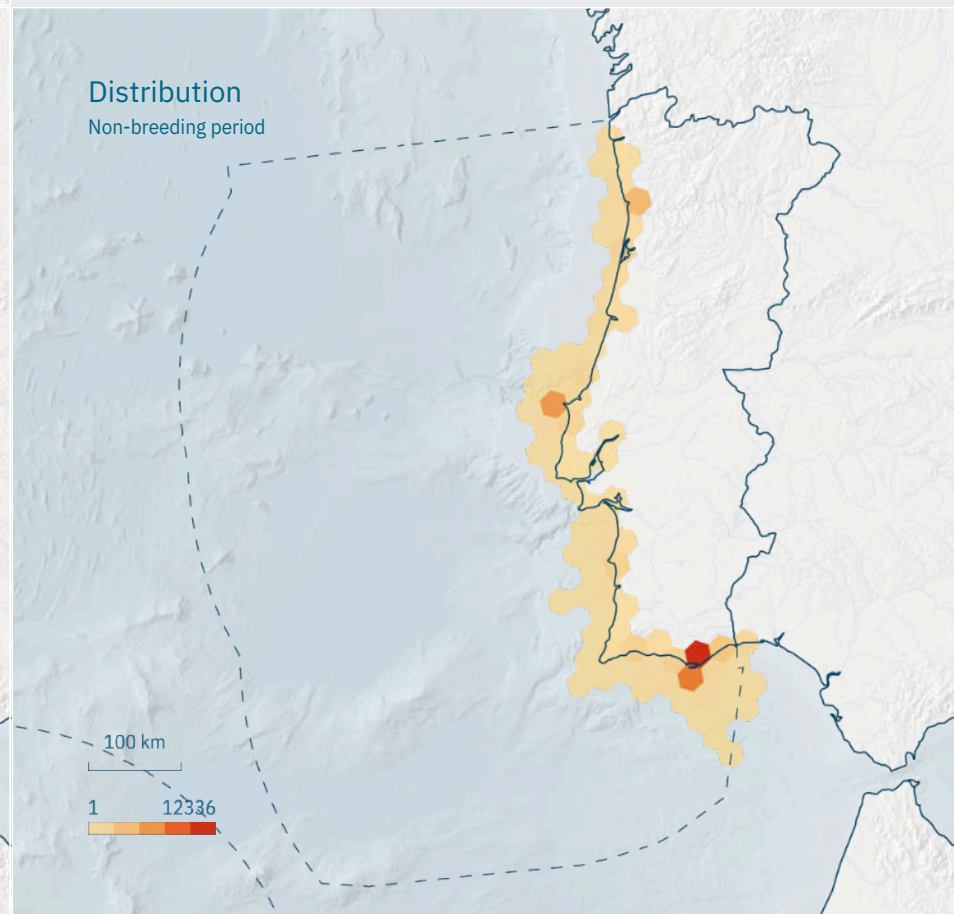
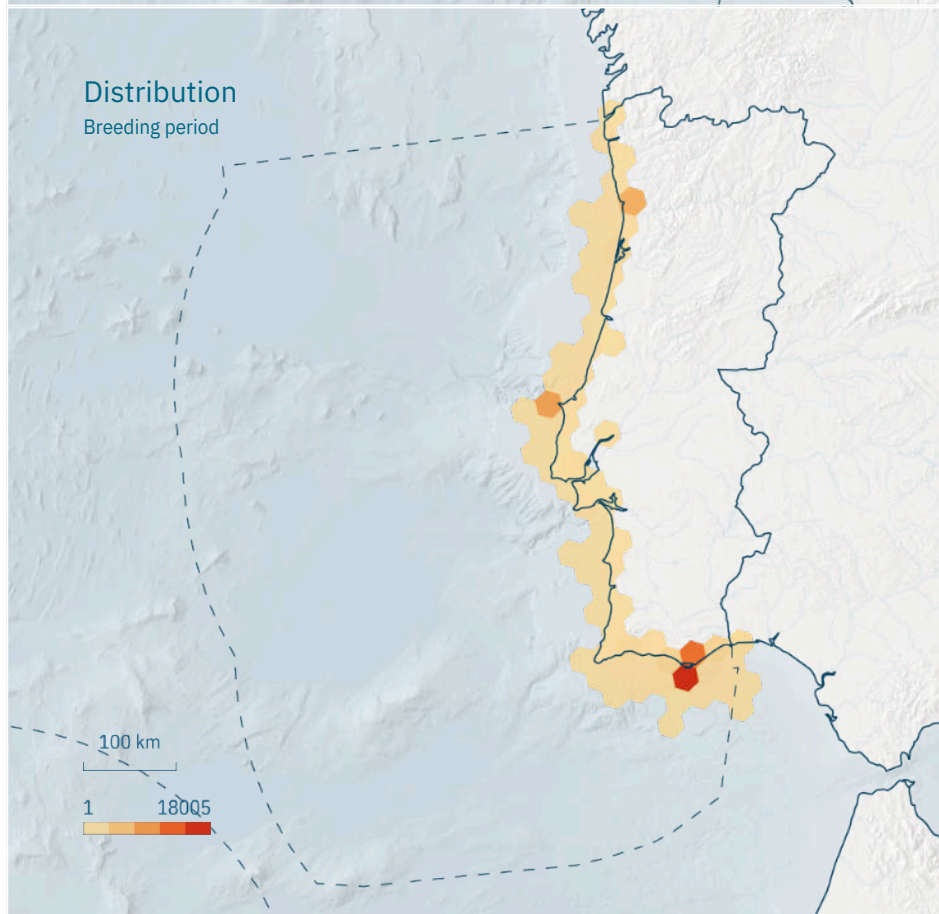
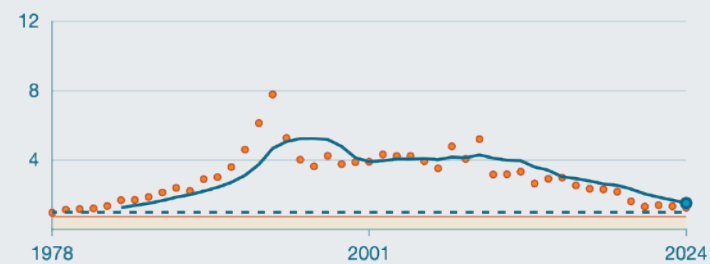
In Portugal, some individuals are frequently captured as bycatch in fishing gear such as gillnets and longlines (Calado *et al.* 2021; Pereira *et al.* 2025a). Furthermore, the species faces other threats such as marine pollution (Lopes *et al.* 2021; dos Santos *et al.* 2024; Veríssimo *et al.* 2025) and diseases (Casero *et al.* 2025). Excessive population numbers in some colonies can place significant pressure on other natural elements, notably flora, other birds and reptiles. Some of these may have increased conservation value, as they are endemic with a limited distribution and/or have an unfavourable conservation status. It is urgent to ensure proper management of urban and fisheries waste in order to limit the unregulated growth of the Yellow-legged Gull.

Author: Jorge Pereira
Owners/sources of tracking data: Ramos 2020b, Ramos 2021b, Ramos 2022, SPEA, Vitor H. Paiva & Filipe Ceia (MARE-UCoimbra)



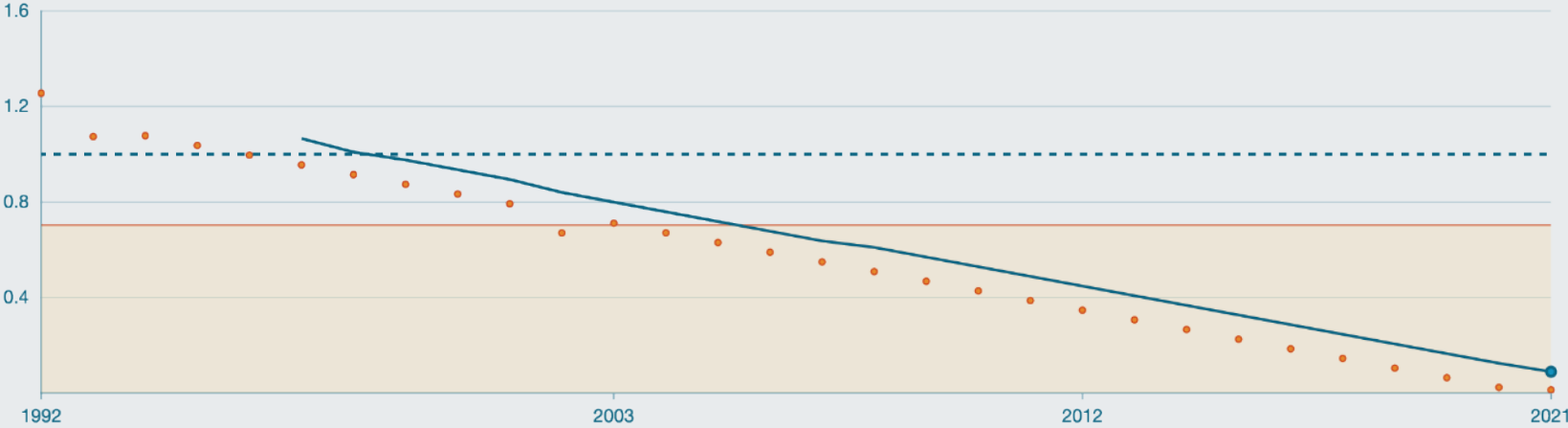
Abundance Indicator Assessment

● Relative abundance — 6-years mean & Assessment value - - - Reference value ■ Threshold



Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold



N
Madeira

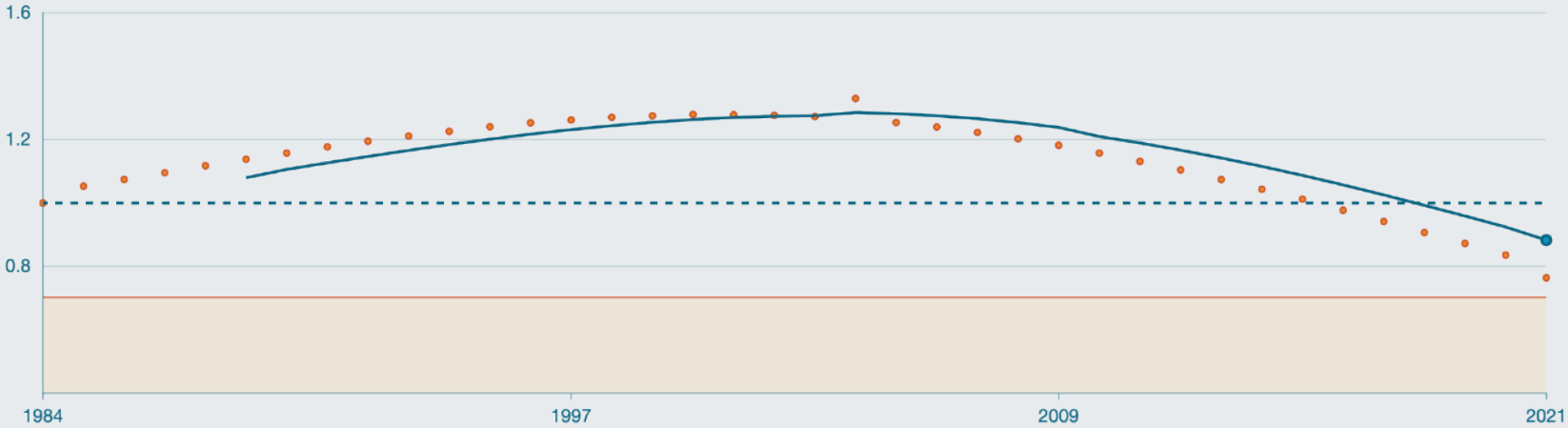
Colonies

Breeding period



Abundance Indicator Assessment

● Relative abundance
 —●— 6-years mean & Assessment value
 - - - Reference value
 ■ Threshold



Colonies Breeding period



Arctic Herring Gull

Larus smithsonianus

Phenology		Conservation status			
Mainland	Vagrant	Mainland	Madeira	Azores	UICN Global
Madeira	Absent	NA	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Arctic Herring Gull breeds on the North American continent and in East Asia (Billerman *et al.* 2026). Following the breeding season, which takes place between May and July, the birds migrate to areas further south of their breeding grounds; the European continent is not a significant stopover area at any stage of their phenology. The birds occurring here are mostly vagrants, representing occasional sightings outside the species' regular distribution. This is confirmed by data from a bird from Canada fitted with a GLS tracker, which shows very limited use of the Portuguese EEZ, restricted to the Azores. This information is also corroborated by records submitted to the Portuguese Rarities Committee, which, although not yet formally accepted, amount to little more than a dozen sightings in the Azores and just one bird on the Mainland between 2004 and 2020.

Abundance and population trends

The global population has been estimated at 430,000 to 520,000 individuals, with a declining trend in the largest populations, which are found in North America (Wetlands International 2025). In Portuguese waters, the species occurs very rarely, and there is no known trend in these occurrences.

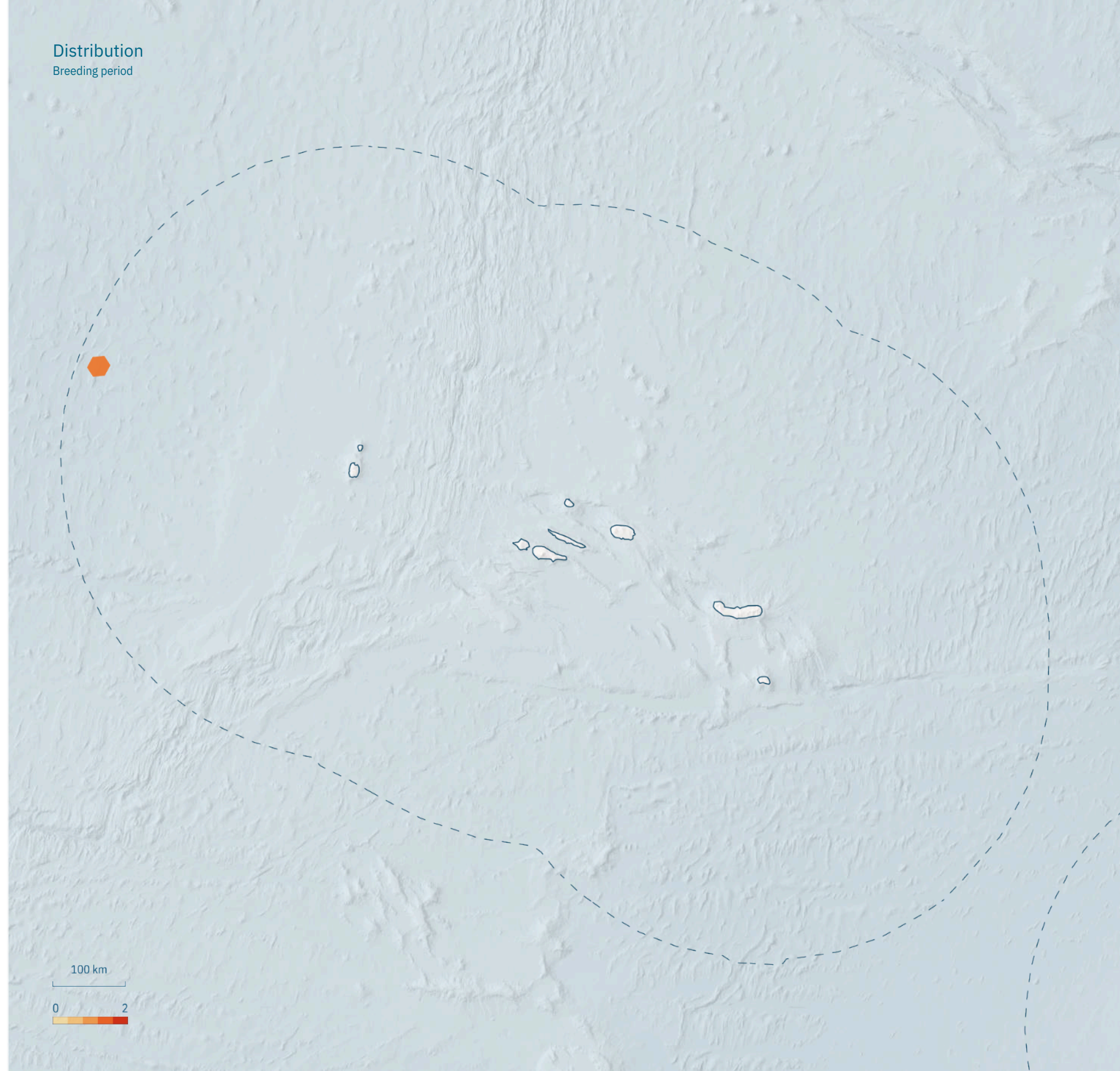
Ecology and habitat

The species has an ecology and diet very similar to that of its close relative, the European Herring Gull *Larus argentatus*. It feeds on a wide variety of species, both in marine environments and in inland freshwater areas (Billerman *et al.* 2026). It also frequently feeds on discards from commercial fishing (BirdLife International 2025).

Threats and conservation

It is not threatened with extinction, despite its declining population trend. Reductions in fishing discards have diminished food availability in several areas of its distribution (Billerman *et al.* 2026). Egg collection in rural areas of Canada, particularly by Indigenous peoples, continues to occur, although this does not appear to account for the species' population trend. Population control programmes for safety around some airports are also common.

Distribution
Breeding period



Sooty Tern

Onychoprion fuscatus

Phenology		Conservation status			
Mainland	Vagrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	NA	NA	NE	LC
Azores	Summer breeder				



Distribution, movements and phenology

The Sooty Tern breeds on most of the tropical and subtropical islands across all the oceans (Billerman *et al.* 2026). In the Western Palearctic, regular breeding of the species occurs only in the Azores, between April and September, on the islets of Praia (Graciosa) and Vila (Santa Maria) (Equipa Atlas 2022). The species has been observed on other islands in the Azores, such as Graciosa, São Miguel, São Jorge and Faial, although there is no evidence of breeding. In Madeira, records are scarce and are mainly concentrated on the Selvagens and Deserta Grande islands, with no recent evidence of breeding either, although it was confirmed on Selvagem Pequena in 1982 (Roux 1983; Meirinho *et al.* 2014). On the Mainland, it is a rare species, with only two records formally accepted by the Portuguese Rarities Committee (Robb *et al.* 2025). It has not been possible to obtain individual tracking data demonstrating use of the Portuguese EEZ.

Abundance and population trends

The global population is estimated at around 23 million mature individuals, with an unknown population trend (BirdLife International 2025). The presence of the Sooty Tern in the Azores has been known since 1902 (Hartert & Ogilvie-Grant 1905), with the first monitoring of the breeding population beginning in the 1990s. It has bred more or less regularly on Praia Islet since 2004, with interannual variations between one and two pairs, the most recent record, in 2025, corresponding to two pairs. One pair also bred on Vila Islet between 1990 and 2006, with no further breeding records since then. Despite the very small population size and highly localised breeding, the Azores population has achieved Good Environmental Status for the abundance indicator.

Ecology and habitat

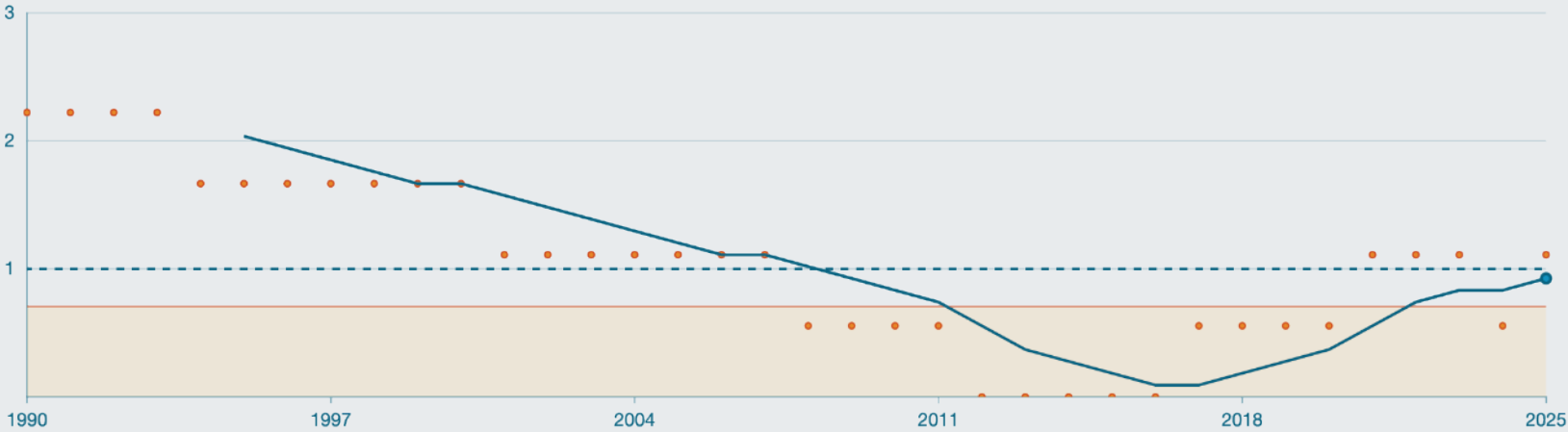
The Sooty Tern nests on the ground, on a substrate of sand, rock or sparse vegetation, usually in flat areas. In the Azores, it nests in mixed colonies of Common *Sterna hirundo* and Roseate Terns *Sterna dougallii*. Outside the breeding season, it is highly pelagic. Its diet consists mainly of small fish and squid, and it may occasionally feed on crustaceans, insects and fishing discards (Billerman *et al.* 2026). It may also associate with large predatory fish that drive prey to the surface (Higgins & Davies 1996).

Threats and conservation

The main threat in breeding areas is predation and disturbance caused by invasive species, notably rats and cats (BirdLife International 2025). At sea, variations in sea surface temperature reduce success in capturing prey, which may impact breeding success (Erwin & Congdon 2007). In Portugal, the introduction of predators into breeding areas poses a risk if there is no monitoring and regular biosecurity measures, a situation exacerbated by human disturbance and predation by other native birds (Meirinho *et al.* 2003a; Meirinho *et al.* 2003b).

Abundance Indicator Assessment

● Relative abundance
 —●— 6-years mean & Assessment value
 - - - Reference value
 ■ Threshold



Colonies

Breeding period

100 km



Little Tern

Sternula albifrons

Phenology		Conservation status			
Mainland	Summer breeder and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	VU	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Little Tern breeds in Eurasia, Africa and Australia (Billerman *et al.* 2026). In Europe, it occurs as a subspecies, with the breeding season taking place between April and July. In Mainland Portugal, the largest colonies are found on the sandy islands of the Ria Formosa, with an increasingly rare occurrence in the salt pans of this area. In smaller numbers, it nests in other wetlands and coastal areas, such as the Ria de Aveiro and the estuaries of the Mondego, Tagus and Sado rivers, or inland, in the Caia and Alqueva reservoirs (Equipa Atlas 2022). During the post-breeding period, between August and September, breeding birds are also found in other European countries, en route to the west coast of Africa (Equipa Atlas 2018), a destination also common to the national population (Catry *et al.* 2010a). Data from 20 birds fitted with GPS between 2021 and 2025 on Barreta Island (Ria Formosa) indicate that they are found primarily in the lagoon, salt pans and sea adjacent to the breeding colonies, and may undertake offshore journeys of up to 20 km (Cerveira *et al.* 2025). It is worth noting that one individual, after losing its clutch, crossed the Gulf of Cádiz to Spain. In the archipelagos of Madeira and the Azores, the species is rare.

Abundance and population trends

The global population has been estimated at between 190,000 and 410,000 individuals, of which 36,000 to 53,000 pairs breed in Europe (BirdLife International 2025). The breeding population in Portugal has shown marked fluctuations over the years, with the most recent estimate pointing to 558 to 943 pairs (Equipa Atlas 2022). The Ria Formosa hosts Portugal's main breeding concentration, with an estimated population of 303 to 522 pairs between 2020 and 2025, mostly on sandy beaches near the tidal inlets. Despite localised declines in some colonies, the significant increase in the Ria Formosa population appears to account for the positive trend at national level. This pattern was corroborated by the assessment presented in this work, which indicates that the species has achieved Good Environmental Status for the abundance indicator. Regarding the migratory population or the situation in the Azores and Madeira, there is no information on abundance that would allow an assessment of its environmental status.

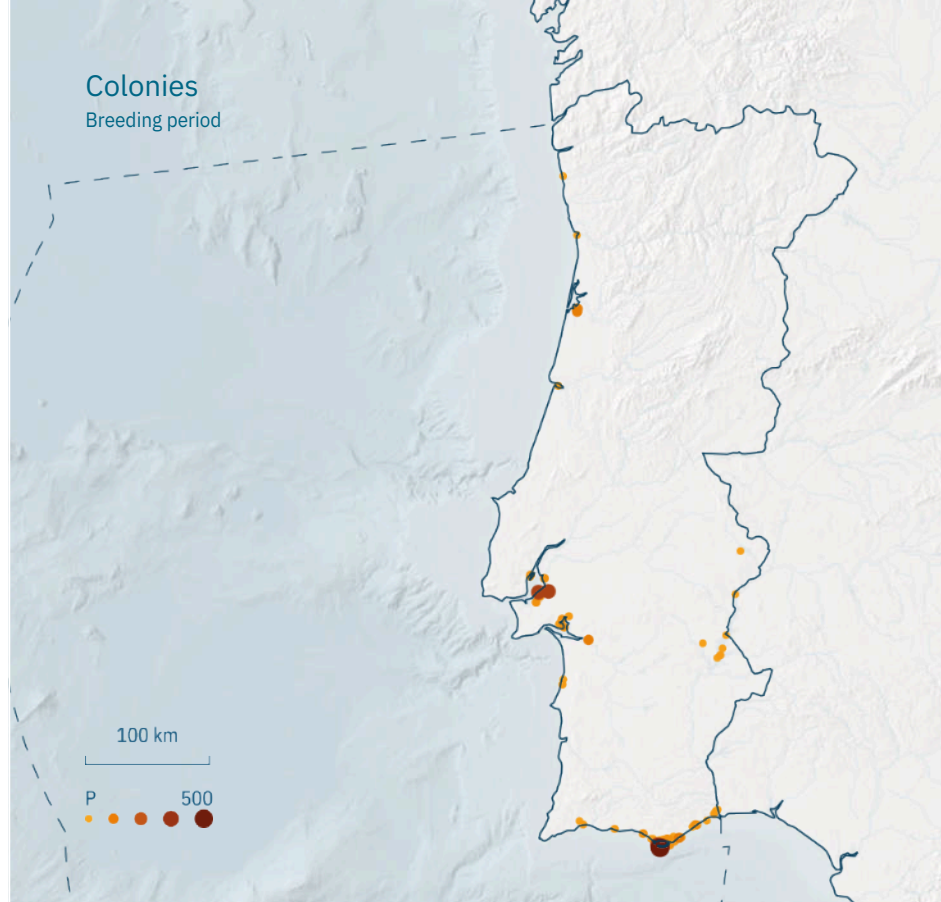
Ecology and habitat

The Little Tern nests in coastal wetlands, sandy beaches, sandbanks and salt pans with little disturbance (Equipa Atlas 2008; Catry *et al.* 2010a) and reduced vegetation cover (Lopes *et al.* 2015). It uses a small depression in the sand or soil as a nest. The species forages around its breeding areas, exploiting inland waters, salt pans, aquaculture sites and also shallow coastal waters (Paiva *et al.* 2008). The main prey of the Little Tern are small fish, particularly sand smelt and gobies in Portuguese waters (Catry *et al.* 2006; Ramos *et al.* 2013a). To a lesser extent, it also consumes white seabreams, garfish, sardines, crustaceans and insects (Correia *et al.* 2016).

Threats and conservation

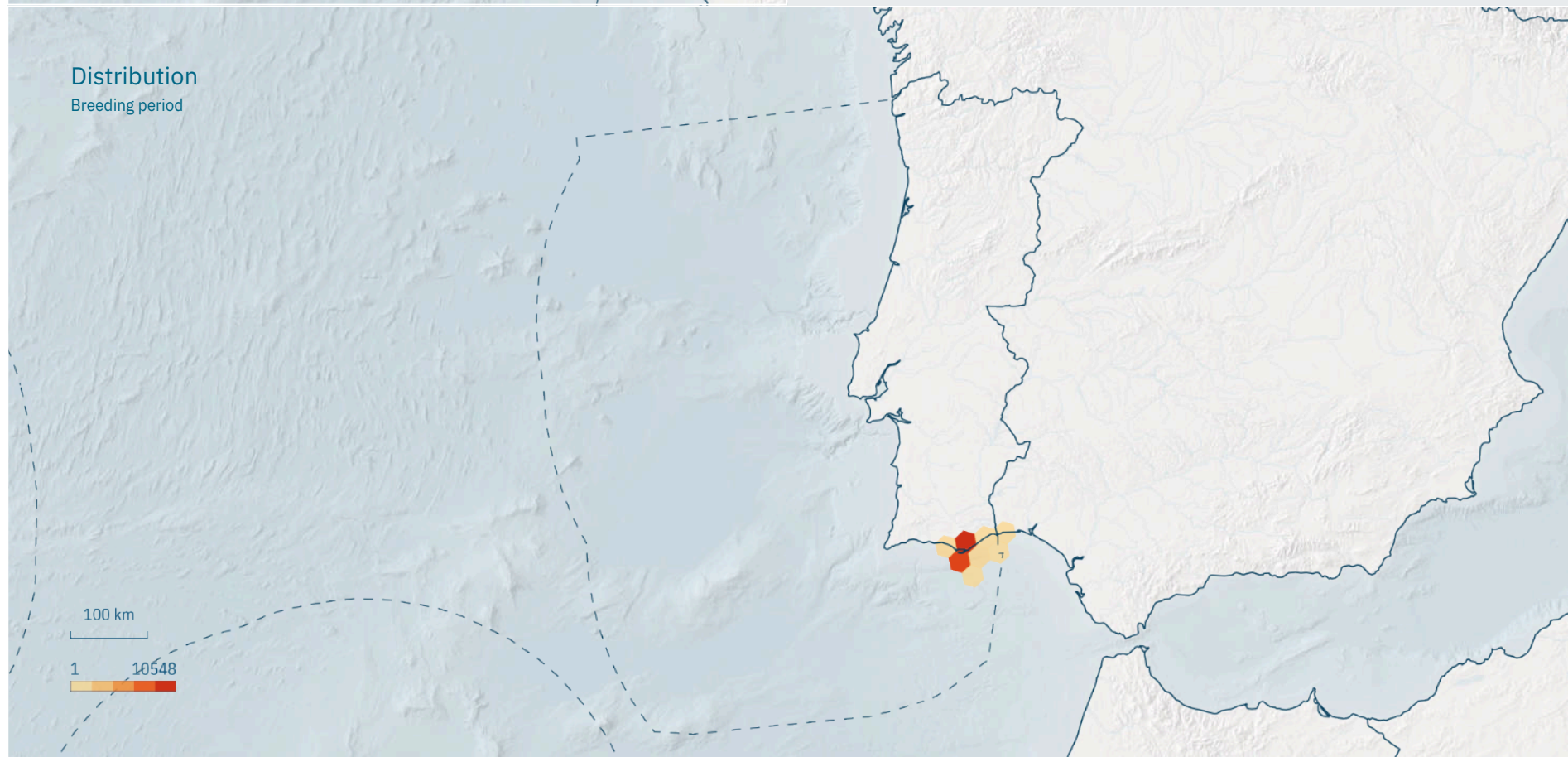
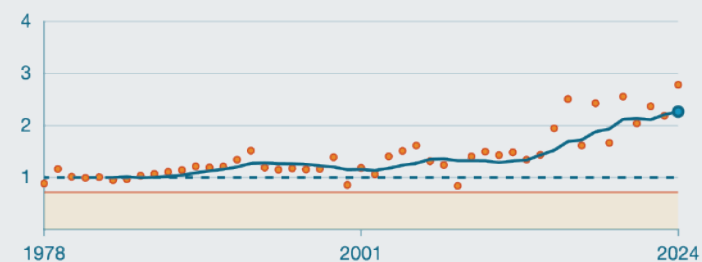
In Portugal, the main threats to the Little Tern are human disturbance in breeding areas and the abandonment of salt pans, with the consequent increase in vegetation cover around the ponds (Medeiros *et al.* 2007; Equipa Atlas 2022). Predation by mammals and birds, particularly by dogs, cats, Eurasian Thick-knee *Burhinus oedichnemos* or Carrion Crows *Corvus corone*, is also a significant threat (Catry *et al.* 2004). Human disturbance in breeding areas can be controlled and reduced through fencing and temporary closure of the main breeding colonies (Medeiros *et al.* 2007). Vegetation management, predator control and the construction of artificial islands in these same areas increase the productivity and stability of the colonies. Such measures are being implemented in the Ria Formosa.

Author: Jaime A. Ramos
Owners/sources of tracking data: Vitor H. Paiva (MARE-UCoimbra)



Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold



Common Gull-billed Tern

Gelochelidon nilotica

Phenology		Conservation status			
Mainland	Summer breeder and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	VU	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Common Gull-billed Tern breeds discontinuously between April and July in southern and central Europe, Asia, North and South America, and Australia (Billerman *et al.* 2026). Part of the European population is migratory, wintering in West Africa. In Mainland Portugal, the Common Gull-billed Tern nests south of the Tagus in breeding populations located mainly in reservoirs in the Alentejo, but also in the Tagus estuary, and is likely to breed in the Ria de Aveiro (Equipa Atlas 2022). The first birds appear from March onwards, with the majority arriving in April and remaining observable until mid-September. Along the coast, it occurs in small numbers, mainly in estuarine coastal areas between May and August (Catry *et al.* 2010a). In recent years, it has been a regular visitor to the Azores throughout the year, with few records from Madeira, where it occurs mainly during the summer (Correia-Fagundes *et al.* 2021; eBird 2026).

Abundance and population trends

The European population has been estimated at between 16,600 and 21,200 breeding pairs, with an upward trend, although the global population is thought to be in decline (BirdLife International 2025). In Portugal, it is estimated that there are between 1,000 and 2,000 breeding pairs, with the Alentejo being the main area of occurrence, particularly the Alqueva and Caia reservoirs (Equipa Atlas 2022). Occupancy of these nesting areas is dynamic, with interannual fluctuations in the number of breeding pairs, and no evidence of a consistent trend of sustained growth in recent years. This pattern reflects the irregular nature of nesting and the high dependence on favourable environmental conditions.

This dynamic is corroborated by the analysis of the environmental status for the breeding population abundance indicator, which shows strong interannual variability. Nevertheless, the species has achieved Good Environmental Status for this indicator. In the case of the Azores and Madeira, the available information does not allow for an assessment of the species' population trends, making it impossible to evaluate its environmental status.

Ecology and habitat

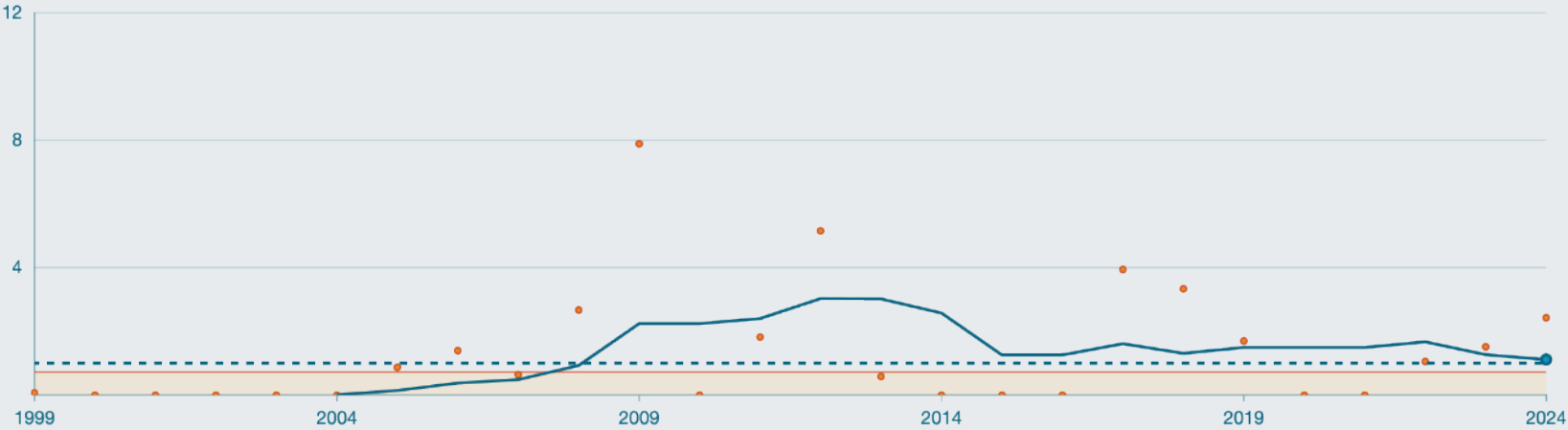
The Common Gull-billed Tern is mainly found in estuaries, coastal lagoons, salt pans, salt marshes, flooded rice paddies and inland wetlands, including reservoirs and temporary lakes. Its diet consists mainly of small fish, but also includes aquatic and terrestrial insects, crustaceans, amphibians and small reptiles (Billerman *et al.* 2026), which it catches by skimming close to the water's surface or the ground. It is a colonial species that nests on sandy ground, mudflats or exposed banks, usually in places with very sparse or absent vegetation.

Threats and conservation

The main threats to the Common Gull-billed Tern in Portugal are linked to the loss, degradation and disturbance of its nesting habitats, particularly coastal and inland wetlands. Drainage, agricultural intensification, changes in salt pan management, human disturbance during the breeding season, predation of eggs and chicks, and artificial fluctuations in water levels are critical factors. Climate change may exacerbate these pressures by increasing the frequency of droughts and extreme weather events. The conservation of the species depends on the proper management of wetlands, the control of disturbance at breeding sites, and the regular monitoring of populations. The creation or maintenance of artificial islands and open areas may also promote breeding success.

Abundance Indicator Assessment

● Relative abundance
 —●— 6-years mean & Assessment value
 --- Reference value
 ■ Threshold



Colonies

Breeding period

100 km

1 500



Caspian Tern

Hydroprogne caspia

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	VU	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Caspian Tern has a wide distribution, breeding between April and June on large lakes and coastal areas of North America and, locally, in Europe, Asia, Africa and Australasia (Billerman *et al.* 2026). Populations in the northern hemisphere are migratory, wintering in tropical regions, whilst those in Africa and Australasia are mostly resident or undertake short-distance dispersals. In Mainland Portugal, it occurs as a winter visitor and a rare passage migrant, being more common between August and March in the Algarve, in estuaries, wetlands and salt pans (Catry *et al.* 2010a). The birds occurring in this region originate mainly from colonies in the Baltic Sea and winter primarily in West Africa (Rueda-Uribe *et al.* 2022). Based on data from four birds fitted with GPS in 2018 and 2019, originating from colonies in Sweden and Finland, the use of the Portuguese EEZ in the southern part of the Mainland sub-area was observed during both migratory periods, but with a more prolonged occurrence during the post-breeding period. These data do not show use of the Azores and Madeira sub-areas, although there have been some, albeit few, observations of the species in both regions (Correia-Fagundes *et al.* 2021; Birding Azores 2022).

Abundance and population trends

The global population has been estimated at between 250,000 and 470,000 individuals, with approximately 11,800 to 14,800 breeding pairs in Europe (BirdLife International 2025). The global population trend is increasing, although some populations are in decline, as is the case with the Baltic Sea populations (Rueda-Uribe *et al.* 2022). Others show some stability or even unknown trends (BirdLife International 2025).

In Mainland Portugal, it is most abundant during migratory passages, with a small wintering population. However, there are no estimates of its abundance or population trends, which has made it impossible to assess its environmental status. The same situation applies to the Azores and Madeira.

Ecology and habitat

The Caspian Tern nests on sandy or stony beaches, dunes, flat rocky surfaces, sheltered reefs or islands with sparse vegetation and shallow, undisturbed waters (Billerman *et al.* 2026). The species feeds mainly on fish, supplementing its diet with other animal resources, including bird chicks, carrion and invertebrates (Shuford & Craig 2002). In winter, it is mainly concentrated along the coast, using sheltered shores and coastal wetlands, but may also occur in inland wetlands.

Threats and conservation

The main threats to the species include habitat and nesting site loss and climate change, as the coastal and freshwater ecosystems on which they depend have been degraded by human activities, including pollution, acidification, rising water temperatures and hydrological changes (Rueda-Uribe *et al.* 2022). It is also particularly vulnerable to human disturbance, as well as to reduced fish availability due to overfishing (Shuford & Craig 2002). In Portugal, no direct threats have been identified, but it is essential to maintain the protection of wetlands and the monitoring of resting and feeding areas (Catry *et al.* 2010a).

Author: Inês Lacerda
Owners/sources of tracking data: Byholm *et al.* 2022, Åkesson *et al.* 2022

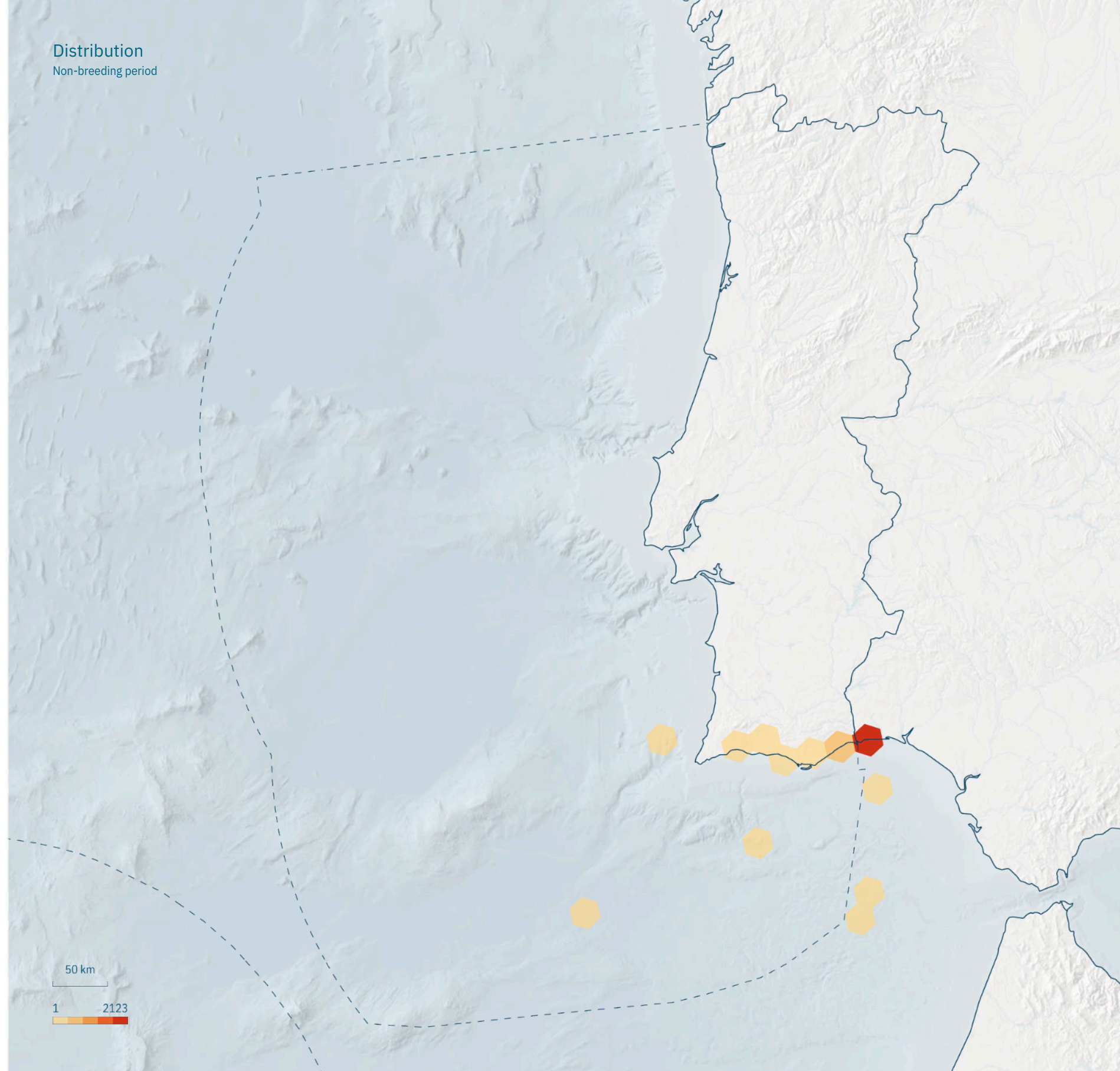


N

Distribution
Non-breeding period

50 km

1 2123



Whiskered Tern

Chlidonias hybrida

Phenology		Conservation status			
Mainland	Summer breeder	Mainland	Madeira	Azores	IUCN Global
Madeira	Vagrant	CR	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The nominate subspecies breeds from May to June, scattered across the more temperate regions of Eurasia, wintering mainly in Africa and South Asia (Billerman *et al.* 2026). In Mainland Portugal, it is a localised and irregular breeder, occupying wetlands such as marshes, reservoirs and fallow rice fields. It occurs mainly in the central region, from the Ria de Aveiro to the Alto Alentejo, breeding sporadically in neighbouring areas (Equipa Atlas 2022). It is rarely observed on the open sea (Meirinho *et al.* 2014). It occurs mainly between April and May, leaving the region between July and September (Catry *et al.* 2010a), although there are exceptional records during winter. In the Azores, it has been recorded sporadically, mainly on the islands of the eastern group and on Terceira Island (Birding Azores 2022), and is equally rare in the Madeira archipelago (Correia-Fagundes *et al.* 2021). It has not been possible to obtain individual tracking data demonstrating its use of the Portuguese EEZ.

Abundance and population trends

The global population has been estimated at 300,000 to 1,400,000 birds, with an unknown population trend (BirdLife International 2025). No information is available regarding the global abundance of the nominate subspecies. In Mainland Portugal, the breeding population has been estimated at 5 to 50 breeding pairs (Equipa Atlas 2022). This species is more common, albeit equally scarce, during migratory passages (Catry *et al.* 2010a). There is no information on population trends either on the Mainland or in the archipelagos. In the latter, the species occurs in very small numbers and only exceptionally. Nor is there any sufficiently robust information available to allow an assessment of its environmental status in any of the regions.

Ecology and habitat

The Whiskered Tern uses various types of wetlands, showing a preference for freshwater habitats. It can also be found in rice paddies. Its diet is very varied and may include terrestrial and aquatic invertebrates, amphibians and small fish (Billerman *et al.* 2026).

Threats and conservation

The drainage of wetlands, the destruction of emergent vegetation and direct disturbance caused by human activities appear to be the main threats to this species in Portugal (Catry *et al.* 1997). Agricultural activities, which are responsible for lowering water levels, may be responsible for the reduced stability of the breeding population in some areas. Other sources of threat include collisions with overhead power lines, the installation of wind farms, adverse weather conditions and predation by native and invasive species.



Black Tern

Chlidonias niger

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Black Tern breeds between April and June in Eurasia and North America. After breeding, the birds migrate south, with European populations wintering along the vast majority of the west coast of Africa (Billerman *et al.* 2026). It is essentially during these migratory movements that the species is found across the Mainland, although there are some records of isolated nesting in the Algarve (Catry *et al.* 2010a). Post-breeding migration occurs from late July to October, with some birds using the coastal marine zone. Pre-breeding migration, which takes place between April and May, was previously assumed to be carried out mainly overland (Snow & Perrins 1998; Meirinho *et al.* 2014). However, more recent data obtained through individual tracking indicate that at least some of the birds utilise the marine environment during these migrations (Alerstam *et al.* 2025). Individual tracking data from eight birds from Swedish colonies, fitted with GLS between 2014 and 2022, illustrate these migratory patterns on the Mainland, whilst also highlighting an interesting occurrence in the Madeira sub-area during those same periods. In the Azores, however, the species is quite rare (Birding Azores 2022).

Abundance and population trends

The global population is estimated at between 800,000 and 1,750,000 individuals, showing a declining trend (BirdLife International 2025). The European population has been estimated at between 74,400 and 154,000 pairs. In Mainland Portugal, the species is uncommon, though flocks of dozens of individuals may be observed during post-breeding migration (Catry *et al.* 2010a). Based on the data used for the environmental status assessment, an estimate of around 100 to 3,200 individuals was obtained for the continental shelf in 2024. The negative trend of this population, combined with the fact that it has not achieved Good Environmental Status for the abundance indicator, appears to be in line with the global trend. In the case of Madeira and the Azores, there is no information on population trends, thus preventing an assessment of their environmental status.

Ecology and habitat

The Black Tern nests in estuarine habitats and inland wetlands, such as lagoons, swamps, ditches, vegetation-covered channels, waterlogged meadows, peatlands and rice paddies (BirdLife International 2025). On the Mainland and during migration periods, it also occurs in the same type of habitats, the coastal marine area and zones further from the coast. During the winter, it is predominantly marine in habits. It feeds mainly on aquatic insects, small fish and amphibians. Outside the breeding season, it consumes mainly marine fish, as well as insects and small crustaceans (Lourenço 2019; Billerman *et al.* 2026).

Threats and conservation

The main threats to this species are found in its breeding areas, due to the disturbance and deterioration of nesting habitats, caused primarily by agricultural exploitation. Drought and water abstraction for human use in wetlands also pose a significant threat to breeding success, due to the loss of nesting platforms and by facilitating access for terrestrial predators (BirdLife International 2025; Billerman *et al.* 2026). The introduction of exotic fish has also led to the disappearance of some prey fish for this species. However, no specific threats to the Black Tern have been documented in Portugal.

Authors: Inês Lacerda, Sissel Sjöberg
Owners/sources of tracking data: Alerstam *et al.* 2025

Distribution Breeding period

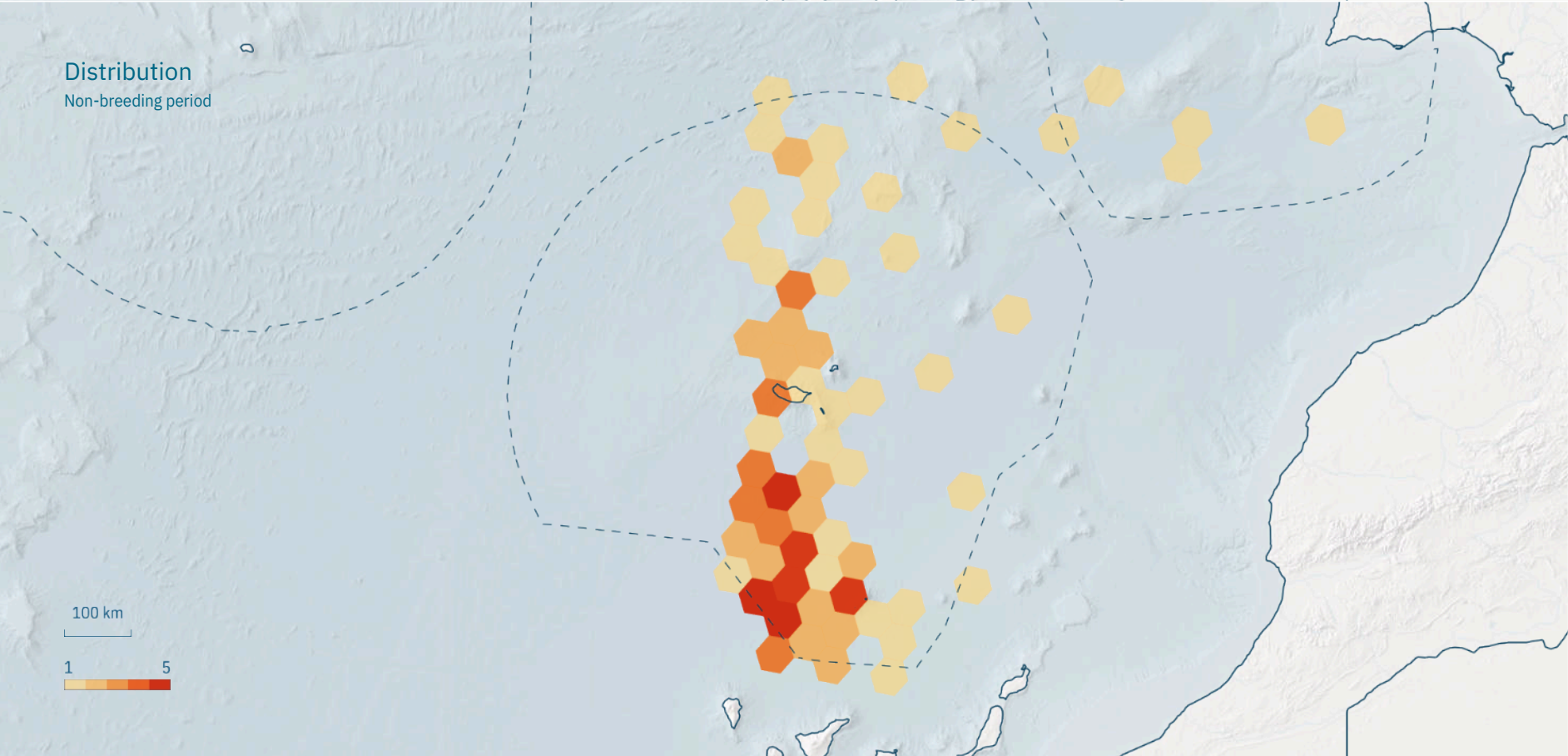
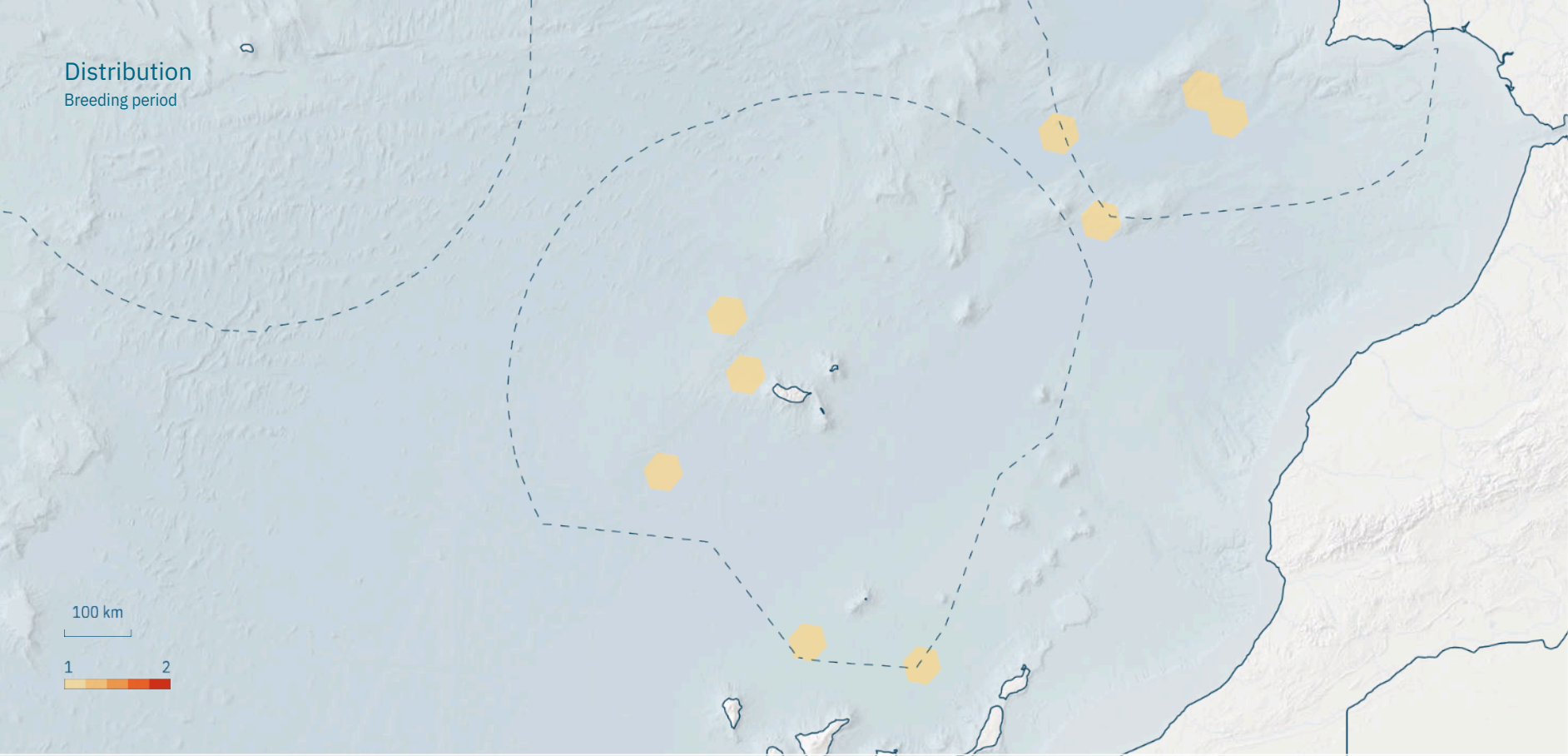
100 km



Distribution Non-breeding period

100 km

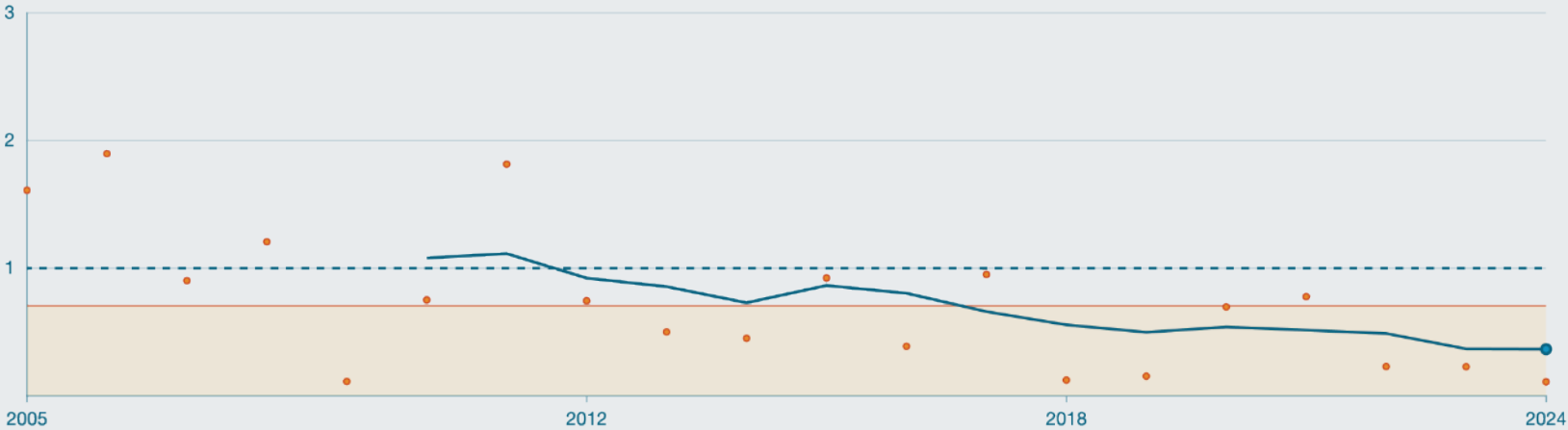




Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

Mainland



Roseate Tern

Sterna dougallii

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Summer breeder and passage migrant	NE	NE	VU	LC
Azores	Summer breeder and passage migrant				



Distribution, movements and phenology

The Roseate Tern breeds in scattered locations across tropical and subtropical regions of the Atlantic, Indian and Pacific Oceans (Billerman *et al.* 2026). In Portugal, it breeds between April and July in the Azores and, to a lesser extent, on the island of Madeira. After breeding, birds that breed in the Azores appear to winter on the west coast of Africa or the coast of South America (Hays *et al.* 2002). On the Mainland, records occur mainly from August onwards, during the post-breeding migration of birds that nest in Northern Europe. This pattern is corroborated by individual tracking data from 26 birds from the United Kingdom and Ireland fitted with GLS devices. These data show that the Portuguese EEZ was used mainly during the non-breeding season, more specifically during the post-breeding migration. These birds were mainly found in the Mainland sub-area and east of Madeira.

Abundance and population trends

The global population has been estimated at between 200,000 and 220,000 individuals, of which 2,300 to 2,900 pairs breed in Europe. The largest colonies are concentrated in Ireland and the Azores (BirdLife International 2025).

In Madeira, breeding is irregular, occurring in a scattered manner across the island and not exceeding 50 pairs (Catry *et al.* 2010b; Equipa Atlas 2022). In the Azores, it breeds on all the islands, being most abundant on Flores, Graciosa, Terceira and Santa Maria. Annual censuses reveal considerable fluctuations, with a current estimate of around 535 to 1,068 pairs, indicating a slight decline (Equipa Atlas 2022). This pattern was also corroborated by the assessment presented in this work, which indicates that the species has not achieved Good Environmental Status for the abundance indicator. Regarding the situation on the Mainland and in Madeira, there is no information on abundance that would allow an assessment of its environmental status. Worthy of note is a count of 1,003 birds during the post-breeding migration in 2015, recorded from Cape Carvoeiro (Elmberg *et al.* 2020).

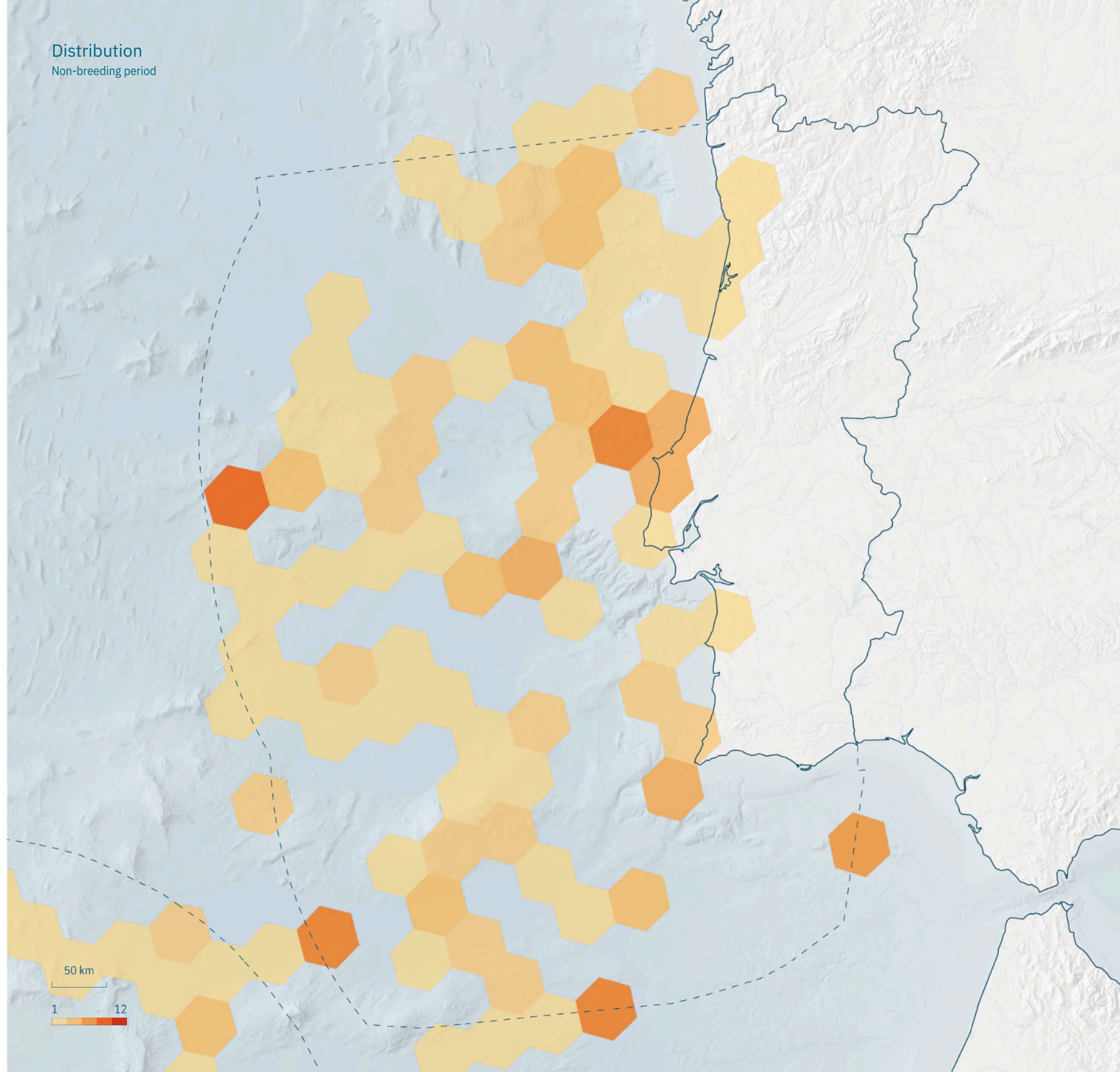
Ecology and habitat

The species nests in various coastal habitats, selecting sites close to shallow, sheltered feeding areas. Outside the breeding season, it uses estuaries and coastal waters, subsequently migrating to tropical coasts (BirdLife International 2025).

During the breeding season, it feeds near the colonies, catching small pelagic and mesopelagic fish in coastal and oceanic environments, and may be associated with the Common Tern (Ramos *et al.* 1998; Monticelli *et al.* 2006).

Threats and conservation

In the Azores, the main threat is predation of adults, eggs and chicks by introduced mammals, such as rats and cats (Lamelas-López *et al.* 2021). Breeding success is also affected by habitat destruction and degradation, including the presence of invasive plants and soil erosion caused by rabbits, disturbance due to human access to colonies, and predation by native species (Monteiro *et al.* 1996a; Cabral *et al.* 2005; Amaral *et al.* 2010; Neves *et al.* 2011b). In 2021, a new international plan for the conservation of the species was adopted (Piec & Dunn 2021). Various conservation measures are being implemented in some colonies, including the control of populations of gulls, rodents and cats (Lamelas-López *et al.* 2021) and habitat restoration (Bried *et al.* 2009a).



Colonies

Breeding period



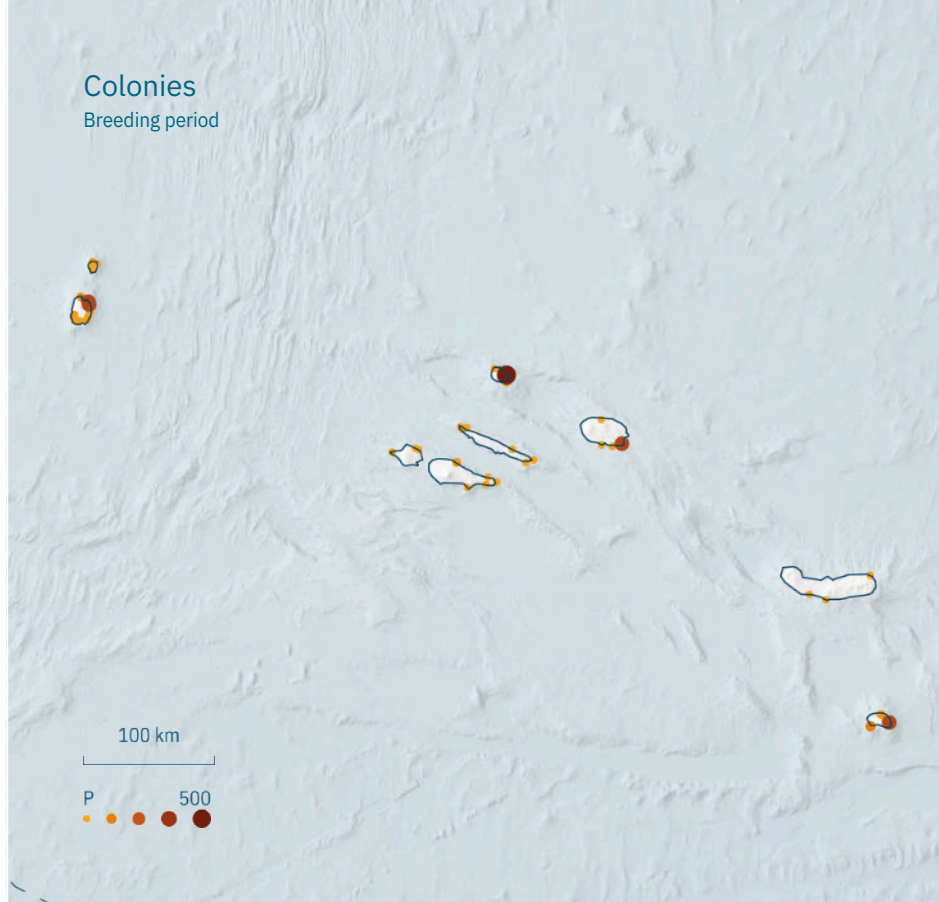
Distribution

Non-breeding period



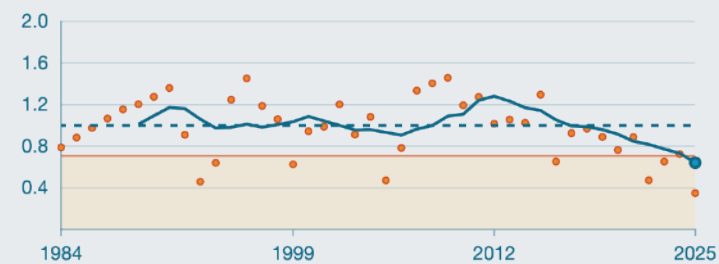
Colonies

Breeding period



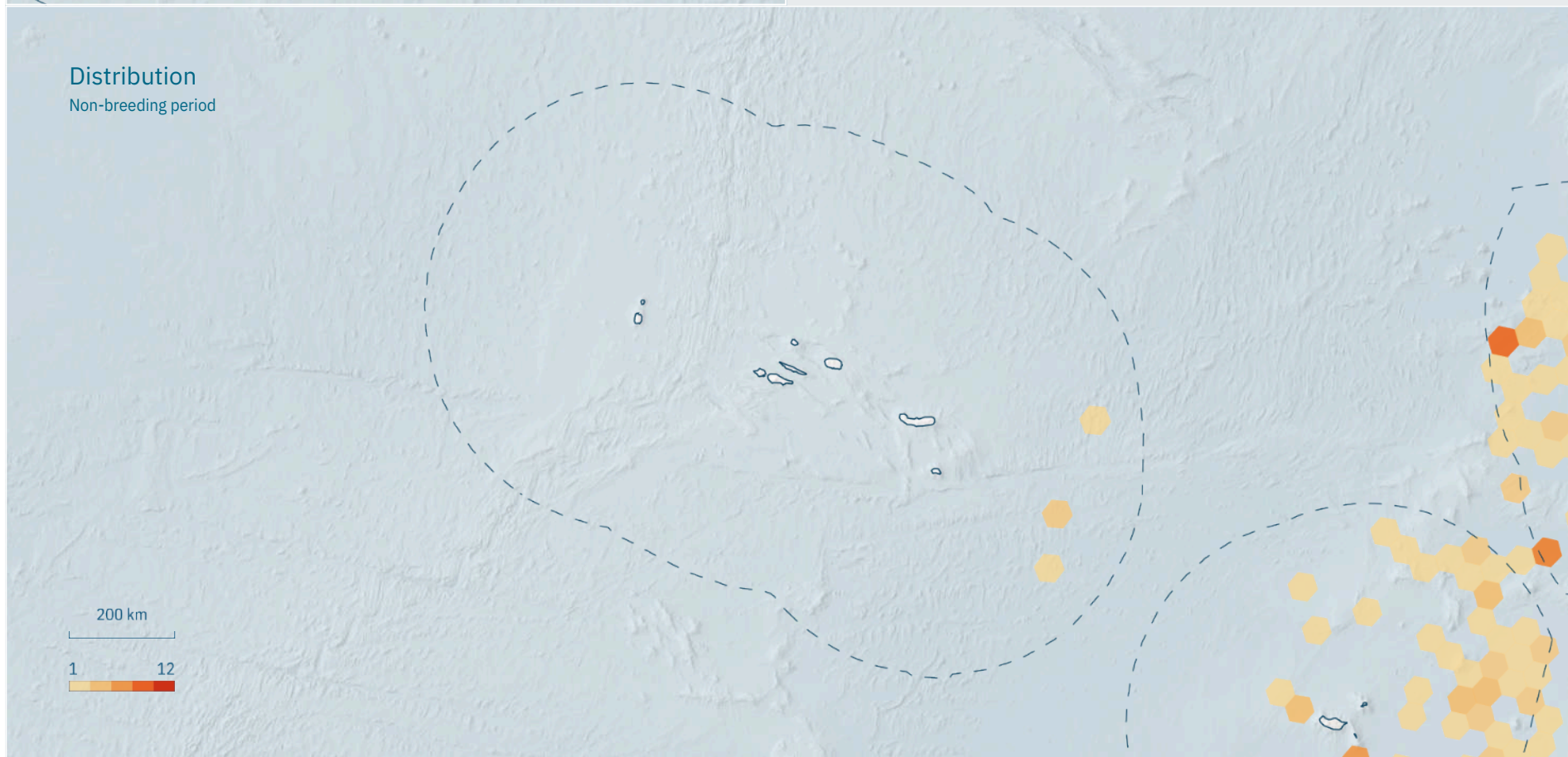
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold



Distribution

Non-breeding period



Common Tern

Sterna hirundo

Phenology		Conservation status			
Mainland	Summer breeder and passage migrant	Mainland	Madeira	Azores	IUCN Global
Madeira	Summer breeder and passage migrant	EN	VU	VU	LC
Azores	Summer breeder				



Distribution, movements and phenology

The Common Tern has a circumpolar distribution, breeding across most of Europe, Asia and North America. It winters along the coasts of South America, Africa, the Arabian Peninsula, India, Southeast Asia and Australia (Billerman *et al.* 2026).

In Portugal, it breeds between April and August in the Azores and Madeira. It also breeds, albeit rarely, on the Mainland, where it is more commonly seen as a passage migrant (Equipa Atlas 2022). Pre-breeding migration takes place in April and post-breeding migration from August to October, involving mainly birds from the British Isles, the North Sea and Scandinavia (Catry *et al.* 2010a). The Azorean populations winter mainly in South America (Neves *et al.* 2002; Neves *et al.* 2015), whilst populations from central and northern Europe prefer the African coast (Billerman *et al.* 2026).

Data from 10 birds fitted with GLS in 2009 and 2012 in the Azores, Germany and Sweden show that the birds used Mainland and Madeiran waters mainly during pre- and post-breeding migrations. In the Azores, however, occurrences were concentrated during the breeding season in the area surrounding the breeding colony, located in the central group of the archipelago.

Abundance and population trends

The global population has been estimated at between 1,600,000 and 3,600,000 individuals, of which 316,000 to 605,000 pairs breed in Europe, with an unknown trend (BirdLife International 2025). The Azores are home to the largest breeding population in Portugal. It breeds on all the islands and has a population of 2,419 to 3,411 pairs, with considerable annual fluctuations. In the Madeira region, estimates do not exceed 1,000 pairs. On the Mainland, it nests sporadically and in small numbers (Equipa Atlas 2022). In this region, the migratory population is more significant, with a total of 700 birds recorded during the post-breeding migration in 2015, observed from Cape Carvoeiro (Elmberg *et al.* 2020).

The assessment of environmental status shows that the Azorean population has achieved Good Environmental Status for the abundance indicator. Regarding the situation on the Mainland and in Madeira, the existing abundance data do not allow for an assessment of the status of these populations.

Ecology and habitat

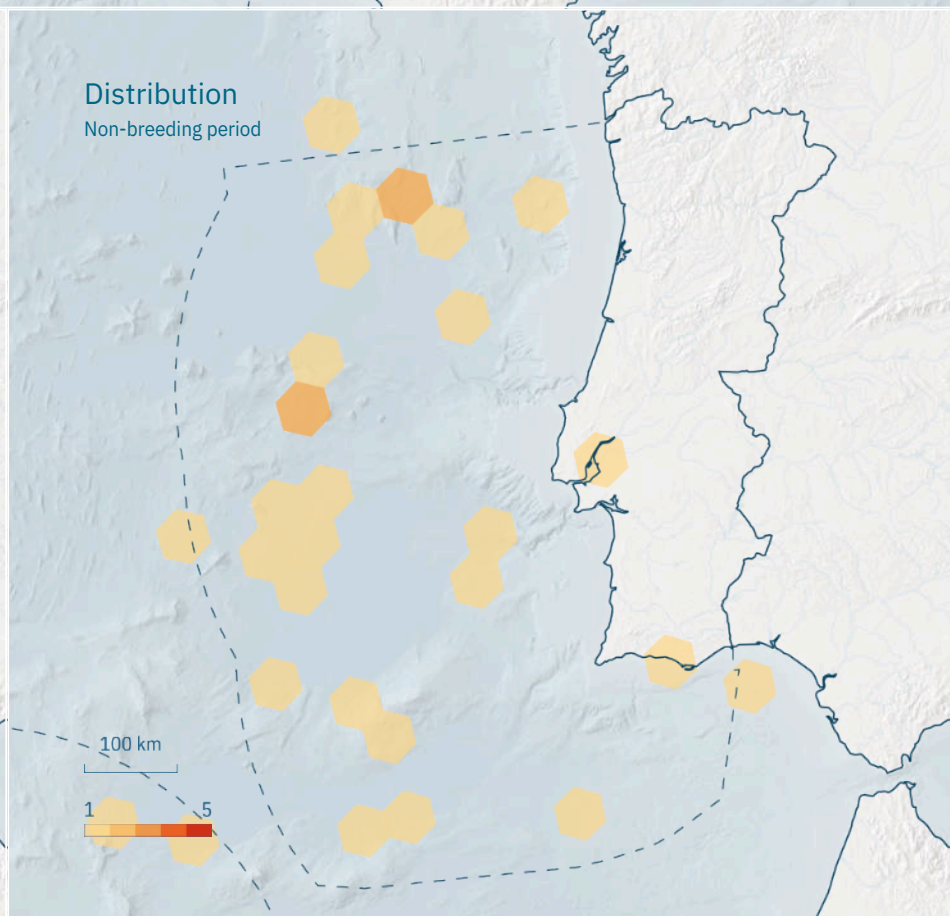
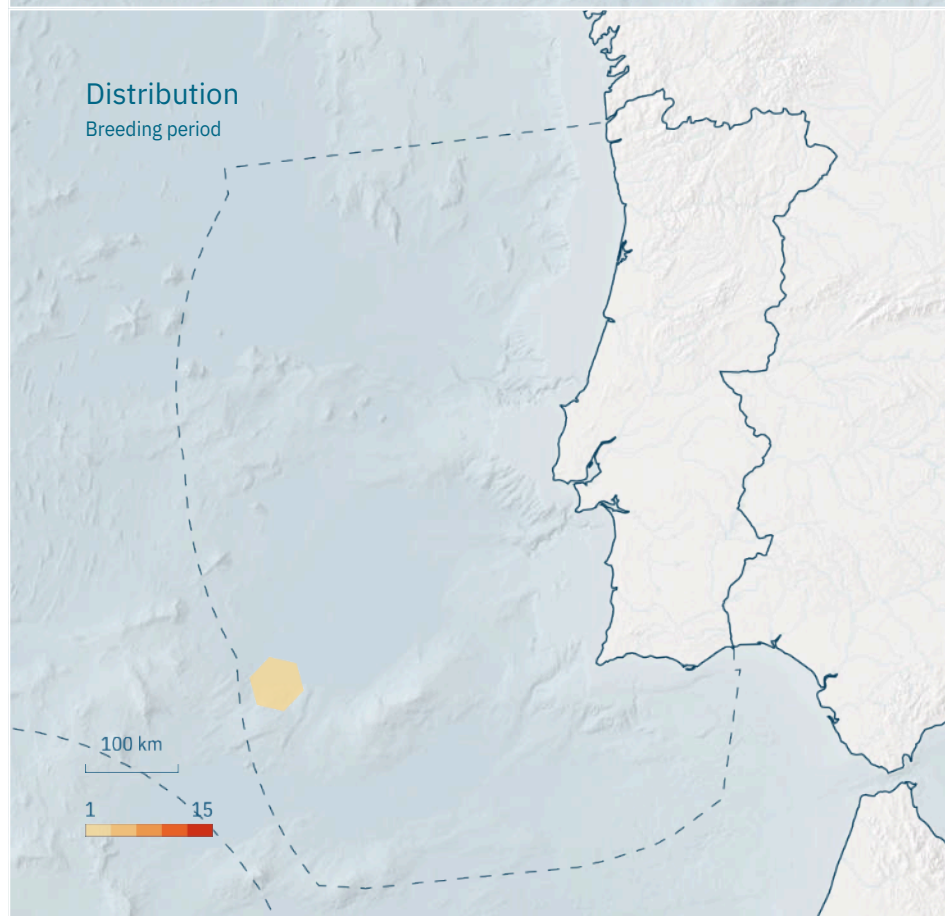
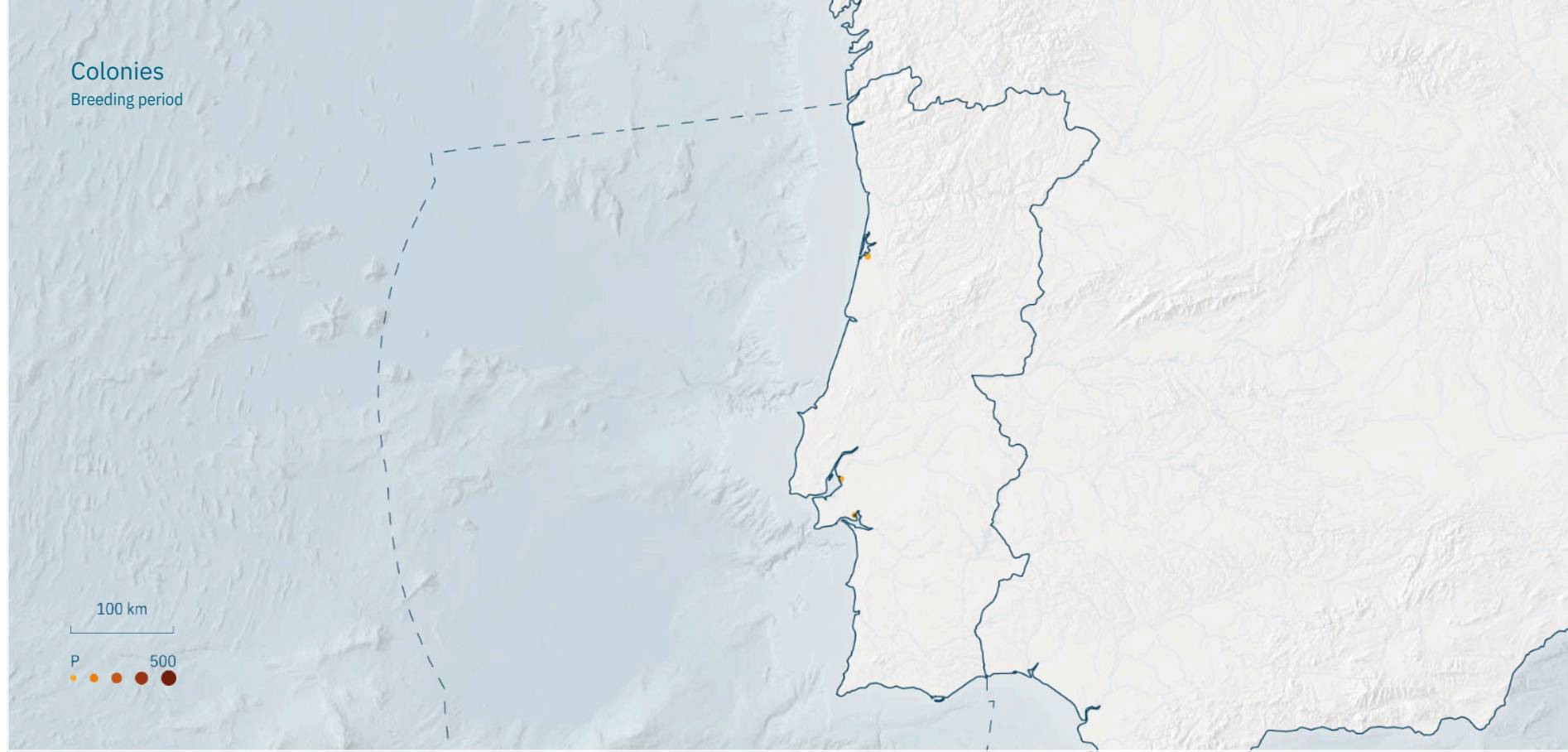
The Common Tern feeds mainly on small mesopelagic fish (Granadeiro *et al.* 2002), preferably in calm waters and relatively sheltered bays (Monticelli *et al.* 2006). On Mainland Portugal, nesting sites are found in estuaries, salt pans and fish farms (Elias & Leitão 1992), whilst in the Azores and Madeira, colonies are generally located on coastal cliffs and islets (Equipa Atlas 2022).

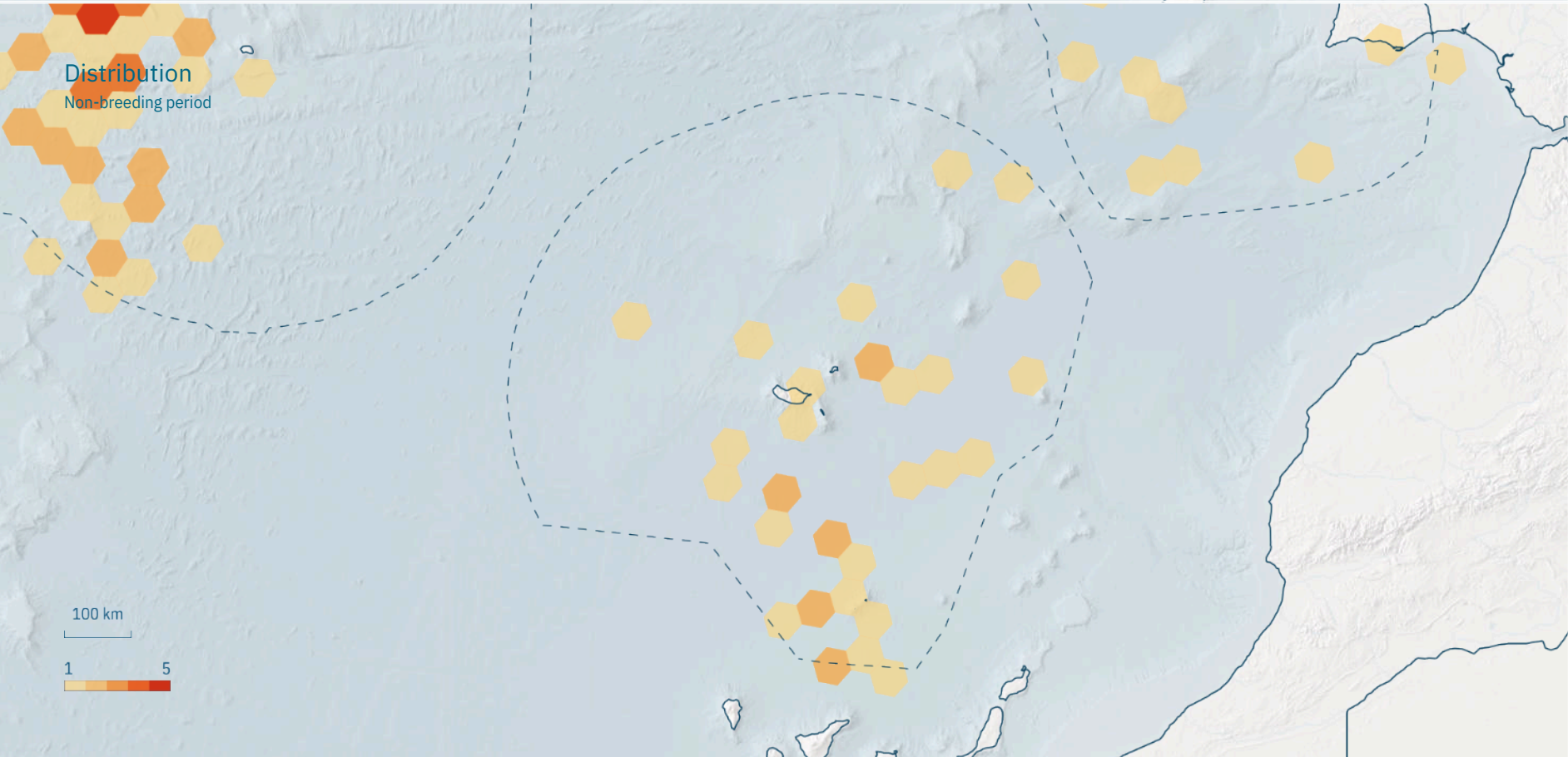
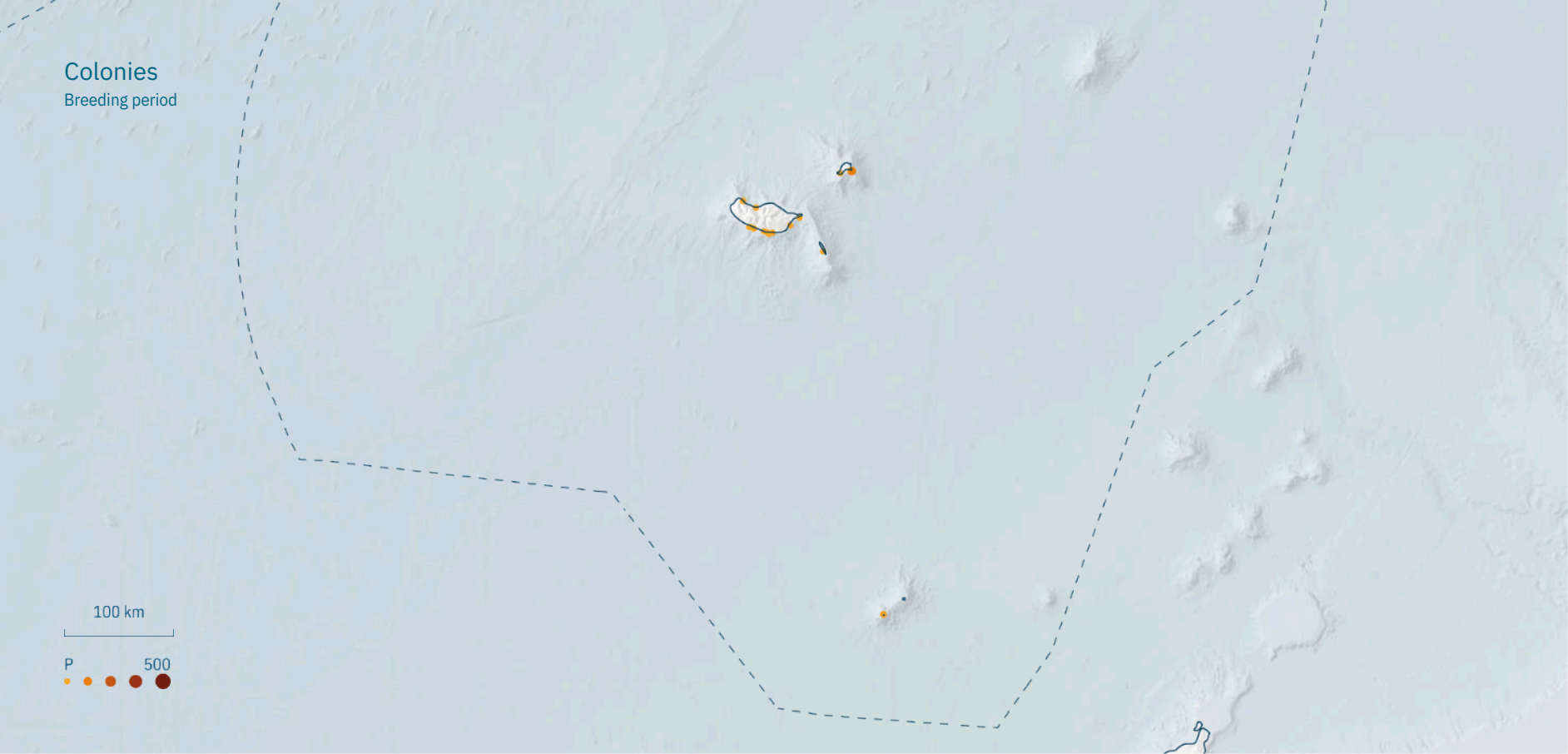
Threats and conservation

The main threats include human disturbance in the areas surrounding the colonies (Monteiro *et al.* 1996a) and predation, both by native species such as starlings (Neves *et al.* 2011b) and by introduced mammals (Amaral *et al.* 2010). The eradication of introduced mammals is a key conservation priority to ensure the viability of breeding populations (Bried *et al.* 2009b; Amaral *et al.* 2010).

Authors: Tânia Nascimento, Sissel Sjöberg

Owners/sources of tracking data: Alerstam *et al.* 2025, Gonzalez-Solis & Becker 2011, Neves *et al.* 2015

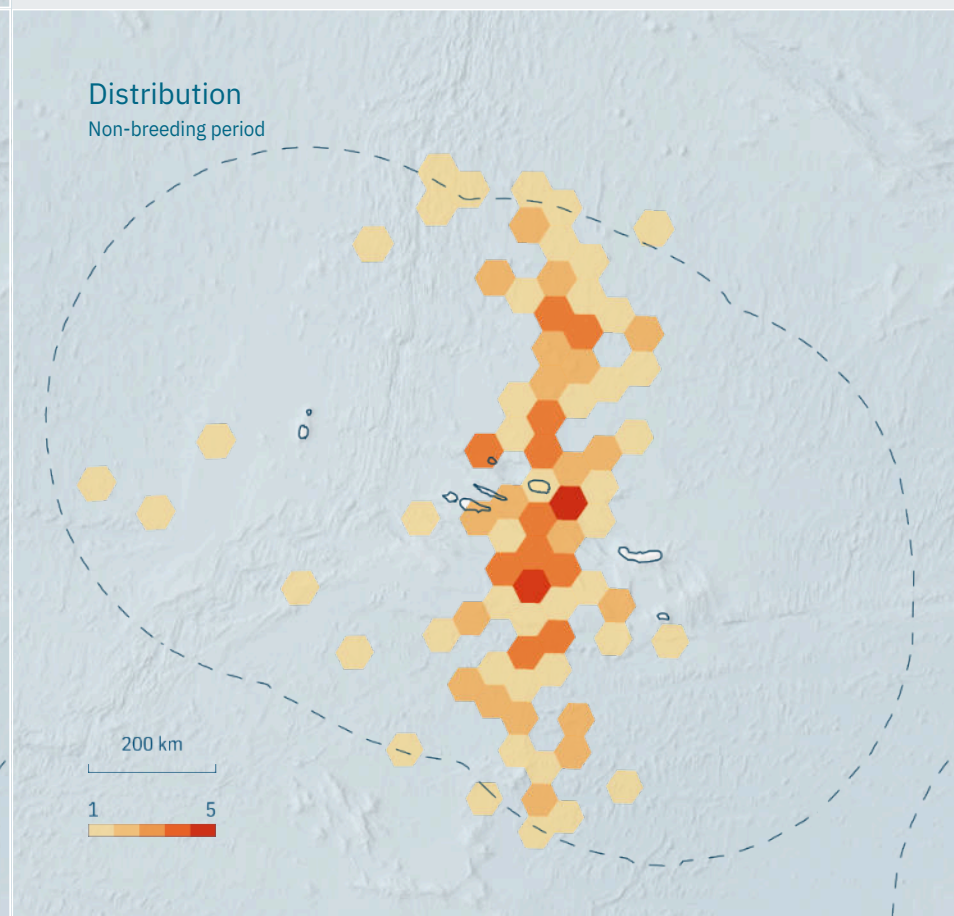
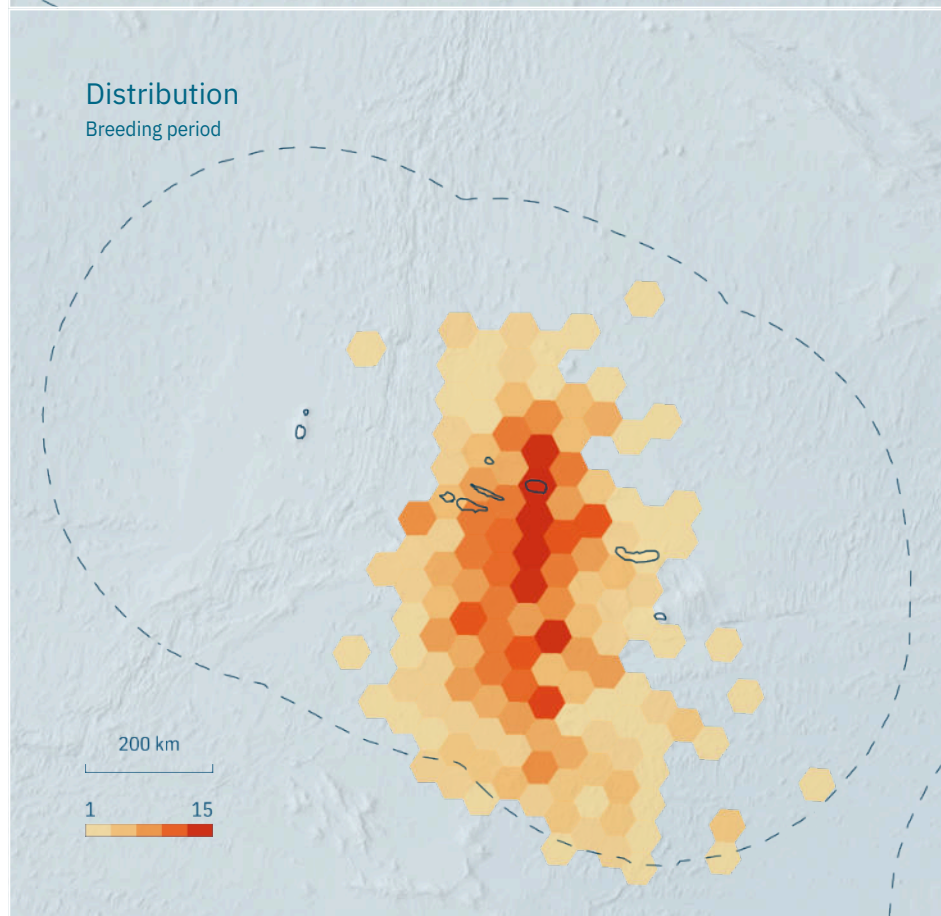
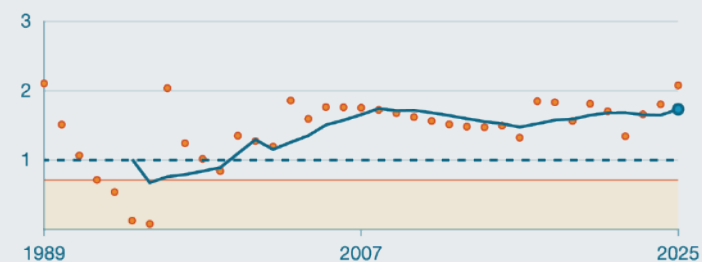






Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold



Arctic Tern

Sterna paradisaea

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NE	LC
Azores	Passage migrant				



Distribution, movements and phenology

During the breeding season, between May and August, the Arctic Tern has a circumpolar Arctic distribution, migrating to sub-Antarctic and Antarctic waters to winter (Billerman *et al.* 2026). It undertakes one of the longest known migrations, covering over 80,000 km per year (Egevang *et al.* 2010). It is during these long journeys that the species occurs in Portugal, preferring predominantly pelagic waters (Fijn *et al.* 2013; Meirinho *et al.* 2014). Pre-breeding migration takes place between March and May and post-breeding migration between August and October. September is when the species is most abundant along the Mainland coast (Catry *et al.* 2010a; Elmberg *et al.* 2020).

Individual tracking of 25 birds from colonies in Greenland, the Netherlands and the United Kingdom, fitted with GLS devices, confirms the extensive use of the Portuguese EEZ during both migratory periods, indicating a higher occurrence in the Azores and Madeira sub-areas during the pre-breeding migration, coinciding with the end of the non-breeding period. The Mainland region was used solely during the final phase of the breeding season, in August, likely by birds that initiated migration early.

Abundance and population trends

The global population has been estimated at over 2,000,000 birds, of which 564,000 to 906,000 pairs breed in Europe, showing a declining trend (BirdLife International 2025).

There is little information regarding the number of Arctic Terns occurring in the Portuguese EEZ, as they are generally observed singly or in small flocks. On the Mainland, land-based observations of the species occur following storms and the passage of cold fronts with strong westerly winds (Moore 2000). During the post-breeding migration in 2015, 1,003 birds were recorded migrating south from Cape Carvoeiro (Elmberg *et al.* 2020). In the Azores and Madeira, there are occasional records (Meirinho *et al.* 2014). However, the lack of systematic information regarding its abundance and population trends has prevented an assessment of the species' environmental status within the Portuguese EEZ.

Ecology and habitat

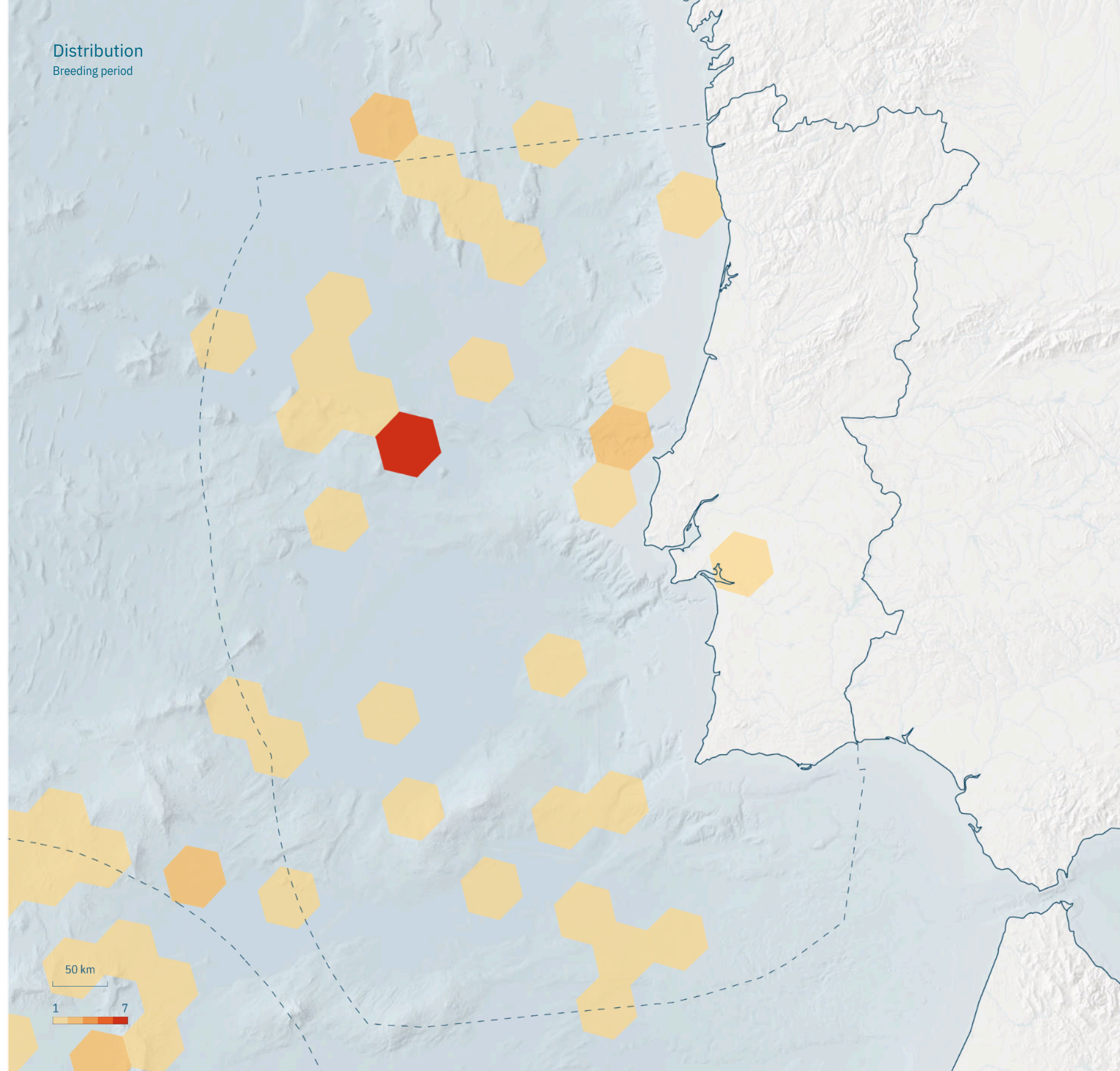
The Arctic Tern nests on the ground on islands, but also away from the coast, in lakes and other wetlands. It nests in Arctic regions and in the northern temperate regions (Billerman *et al.* 2026). Colonies can range from a few pairs to hundreds or thousands of birds. In Portugal, it occurs during migration throughout the EEZ, in pelagic areas, mostly far from land. It feeds at the surface and its diet consists of small fish, crustaceans, molluscs and insects.

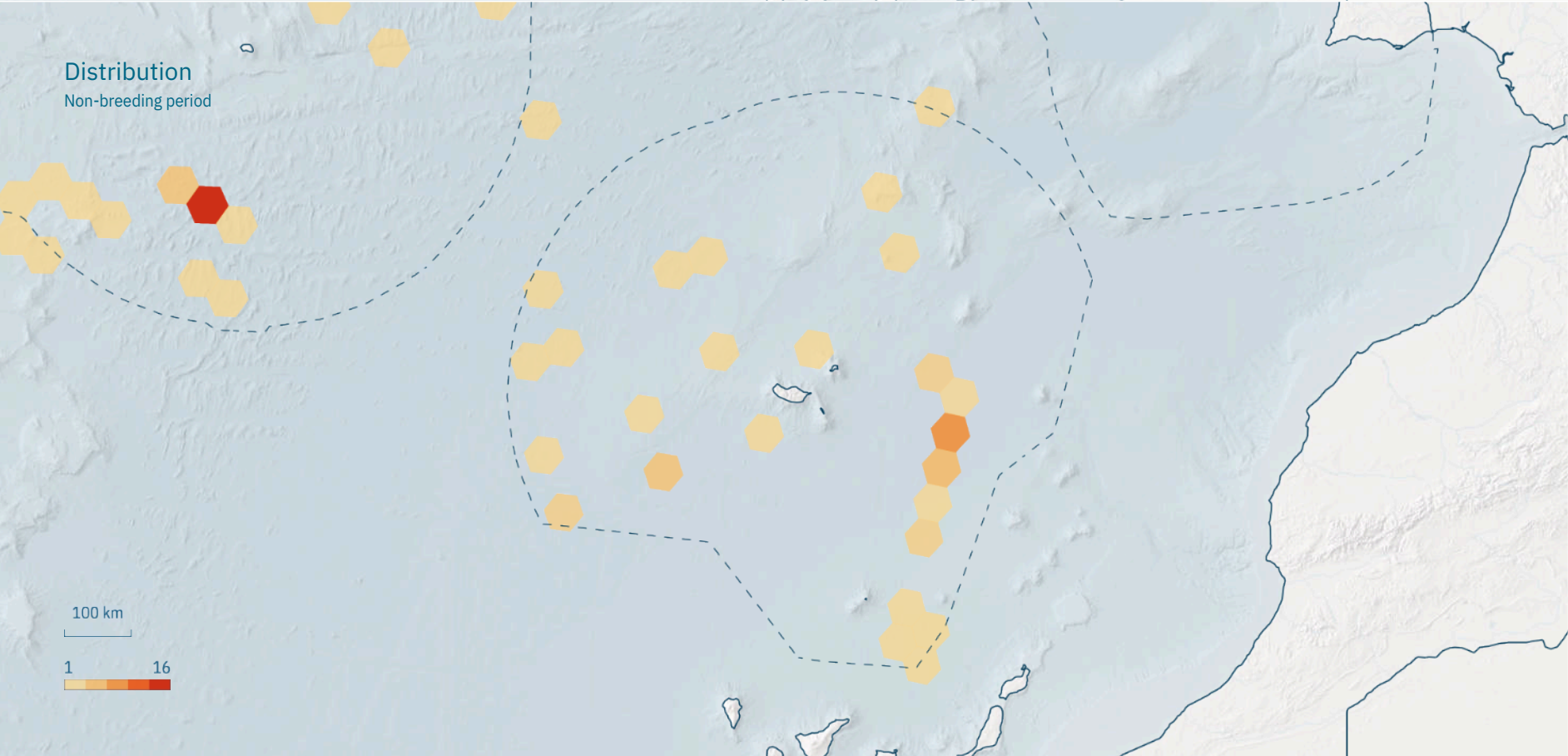
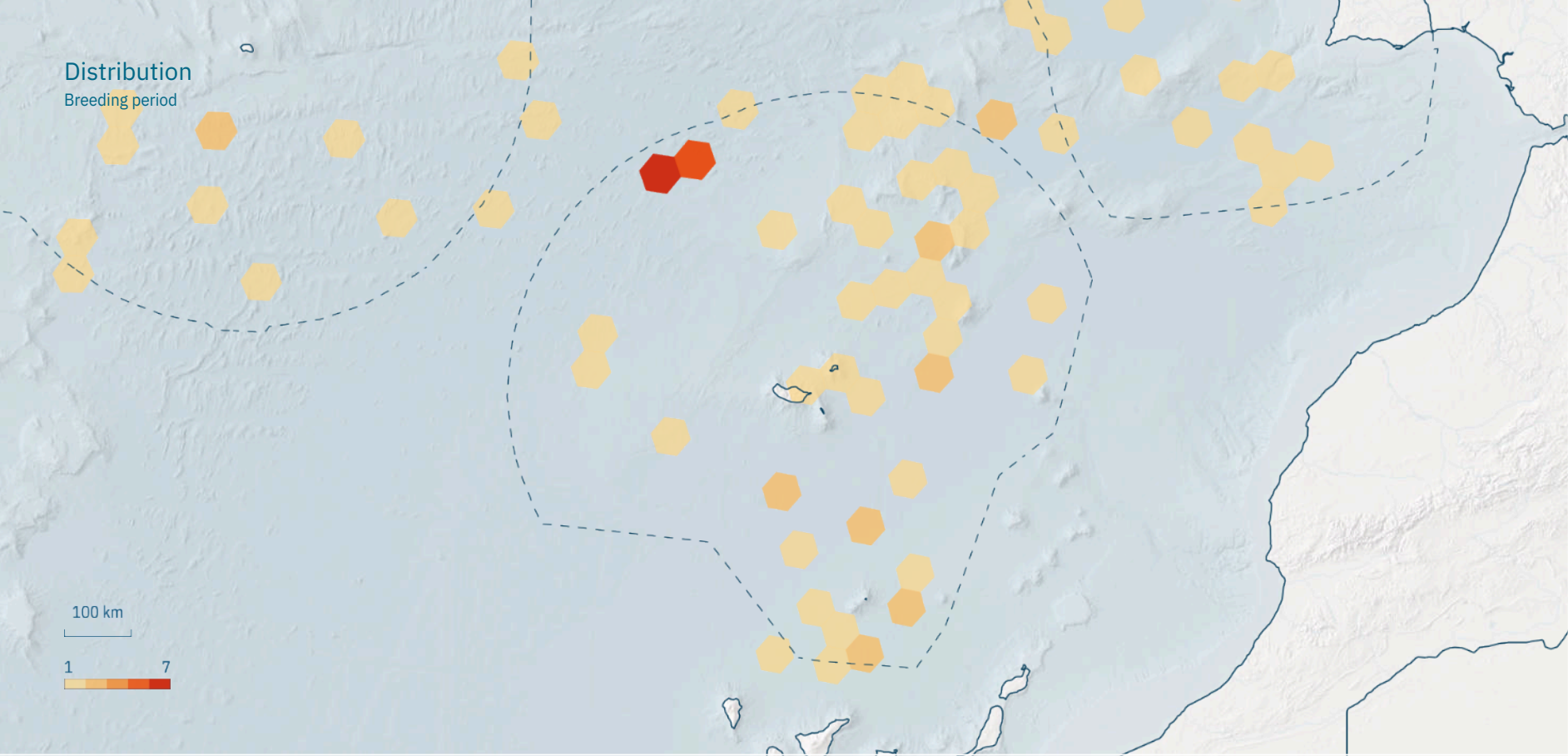
Threats and conservation

Potential threats to the species are likely related to the effect of climate change on breeding areas and Arctic ecosystems, which could lead to a decrease in food availability (Møller *et al.* 2006) or a reduction in available nesting habitat. There is a strong relationship between breeding success and prey availability. Some populations have been affected by the collapse of their main prey (e.g. sand eels), reducing or preventing breeding altogether (Billerman *et al.* 2026). In some colonies, eggs and chicks are subject to predation by invasive predators, such as the American mink *Neovison vison*. No threats have been identified for Portugal.

Authors: Joanne Morten, Ruben Fijn, Tânia Nascimento
Owners/sources of tracking data: Egevang 2008, Fijn *et al.* 2013, Morten *et al.* 2018, Redfern 2018b, Redfern 2018c

Distribution
Breeding period

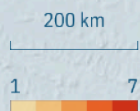






Distribution

Breeding period



Distribution

Non-breeding period



Sandwich Tern

Thalasseus sandvicensis

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	IUCN Global
Madeira	Passage migrant	LC	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Sandwich Tern breeds in Eurasia, Africa and the Americas. The European population breeds between May and August along the coasts of much of the continent, and winters from France to South Africa, mainly along the African coast (Billerman *et al.* 2026).

In Mainland Portugal, it occurs during migration and wintering. It is found mainly in coastal areas, generally not venturing beyond the limits of the continental shelf (Meirinho *et al.* 2014), although some birds do venture into deeper waters (Fijn 2024). Most of the birds occurring in this area originate from the British Isles and the North Sea (Catry *et al.* 2010a). Pre-breeding migration takes place between March and June, whilst post-breeding migration occurs between August and October. In the Azores and Madeira, it is occasionally observed during migration in artificial areas such as harbours and marinas. The tracking of 24 birds fitted with GPS from colonies in the Netherlands confirms the use of the Mainland coast during both phenological periods, with a notable concentration in the Ria de Aveiro area. It is noted that they did not remain during the winter, nor were they recorded in the Azores and Madeira.

Abundance and population trends

The global population is stable and has been estimated at between 490,000 and 640,000 birds, of which 79,900 to 148,000 pairs breed in Europe (BirdLife International 2025).

It is an abundant species along the coast of Mainland Portugal. It occasionally uses coastal wetlands as stopover sites, where it may form large concentrations, reaching up to a thousand individuals (Farinha & Costa 1999). During the post-breeding migration in 2015, 5,661 birds were counted passing southwards from Cape Carvoeiro (Elmberg *et al.* 2020). A considerably smaller number of individuals winter in Portugal, amounting to a few hundred birds (Equipa Atlas 2018). Based on the data used for the environmental status assessment, an estimate of around 8,500 to 16,600 individuals was obtained for the continental shelf in 2024. Despite fluctuations in the size of this population over recent years, Good Environmental Status has been achieved for the abundance indicator.

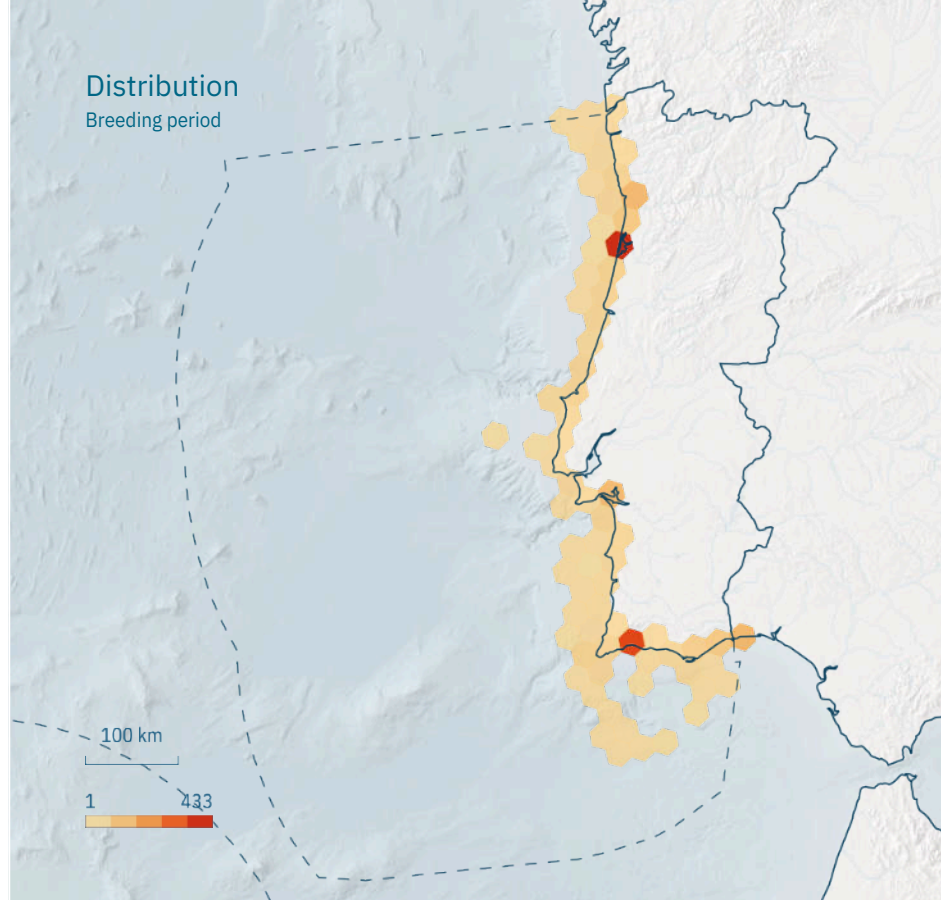
Ecology and habitat

The Sandwich Tern occupies coastal habitats during migratory stopovers, but can be observed far from the coast during migration. It feeds mainly on small fish, but may also capture small marine crustaceans and annelids (Billerman *et al.* 2026). It prefers open marine environments, but is also frequently observed in wetlands such as estuaries, coastal lagoons, fish farms, salt pans and saltmarshes.

Threats and conservation

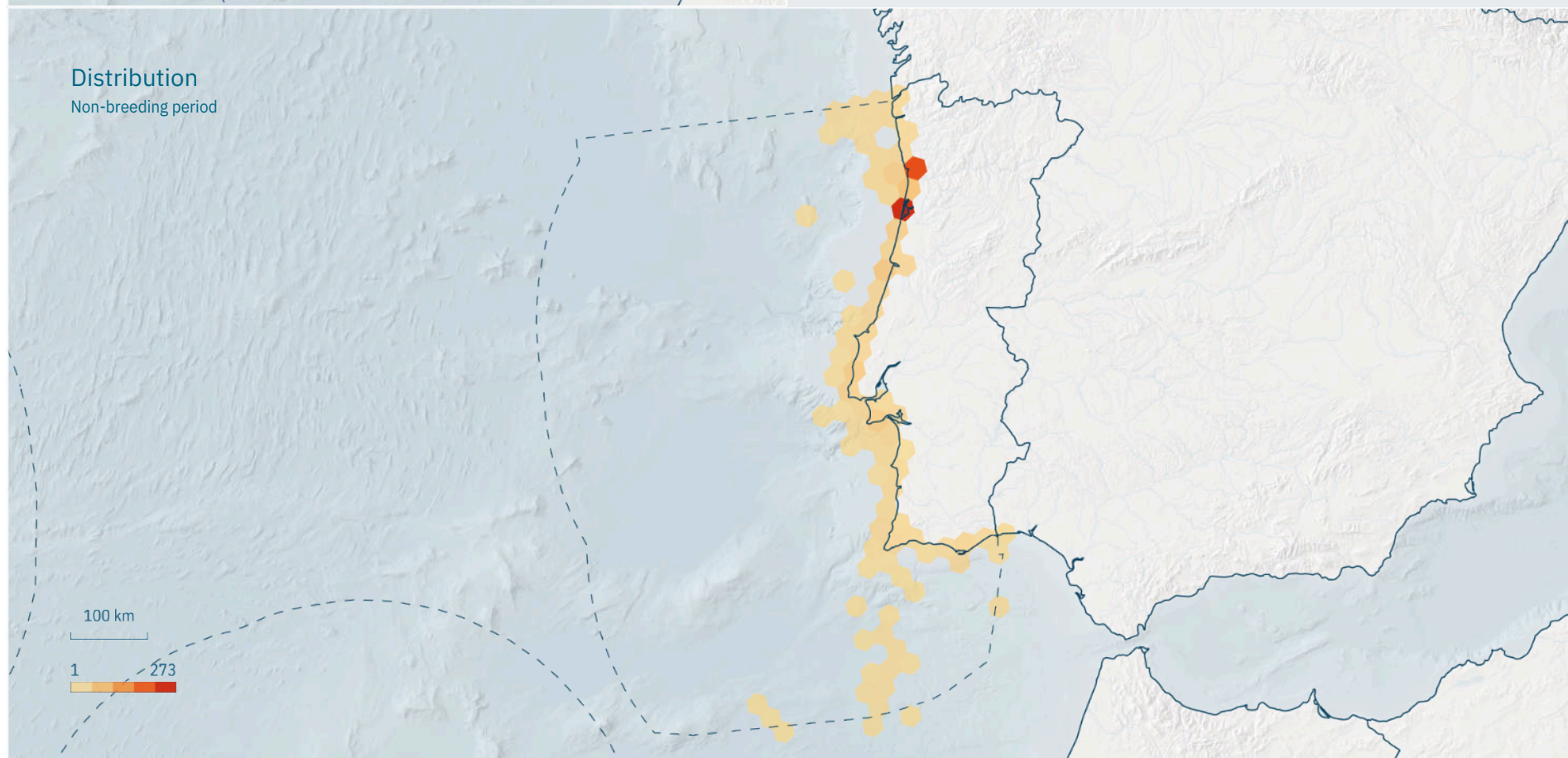
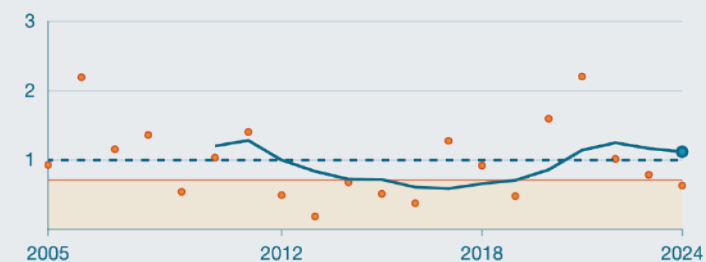
It is particularly vulnerable to human disturbance in breeding colonies (Billerman *et al.* 2026). The European population appears to be stable, although it has suffered significant declines in some countries due to recent outbreaks of avian influenza (Knief *et al.* 2024; BirdLife International 2025). The species may also be sensitive to the impacts of offshore wind farms through disturbance, collision risk, barrier effects and habitat loss (Fijn 2024; van Bemmelen *et al.* 2024a).

Authors: Ruben Fijn, Tânia Nascimento
Owners/sources of tracking data: Ruben Fijn



Abundance Indicator Assessment

• Relative abundance — 6-years mean & Assessment value - - - Reference value Threshold



Long-tailed Jaeger

Stercorarius longicaudus

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NE	LC
Azores	Passage migrant				



Distribution, movements and phenology

The Long-tailed Jaeger breeds between June and August in the circumpolar Arctic region and winters in the seas of the southern hemisphere (Gilg *et al.* 2013; Billerman *et al.* 2026). The Atlantic population uses the Atlantic Ocean Marine Flyway, with a portion of the population frequently utilising the Portuguese EEZ during migrations (Gilg *et al.* 2013). On the Mainland, it occurs mainly during post-breeding migration between August and October, preferring pelagic waters but also the continental shelf, and is observed passing close to headlands, particularly after storms (Moore 2000; Sittler *et al.* 2011; Elmberg *et al.* 2020). It is also a regular visitor to the Azores and Madeira during migration (Sittler *et al.* 2011; Meirinho *et al.* 2014).

Based on data from 38 birds, from colonies in Greenland, Sweden and Norway, fitted with GLS, use of the Portuguese EEZ was observed during both phenological periods, but with greater occurrence during the migratory periods (April, May, August and September). Most records were concentrated in the Azores sub-area, followed by the Madeira sub-area, with extensive use of both. On the Mainland, occurrences were very sporadic.

Abundance and population trends

The global population has been estimated at around 250,000 to 749,999 mature individuals (BirdLife International 2025). The population is thought to be stable, with no evidence of any decline or substantial threat. In recent decades, there has been an increase in sightings of this species in Portugal, likely due to increased observation efforts. However, the lack of systematic information regarding its abundance and population trends has prevented an assessment of the species' environmental status within the Portuguese EEZ.

Ecology and habitat

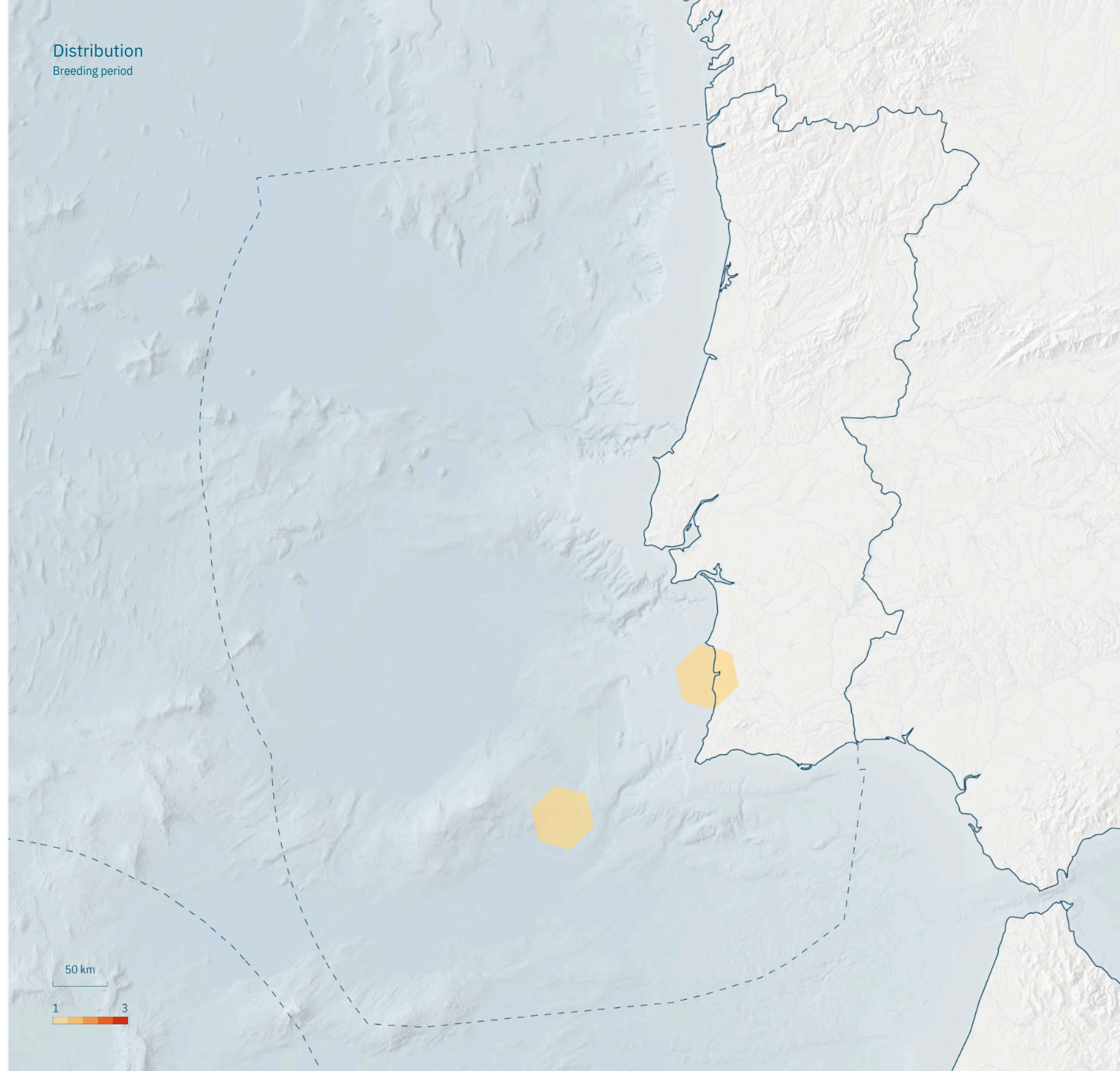
The Long-tailed Jaeger is a highly pelagic marine species outside the breeding season. It nests on the ground in the Arctic and sub-Arctic tundra and also in the alpine tundra up to an altitude of 1,300 metres in Scandinavia (BirdLife International 2025). During the breeding season, it feeds on lemmings, shrews, various insects, berries and small birds (Billerman *et al.* 2026). In winter, its diet consists mainly of fish, sometimes obtained through kleptoparasitism.

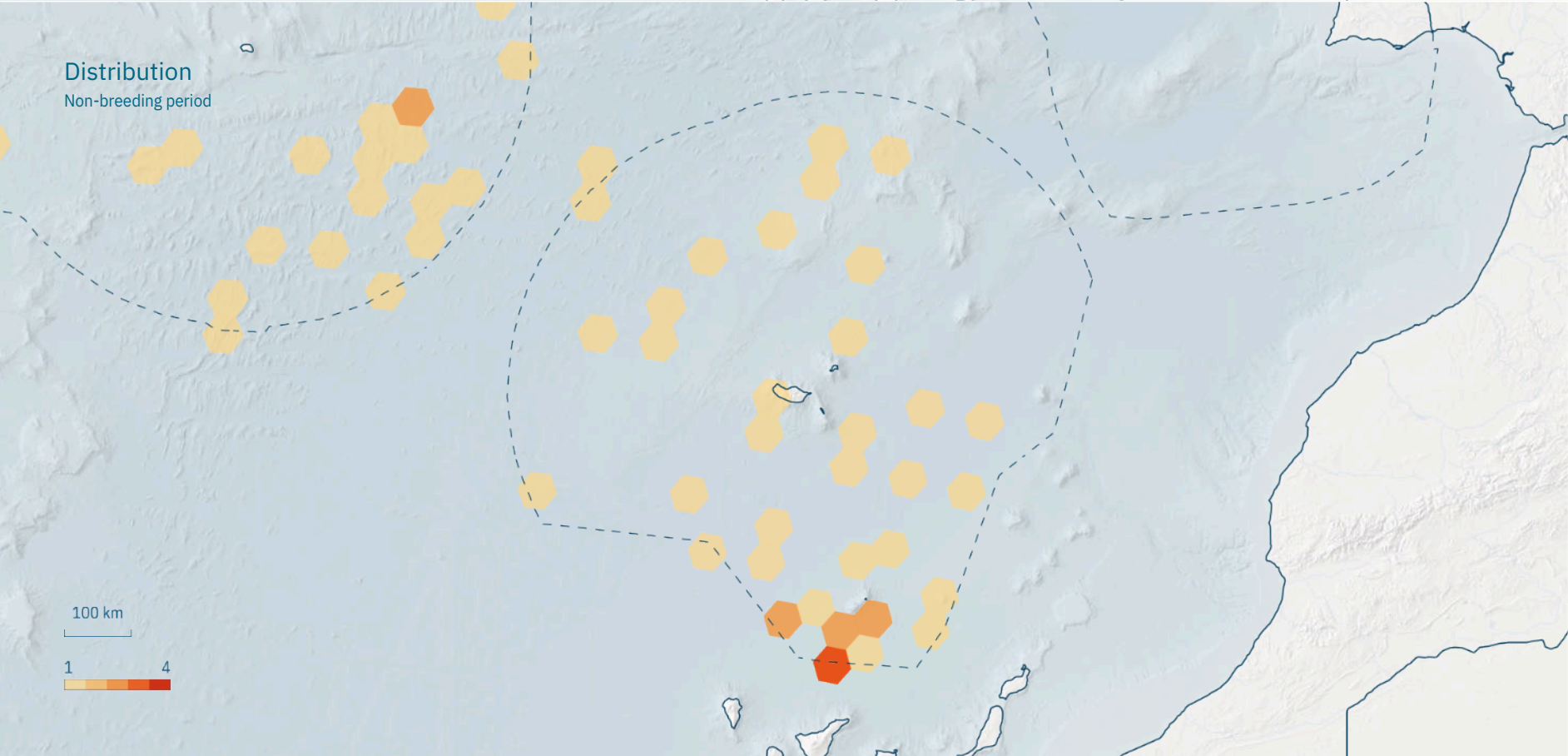
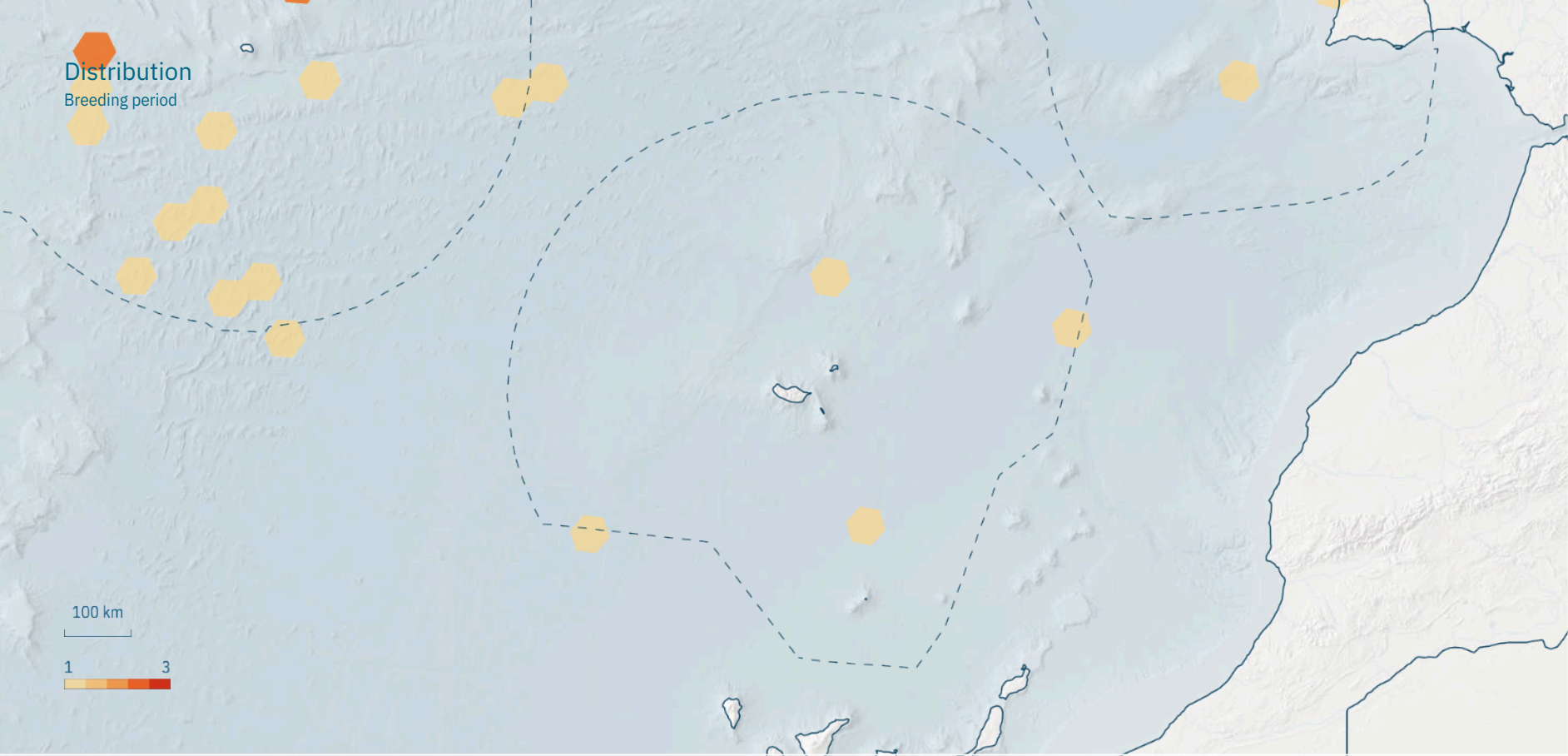
Threats and conservation

Low food availability can lead to declines in breeding success, as productivity fluctuates in line with changes in the lemmings population, a key prey item during the breeding season (Billerman *et al.* 2026). However, no specific threats to the Long-tailed Jaeger have been described.

Distribution
Breeding period

50 km

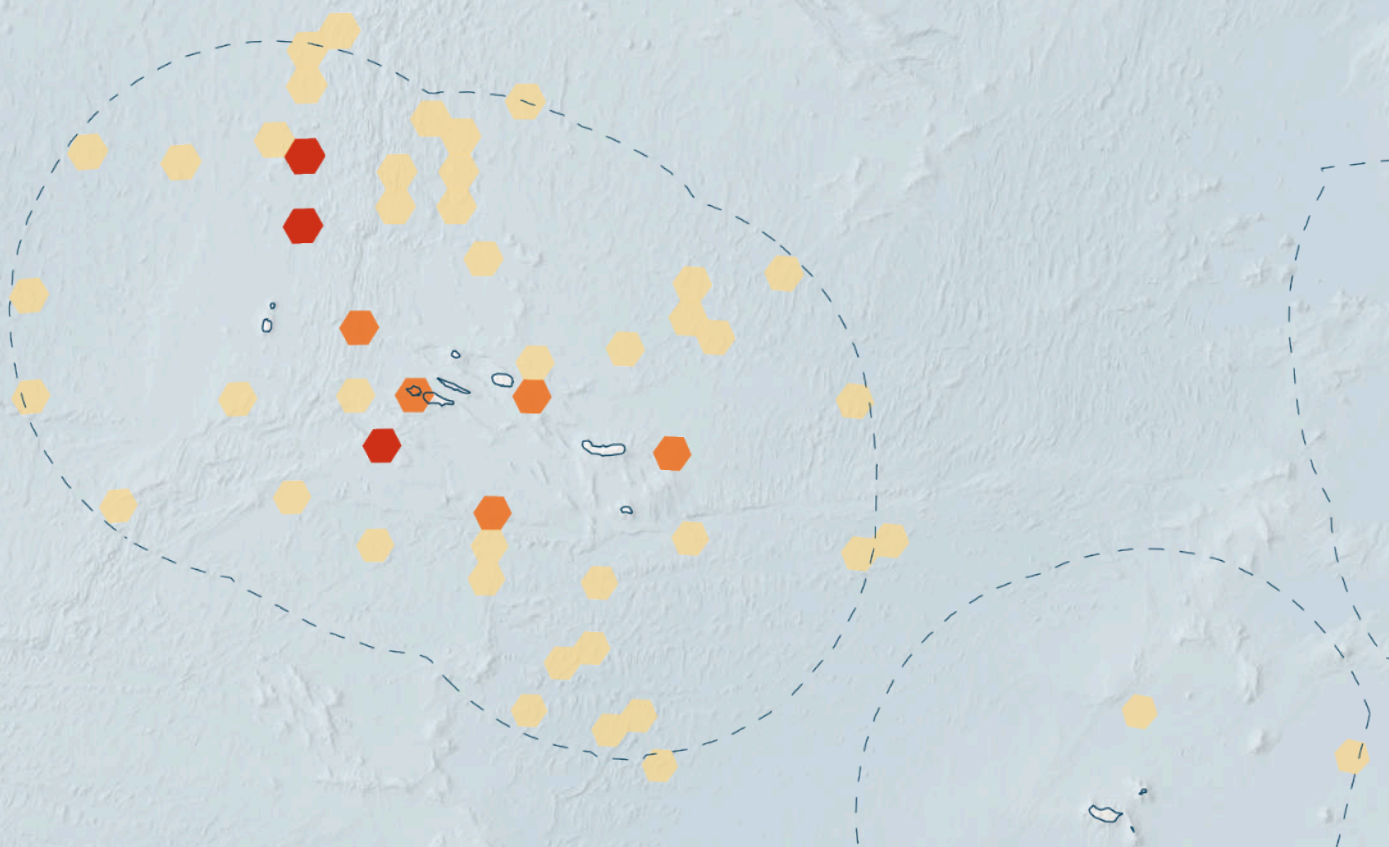
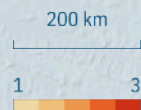






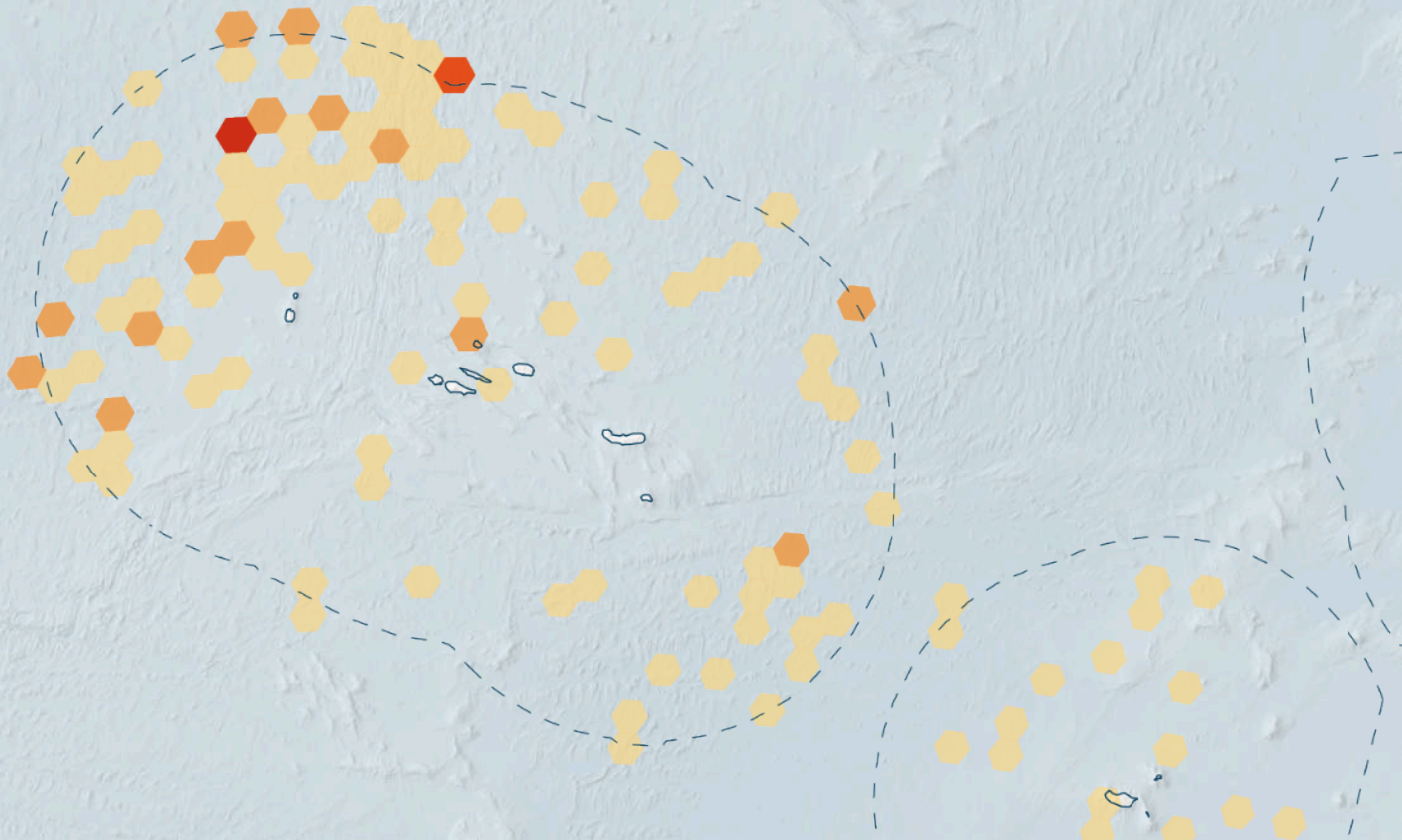
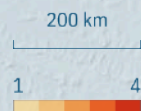
Distribution

Breeding period



Distribution

Non-breeding period



Arctic Jaeger

Stercorarius parasiticus

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NE	LC
Azores	Passage migrant				



Distribution, movements and phenology

The Arctic Jaeger breeds between May and August in Arctic and sub-Arctic regions, wintering mainly in the southern hemisphere off the coasts of various continents (Billerman *et al.* 2026), but also in subtropical waters (van Bemmelen *et al.* 2024b). In Portugal, it is mainly found along the western Mainland coast, occurring particularly during migration, but also in winter (Ramírez *et al.* 2008; Catry *et al.* 2010a), this region being the northernmost limit of its wintering range in the Atlantic Ocean (van Bemmelen *et al.* 2024b). In the Azores, it occurs almost exclusively during migration, particularly from mid-July to late October, being most frequent in August and September. In Madeira, it occurs mainly between August and October (Meirinho *et al.* 2014).

Individual tracking of 17 birds fitted with GLS devices, originating from Norway and Greenland, confirms the extensive use of the Portuguese EEZ, mainly during the non-breeding period, with some birds arriving earlier, probably having completed breeding sooner.

Abundance and population trends

The European population has been estimated at between 39,900 and 56,200 pairs, representing 20% of the global population (BirdLife International 2025) and showing a declining trend (Langlois Lopez *et al.* 2026). On the Mainland, observations from land are more likely during periods of bad weather, when strong westerly winds bring birds closer to the coast, with hundreds sometimes recorded on certain days (Moore 2000). During the post-breeding migration in 2015, 1,146 birds were counted passing south from Cape Carvoeiro (Elmberg *et al.* 2020). Based on the data used for the environmental status assessment, an estimate of between 8,700 and 27,200 individuals was obtained for the continental shelf in 2024.

The negative trend in this population, combined with the fact that it has not achieved Good Environmental Status for the abundance indicator on the Mainland, appears to align with negative trends documented for various populations across its range (Langlois Lopez *et al.* 2026). In the case of Madeira and the Azores, there is no information on population trends, thus preventing an assessment of its environmental status.

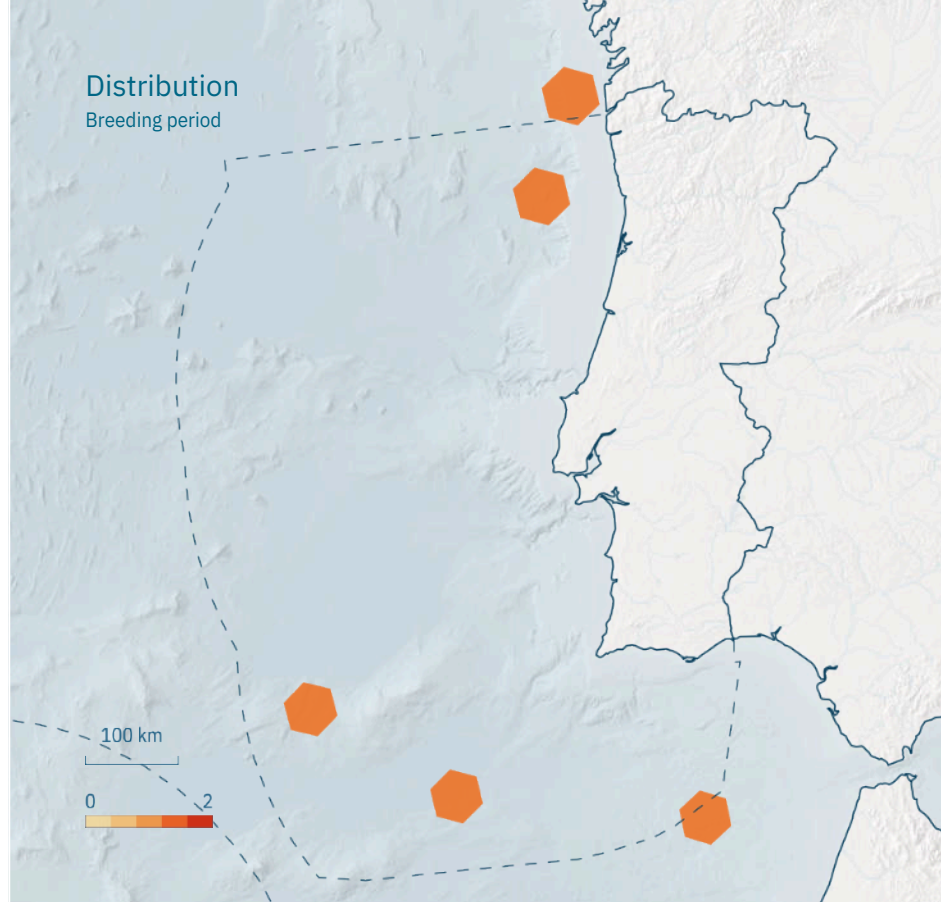
Ecology and habitat

Outside the breeding season, it mainly frequents the waters of the continental shelf, though it also occurs beyond this (O'Hanlon *et al.* 2024; van Bemmelen *et al.* 2024b; Billerman *et al.* 2026). It may nest colonially or solitarily, in coastal areas or on islands. During the breeding season, when nesting near colonies of other seabirds, it obtains a considerable proportion of its food through kleptoparasitism. In the tundra, it has a largely generalist diet that includes small passerines and their chicks, wader chicks and other waterbirds, rodents, insects and berries (Billerman *et al.* 2026). In Portuguese waters, it steals food from various species of seabirds, particularly terns and gulls (Catry *et al.* 2010a).

Threats and conservation

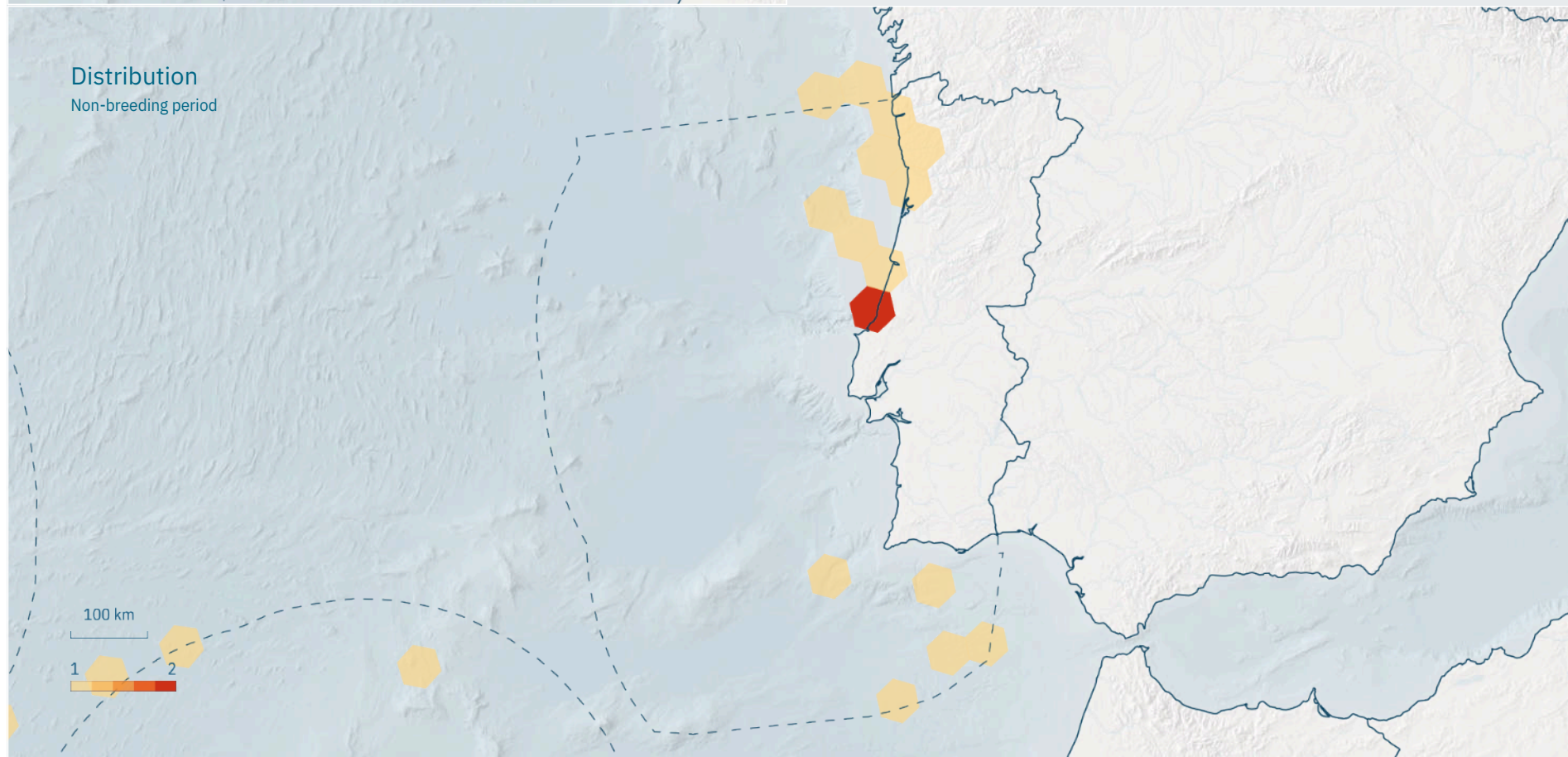
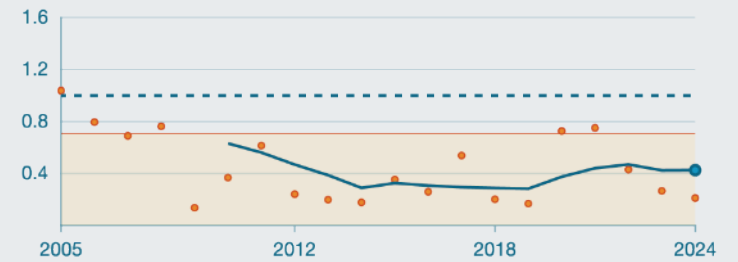
The species appears to be stable globally. However, it has suffered significant declines in its main colonies, most notably in the North Atlantic (Langlois Lopez *et al.* 2026). This trend is likely linked to declines in other seabird species. In its breeding grounds, it may also be affected by human persecution (BirdLife International 2025).

Authors: Rob van Bemmelen, Olivier Gilg, Tânia Nascimento
Owners/sources of tracking data: Borge Moe & Sveinn Are Hansen, Olivier Gilg, Rob van Bemmelen



Abundance Indicator Assessment

● Relative abundance ● 6-years mean & Assessment value --- Reference value ■ Threshold



Distribution

Non-breeding period

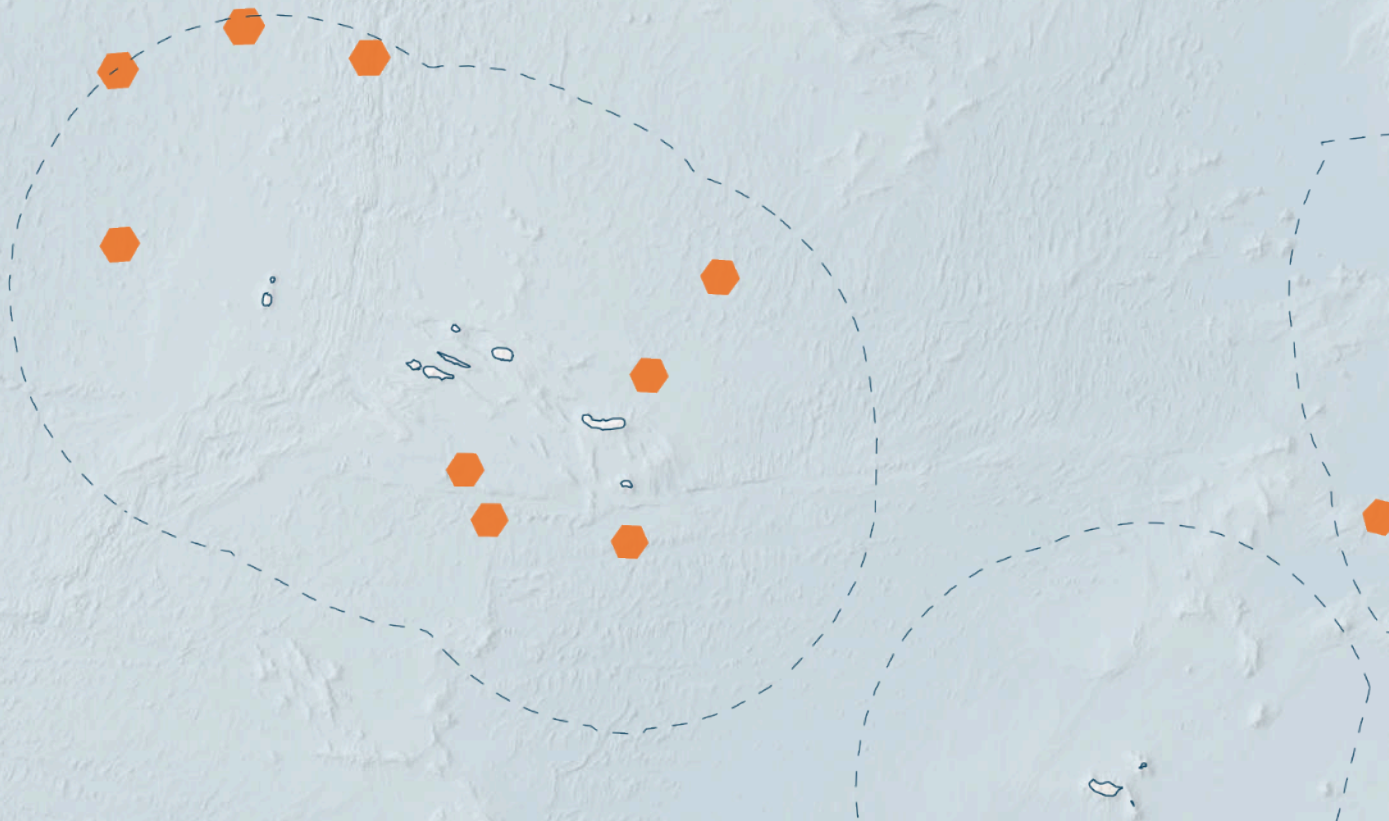
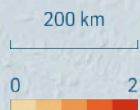
50 km



Colony(ies) of origin: Greenland (Denmark), Slettnes, Svalbard (Norway) | Device: GLS
Data period / number of individuals: October 2009 and April 2015 / 2 ind.

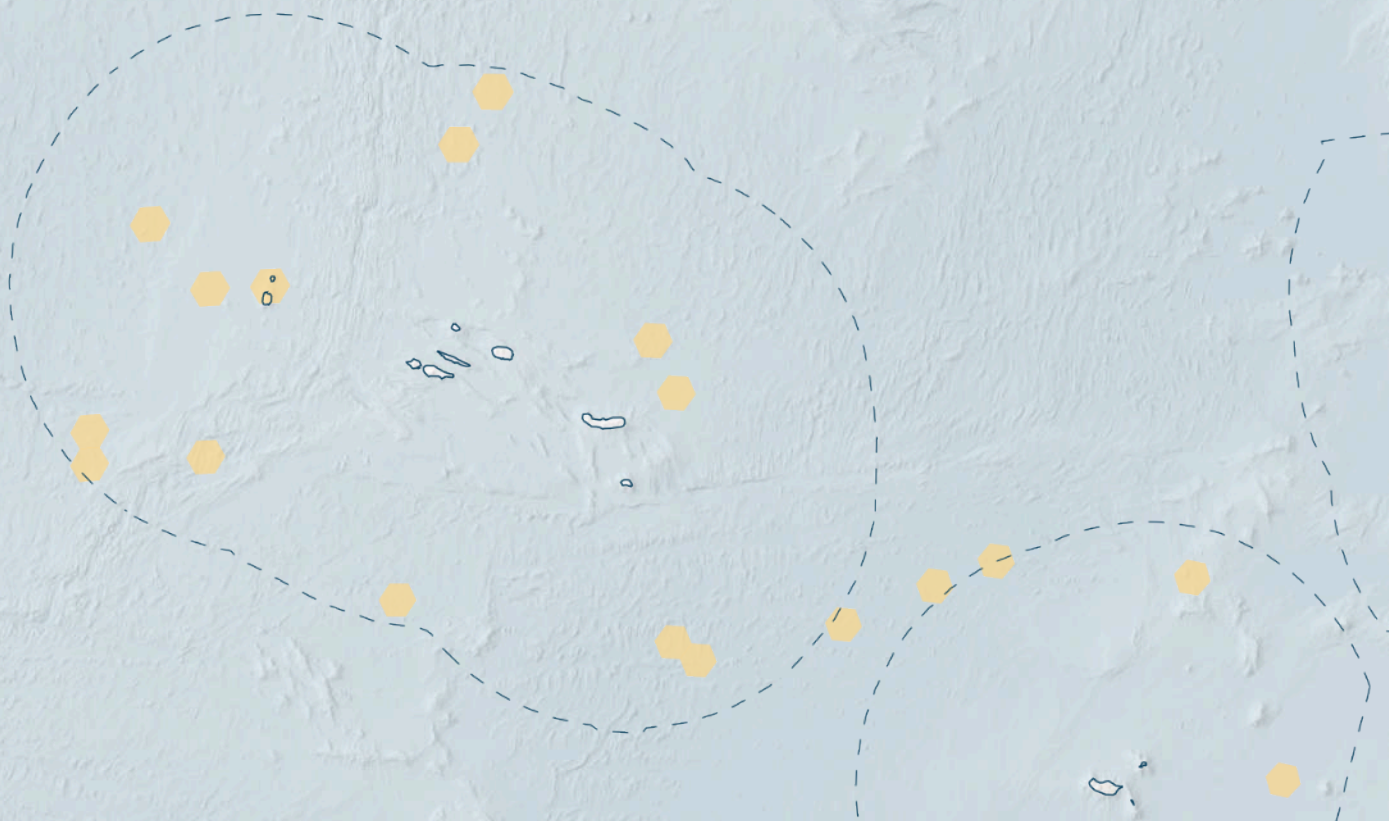
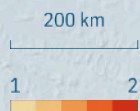
Distribution

Breeding period



Distribution

Non-breeding period



Pomarine Jaeger

Stercorarius pomarinus

Phenology		Conservation status			
Mainland	Passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NE	NE	NE	LC
Azores	Passage migrant				



Distribution, movements and phenology

The Pomarine Jaeger breeds between May and August in the high Arctic regions of Eurasia and North America, and winters in the tropical and subtropical waters of the Atlantic, Indian and Pacific Oceans, along the coasts of Argentina, South Africa and Australia (Billerman *et al.* 2026). In Mainland Portugal, it occurs in the waters of the continental shelf and slope, and may also be observed in oceanic waters or near the coast (Meirinho *et al.* 2014; Calderón & Fagundes 2022). It is a passage migrant, with some birds still occurring at the end of the breeding season (likely due to early completion of the breeding season) or already during the typical post-breeding migration, from July to November, and in lower numbers during the pre-breeding migration, between March and April (Catry *et al.* 2010a). In the Azores and Madeira, it is a regular visitor during post-breeding migration (Alfrey & Legrand 2025). It has not been possible to obtain individual tracking data demonstrating use of the Portuguese EEZ.

Abundance and population trends

The global population has been estimated at around 400,000 mature individuals, with a stable trend, of which 20,000 pairs breed in Europe (BirdLife International 2025). There is little information regarding the number of Pomarine Jaegers occurring in the Portuguese EEZ, despite an increase in the number of sightings, likely as a result of greater observation efforts from land. During the post-breeding migration in 2015, 1,124 birds were counted passing south from Cape Carvoeiro (Elmberg *et al.* 2020). Based on the data used for the environmental status assessment, an estimate of approximately 900 to 9,800 individuals was obtained for the continental shelf in 2024. Despite these values showing large interannual variability, the Mainland population appears to have achieved Good Environmental Status for the abundance indicator. In the case of Madeira and the Azores, there is no information regarding population trends, thus preventing an assessment of their environmental status.

Ecology and habitat

The Pomarine Jaeger nests in a scattered manner across the Arctic tundra. During the breeding season, it feeds primarily on lemmings and other rodents. It also preys on the eggs and chicks of waterbirds (BirdLife International 2025). During the non-breeding season, it remains relatively close to the coast in upwelling areas, feeding mainly on fish, sometimes through kleptoparasitism, but it may also prey on small seabirds (Billerman *et al.* 2026).

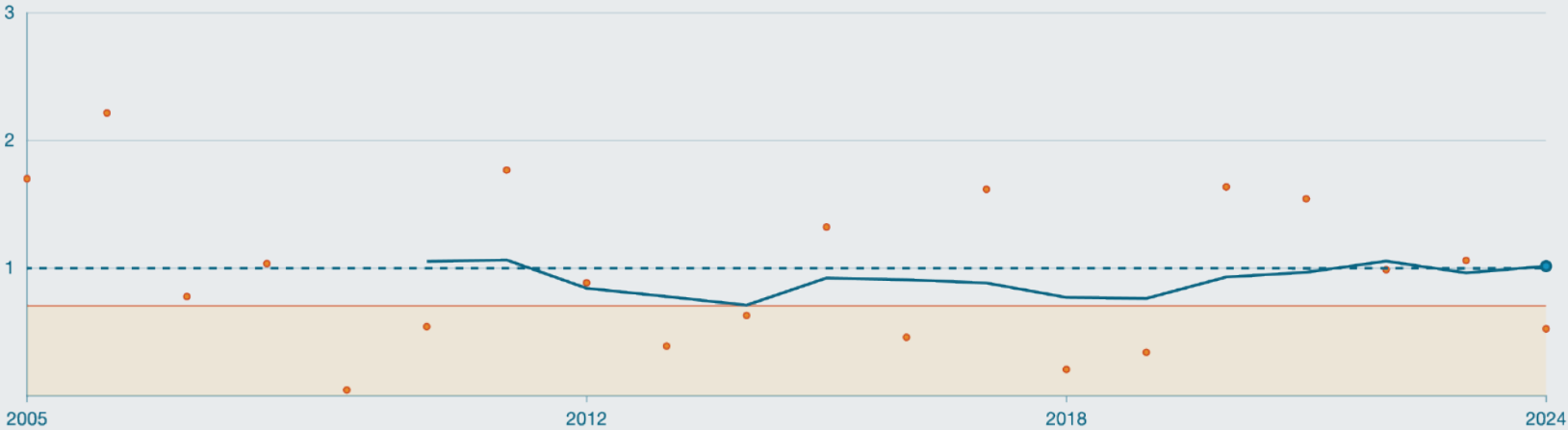
Threats and conservation

The population of this species appears to be stable; however, productivity is heavily dependent on the availability of lemmings, which may experience sharp fluctuations and declines associated with climate change. Although the future impact on populations is still unknown, there is potential for significant negative effects on productivity. If such effects persist over several years, they could result in a population decline (BirdLife International 2025).

Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

Mainland



Great Skua

Catharacta skua

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	LC	NE	NE	LC
Azores	Wintering and passage migrant				



Distribution, movements and phenology

The Great Skua breeds between May and September in northern Europe, notably in Scotland, Iceland, the Faroe Islands, Norway, and Russia (Billerman *et al.* 2026). It winters off the coasts of France and the Iberian Peninsula as far south as West Africa, with some individuals dispersing as far as Newfoundland, Brazil, and the Caribbean (Furness *et al.* 2006; Magnúsdóttir *et al.* 2012; Billerman *et al.* 2026). In Portugal, it occurs off the Mainland coast throughout the year, with the highest concentration in autumn and winter, particularly near estuarine areas (Catry *et al.* 2010; Araújo *et al.* 2022a). It is rare in the archipelagos, occurring most frequently in the Azores between December and March, and in Madeira during post-breeding migration between July and October; it is also observed during spring migration and winter (eBird 2026). Individual tracking data from 74 birds from Norway, Iceland, and Scotland fitted with GLS tags between 2008 and 2022 corroborate the extensive use of the entire Portuguese EEZ. These data also suggest that the Madeira sub-area is important in winter, and is likely an area regularly used by populations wintering on the African coast (Magnúsdóttir *et al.* 2012).

Abundance and population trends

The global population is estimated at between 16,300 and 17,200 breeding pairs, with a stable trend (BirdLife International 2025). In Portugal, sightings of this species were rare in the 20th century, but have increased significantly since then, becoming quite conspicuous along the Mainland coast, particularly in winter (Catry *et al.* 2010). This population was estimated at 5,370 to 9,702 individuals for the period between 2010 and 2015 (Araújo *et al.* 2022a), reflecting the region's important role as a migratory corridor, used by around 7% of the species' global population during post-breeding migration (Leitão *et al.* 2014). Nevertheless, although these figures show significant interannual variations, a downward trend has been observed in recent years, reflected in the indicator relating to population abundance, with the Mainland population failing to achieve Good Environmental Status. In the case of the Azores and Madeira, however, the available information does not allow for firm conclusions to be drawn regarding the population trends in these regions.

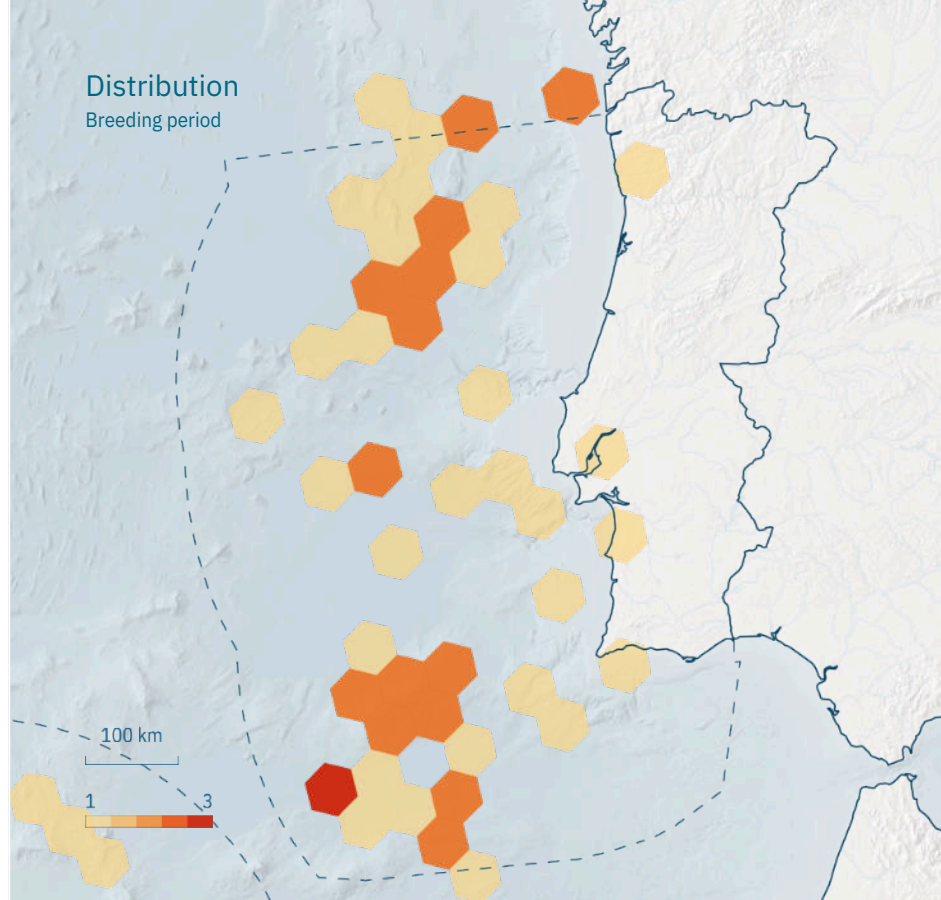
Ecology and habitat

During the breeding season, it is a semi-colonial but highly territorial bird. Nesting takes place on flat terrain with some vegetation (BirdLife International 2025). At sea and during the non-breeding season, it exhibits essentially pelagic behaviour, utilising mainly the continental shelf. It has a varied and opportunistic diet, frequently following fishing vessels (Valeiras 2003; Pereira *et al.* 2025a) and displaying kleptoparasitic behaviour, chasing other seabirds to steal their food.

Threats and conservation

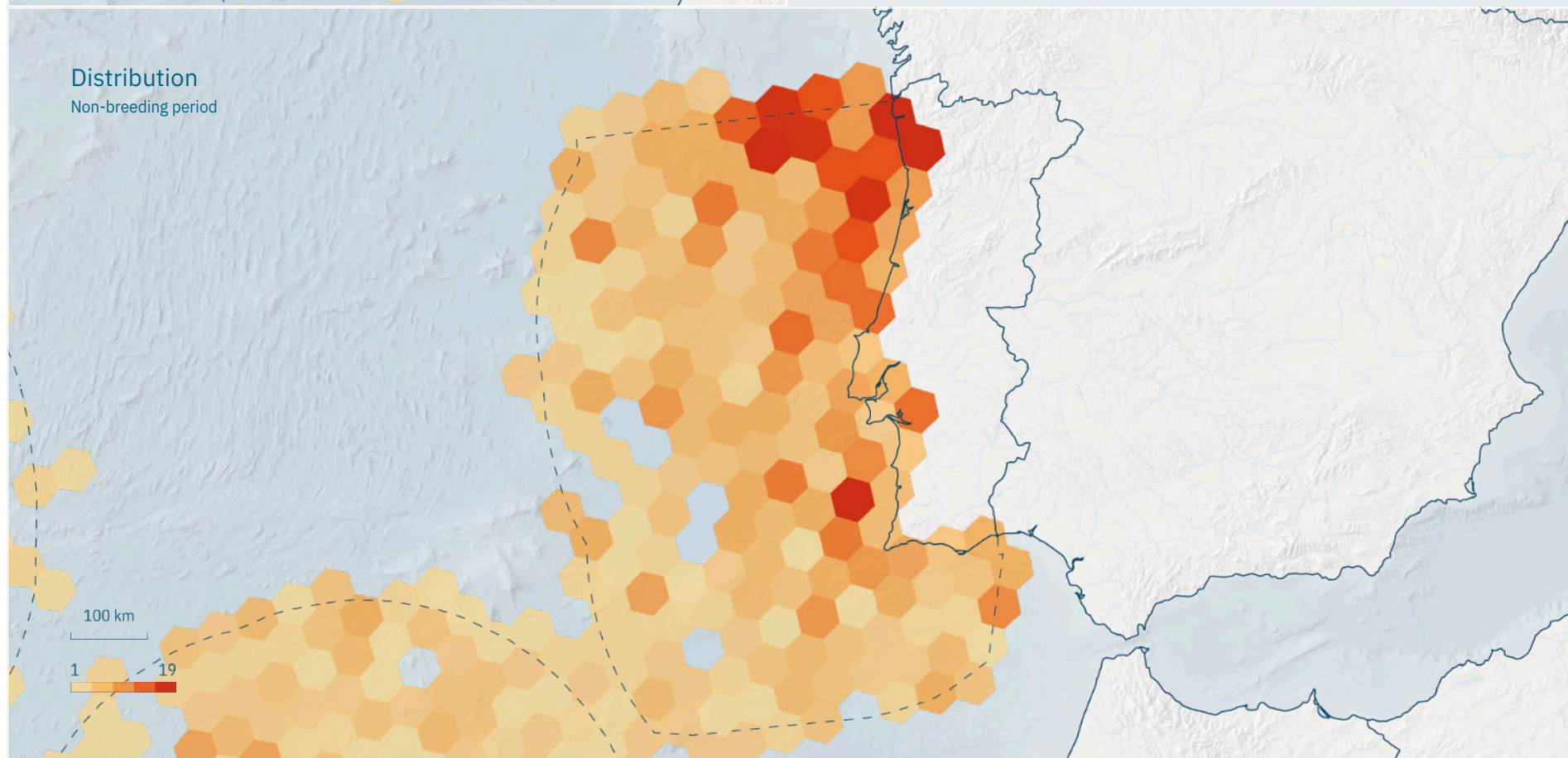
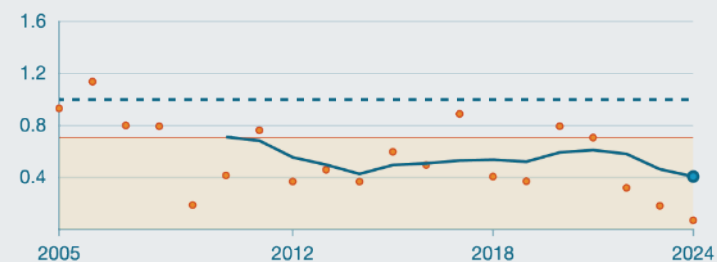
The Great Skua relies on fishing discards, particularly during the breeding season, and the species may be affected by policies aimed at reducing discards (BirdLife International 2025). Furthermore, a decline in the stocks of its main prey species may lead to population declines and reduced breeding success.

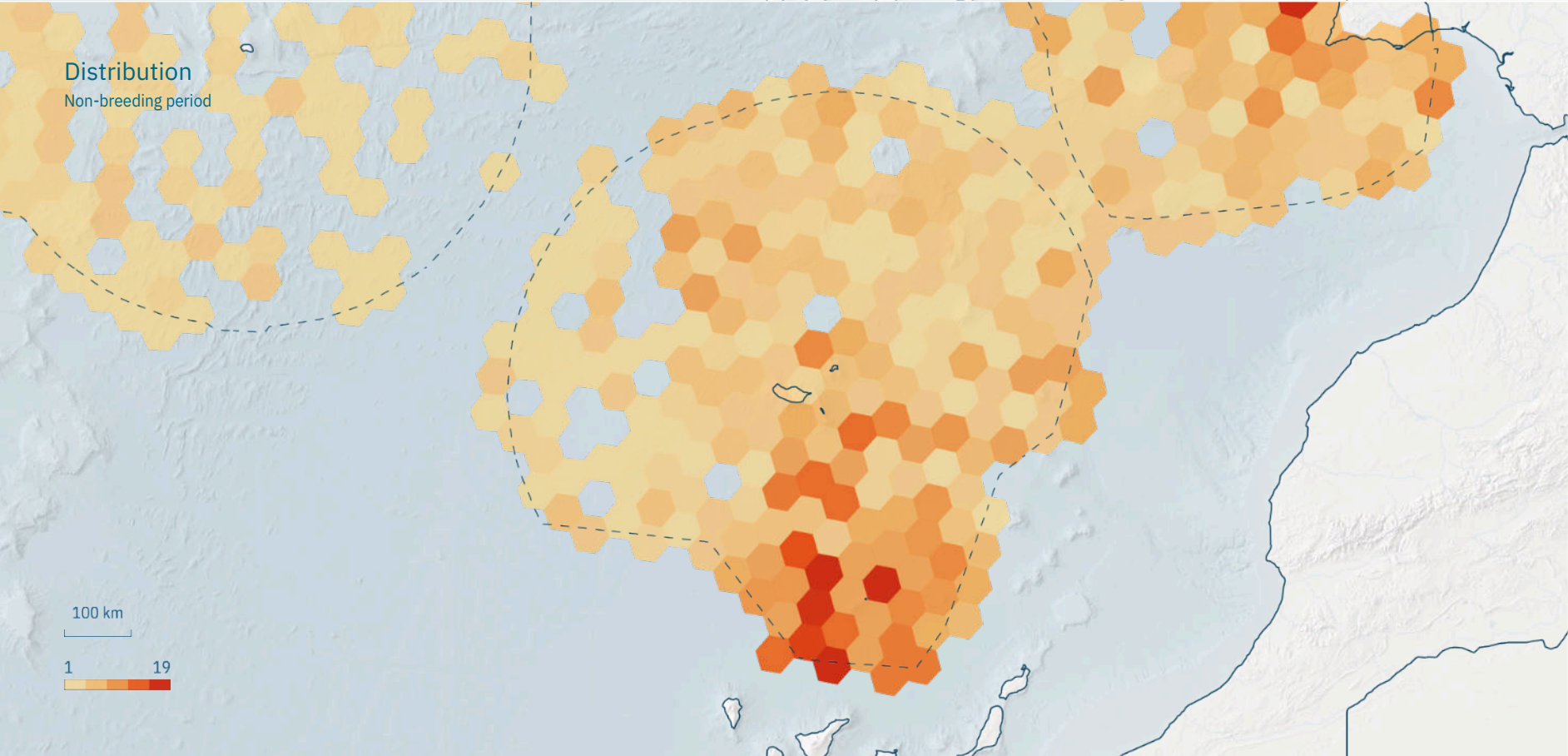
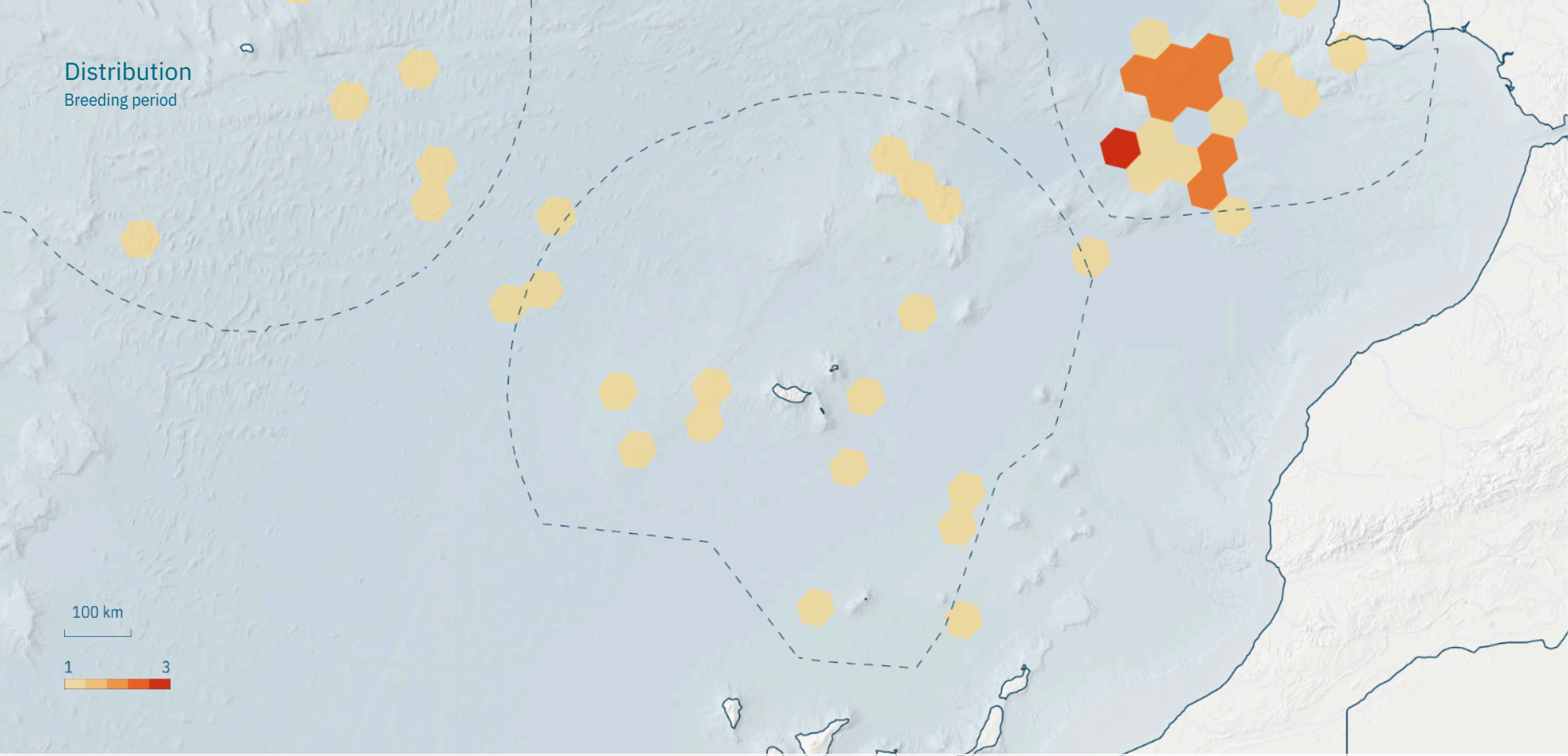
Author: Hany Alonso
Owners/sources of tracking data: Furness *et al.* 2009a, Furness *et al.* 2009b, Furness *et al.* 2010



Abundance Indicator Assessment

● Relative abundance — 6-years mean & Assessment value - - - Reference value Threshold







N

Distribution

Breeding period



Distribution

Non-breeding period



South Polar Skua

Catharacta maccormicki

Phenology		Conservation status			
Mainland	Vagrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	NA	NE	NE	LC
Azores	Wintering and passage migrant				



Distribution, movements and phenology

The South Polar Skua breeds between November and May on the Antarctic coast, particularly on the Antarctic Peninsula and in the South Orkney and South Shetland archipelagos and the Ross Sea. It is one of the seabirds with the longest migration, wintering in the North-west Atlantic and the northern Pacific. It is precisely during the pre-breeding migration that this species crosses the North-east Atlantic, passing mainly off the European mainland coast, though some individuals approach the coast of the Iberian Peninsula, particularly between late August and early November (Kopp *et al.* 2011). The species' rare occurrence, combined with the difficulty in identifying it, contributes to the scarcity of observations in this region (Flood *et al.* 2024). Tracking data from 28 birds from the South Shetland Islands fitted with GLS devices show this fragmented use of continental waters. However, this is not observed in the Azores sub-area, where the species appears to make more extensive use of the waters, particularly in the western half and during the wintering period. Corroborating observations have recently been recorded during birdwatching trips on the open sea (e.g. Alfrey & Legrand 2025). In the waters off Madeira, there appears to be a lower but still significant occurrence of the species, particularly near the Selvagens Islands, and it can also be observed in other areas (e.g. Flood *et al.* 2013).

Abundance and population trends

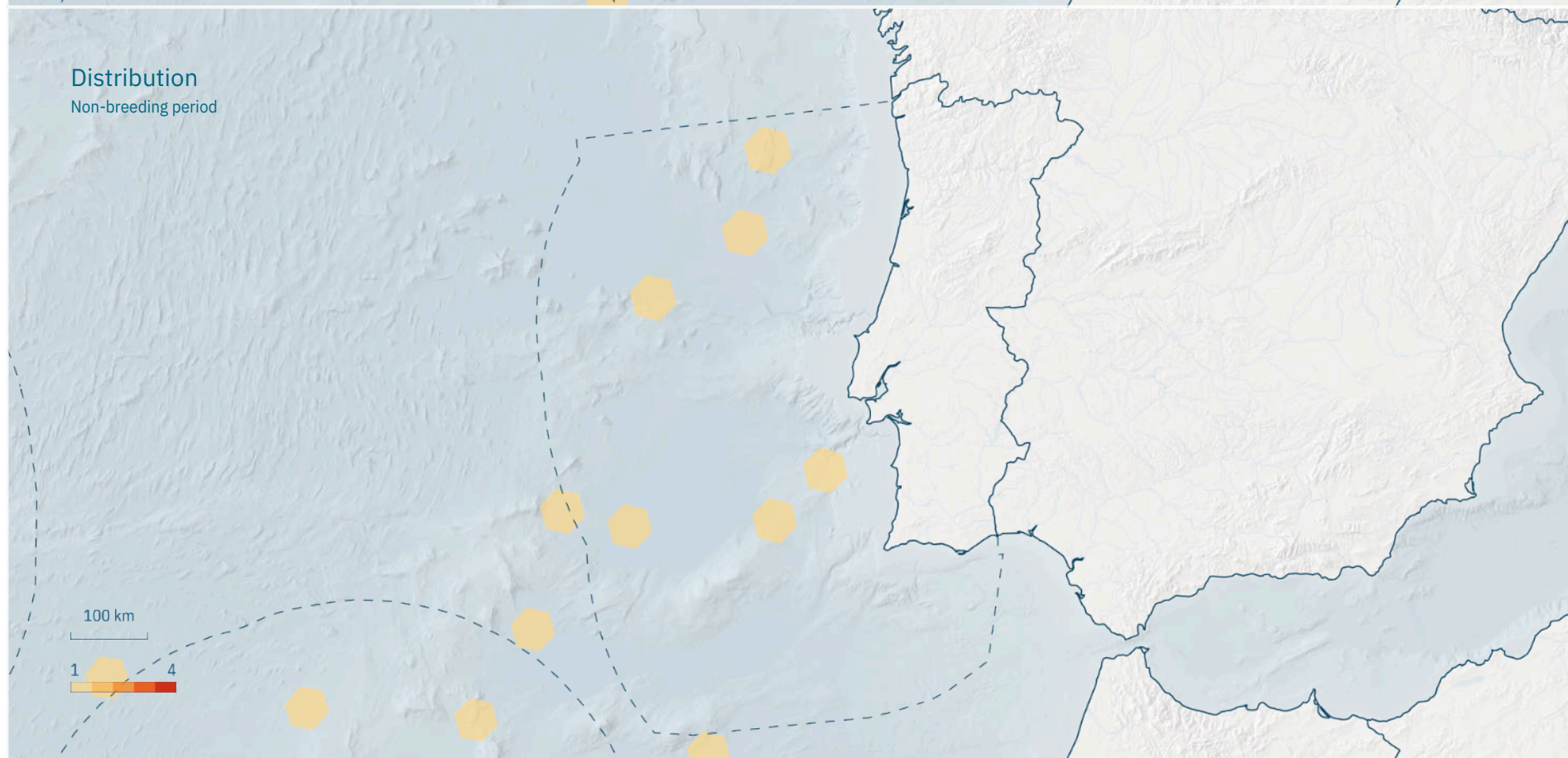
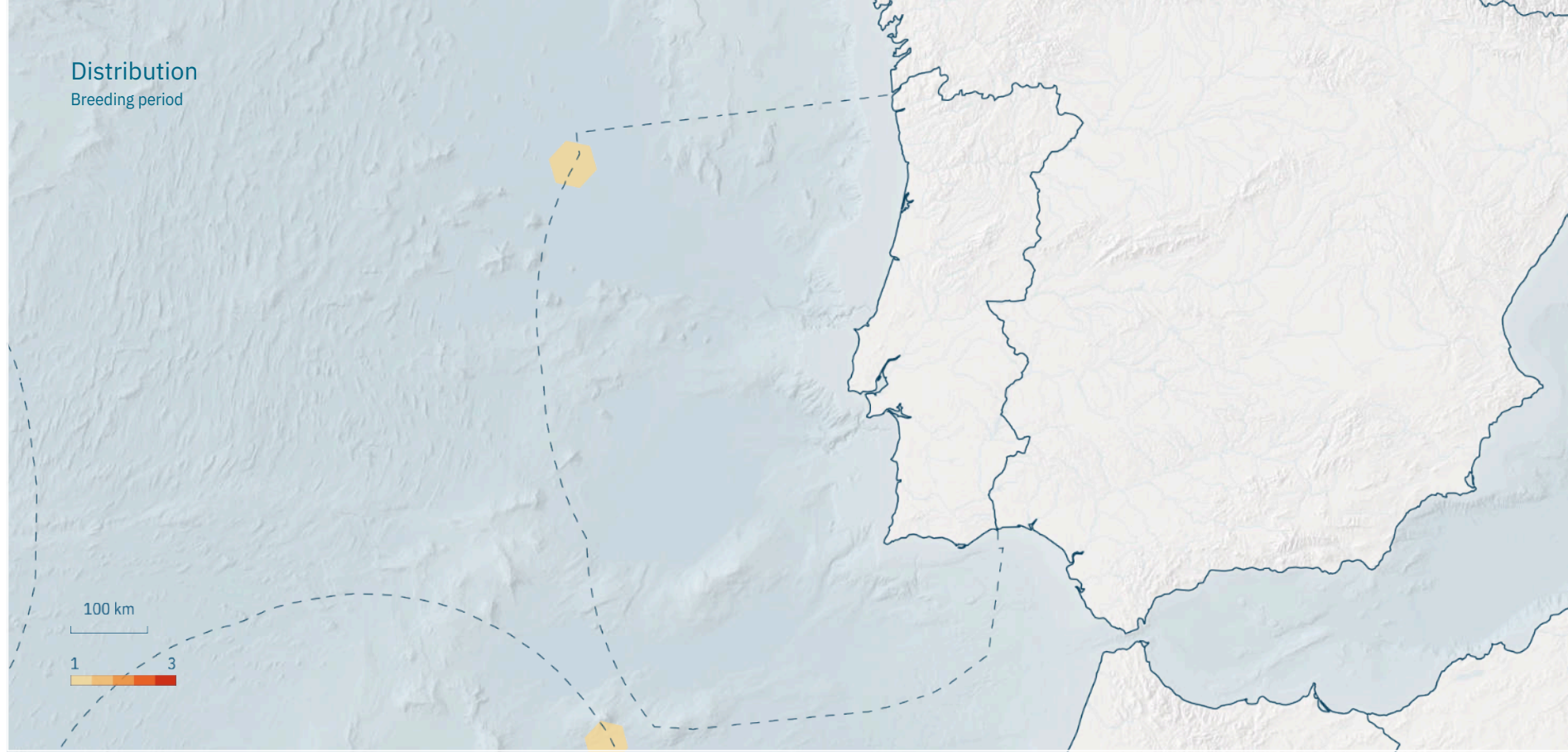
The global population is estimated to number between 6,000 and 15,000 mature individuals (BirdLife International 2025). The population appears to be stable, with no evidence of decline or significant threats. As the species is rarely observed in Portugal, there are no data available to assess population trends or its environmental status.

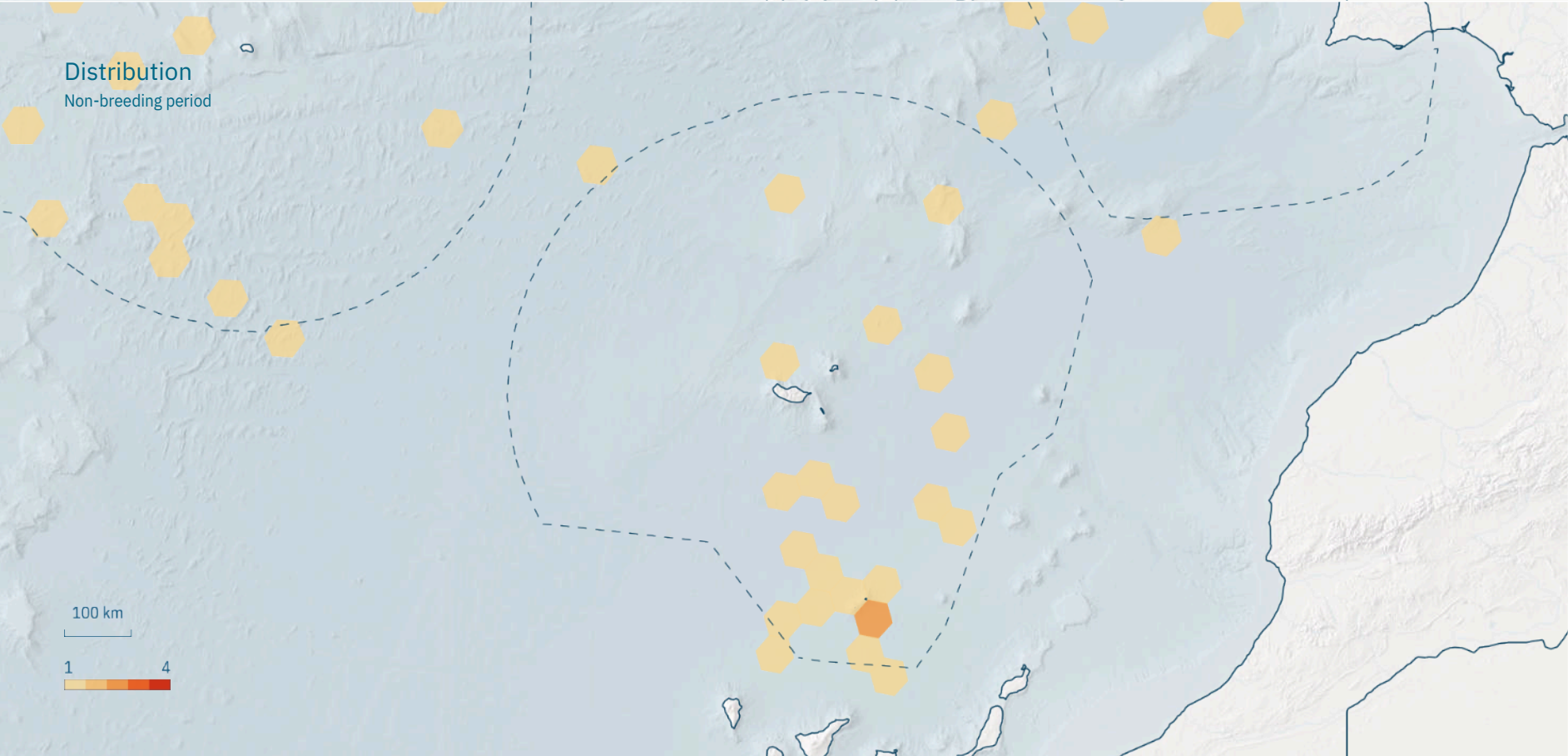
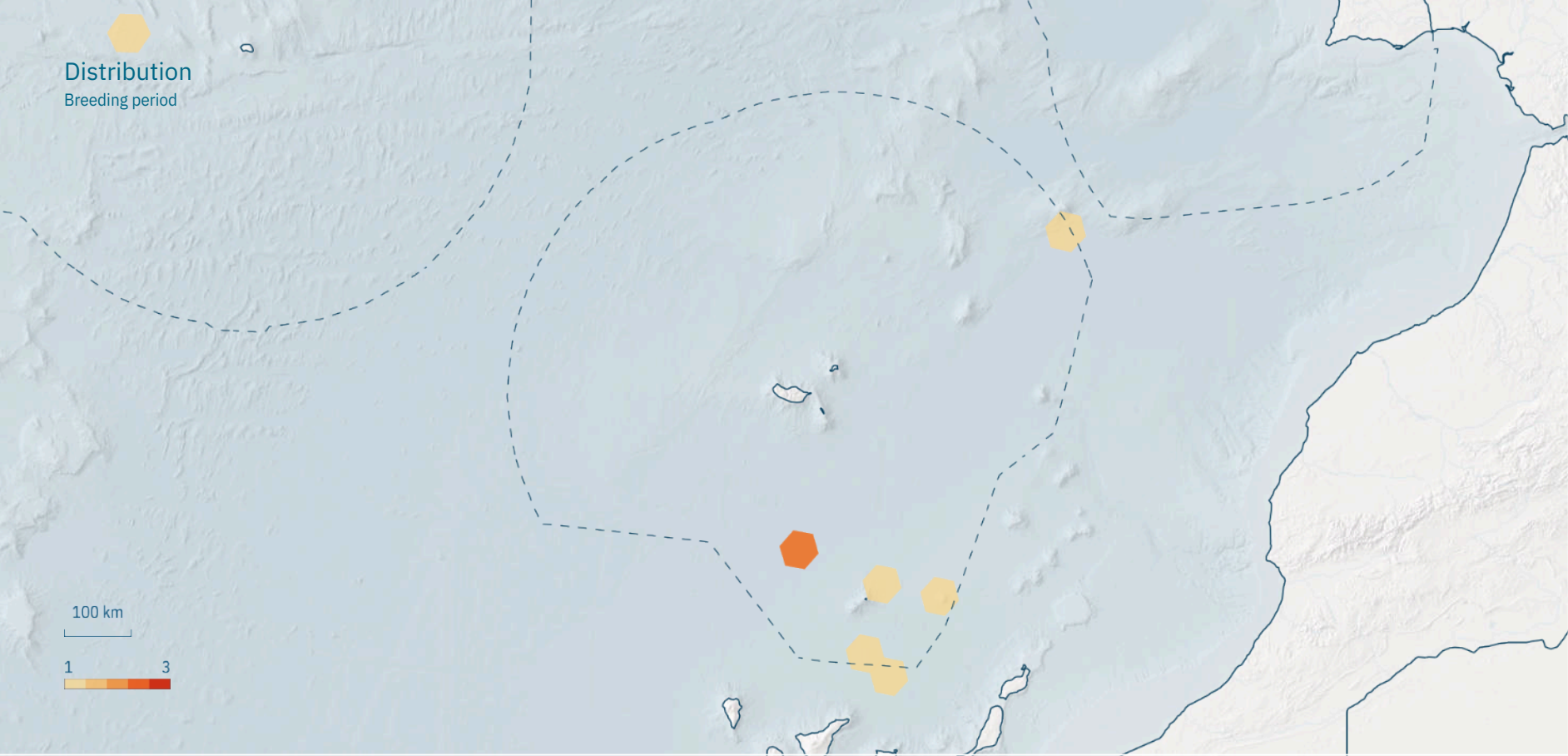
Ecology and habitat

The South Polar Skua nests in areas with little snow cover, where it usually lays two eggs between November and December. It feeds mainly on fish, krill, and penguins, supplementing its diet with carrion (Billerman *et al.* 2026).

Threats and conservation

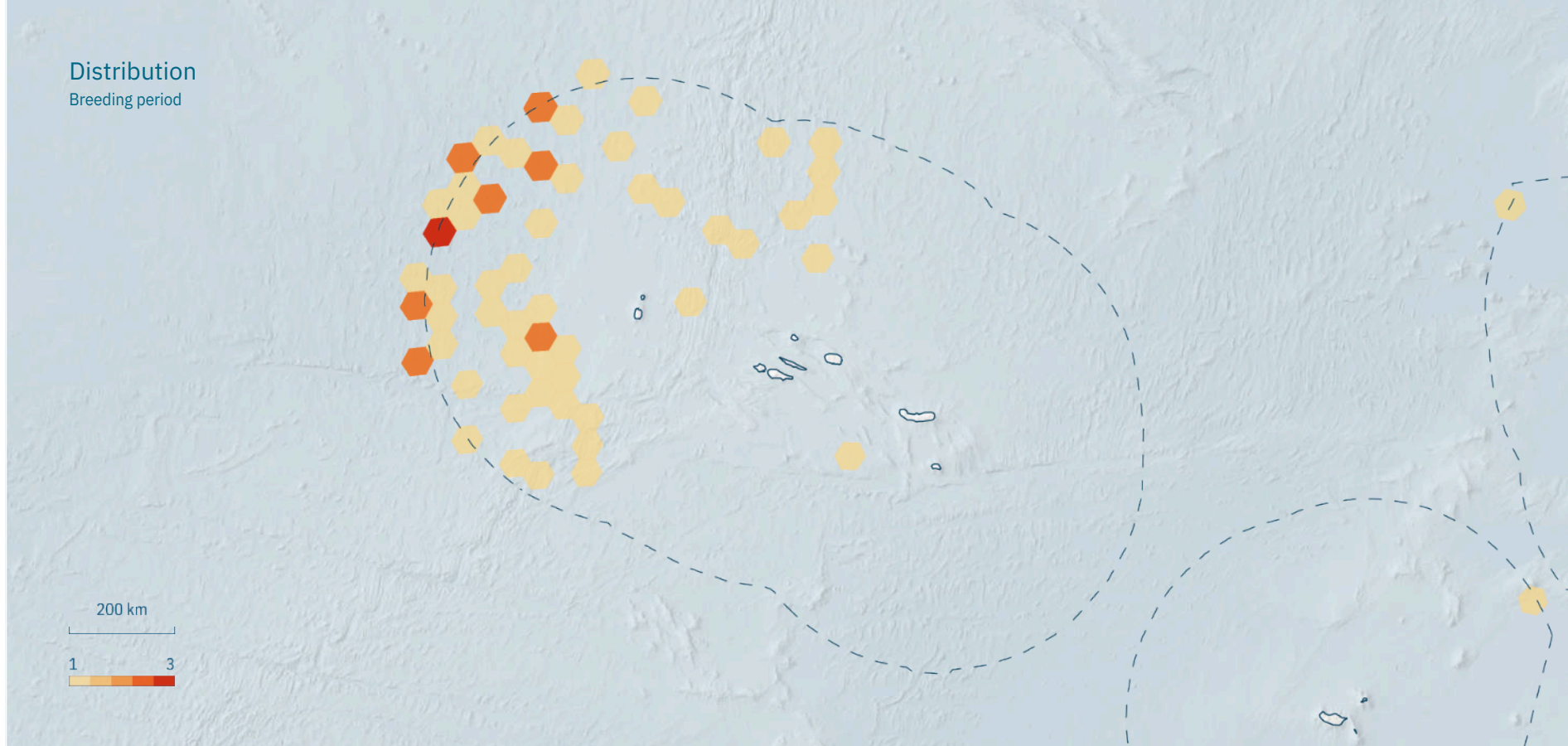
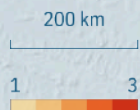
Population survival may be affected by prey abundance, climate change leading to a decline in sea ice concentrations (Pacoureaux *et al.* 2019), and infectious diseases (León *et al.* 2025). They also exhibit bioaccumulation and biomagnification of organic pollutants, which may pose a risk of chronic effects on survival and breeding success (Bustnes *et al.* 2006).





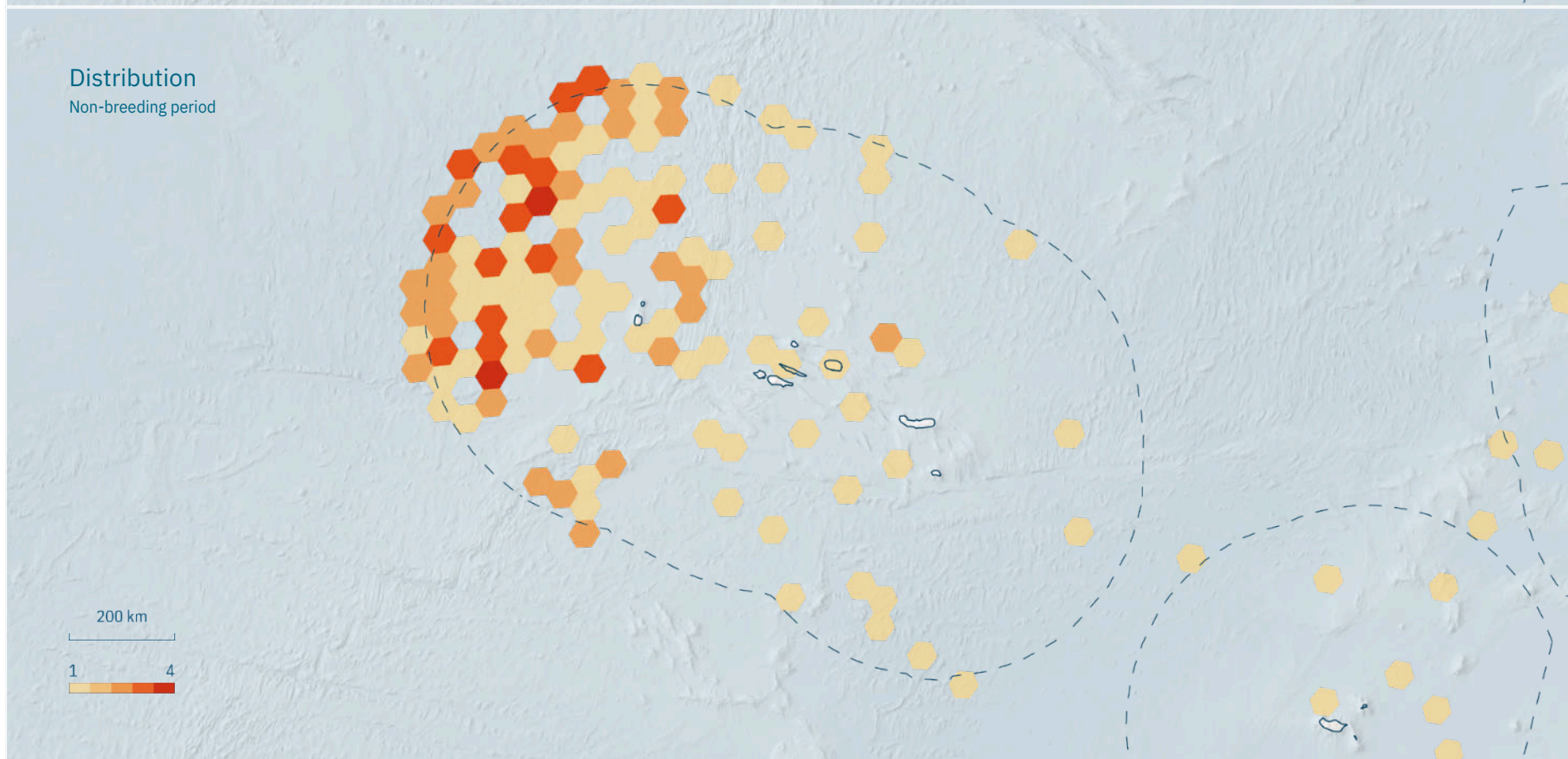
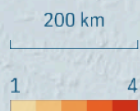
Distribution

Breeding period



Distribution

Non-breeding period



Atlantic Puffin

Fratercula arctica

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Wintering and passage migrant	DD	NE	NE	VU
Azores	Wintering and passage migrant				



Distribution, movements and phenology

The Atlantic Puffin is a species found mainly in the North Atlantic, which, outside the breeding season, disperses to pelagic environments (Guilford *et al.* 2011). The Moroccan coast and the western Mediterranean represent the southern limit of its range (Billerman *et al.* 2026). In Portugal, it occurs as a winter visitor and a passage migrant, being present mainly between October and early April (Catty *et al.* 2010a). Based on data from 129 birds fitted with GLS devices between 2008 and 2023 in various colonies across northern Europe, there was extensive use of the Portuguese EEZ, with records throughout all months of the year. Most sightings were concentrated in the Mainland sub-area, particularly in the areas furthest from the coast in the centre and north of the region. Significant concentrations of the species were also recorded north-east of Madeira and north-west of the Azores, with these areas likely marking the southern limit of the species' distribution during the wintering period (Fayet *et al.* 2017).

Abundance and population trends

The global population has been estimated at 12 to 14 million mature individuals, with 70% to 95% of this population concentrated in Europe (BirdLife International 2025). Iceland and Norway, which host around 80% of the European population, have recorded sharp declines since the early 2000s, with frequent breeding failures and iconic colonies in collapse. As the species has a predominantly oceanic distribution during the wintering period, there are no recent or historical estimates of the number of birds occurring in Portugal; however, based on the data used for the environmental status assessment, it is estimated that there are thousands of birds, at least on the Mainland. A pattern corroborated by stranding events involving several thousand birds that have occurred recently in the country (Oliveira *et al.* 2023c).

Despite some variation in abundance figures for the continental shelf, this population has not achieved Good Environmental Status for the respective indicator. In the case of Madeira and the Azores, there is no information regarding population trends, thus preventing an assessment of their environmental status.

Ecology and habitat

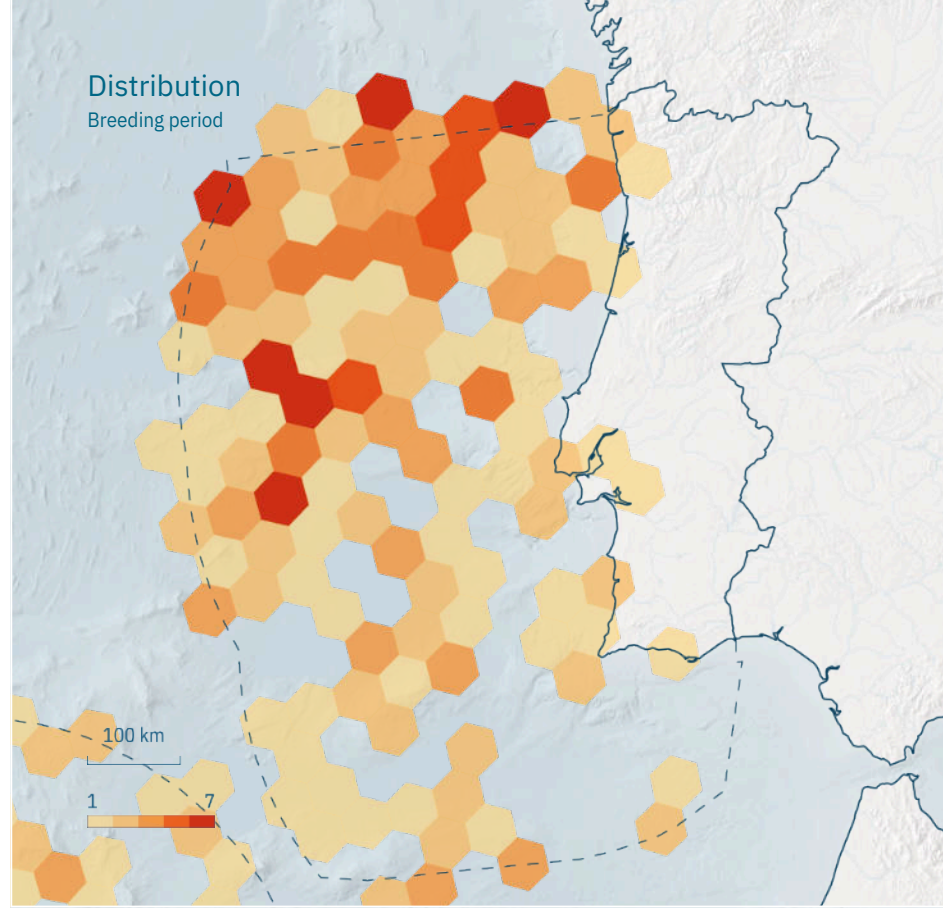
It nests on grassy coastal slopes, cliffs and rocky slopes, digging its nests into the ground. During the winter, it has a wide distribution and is found in distinctly pelagic habitats; its distribution may depend on oceanic productivity and the movements of schools of small pelagic fish (Harris *et al.* 2010). During the wintering period, its diet includes small fish, crustaceans and cephalopods (Falk *et al.* 1992), although there is no information regarding its diet in Portugal.

Threats and conservation

The species is highly vulnerable to climate change, particularly to rising sea surface temperatures, which affect the availability, distribution and quality of prey, leading to frequent breeding failures (Durant *et al.* 2003; Sandvik *et al.* 2005). Extreme weather events also cause mass mortalities (Costa *et al.* 2026). These impacts are exacerbated by overfishing, invasive predators in colonies, human disturbance, marine pollution (including oil spills and plastics) and, potentially, by the expansion of offshore infrastructure (BirdLife International 2025). Monitoring of stranding events, measures to minimise bycatch in fishing nets, and oil spill prevention and response plans are potentially important for the conservation of the species in Portugal.

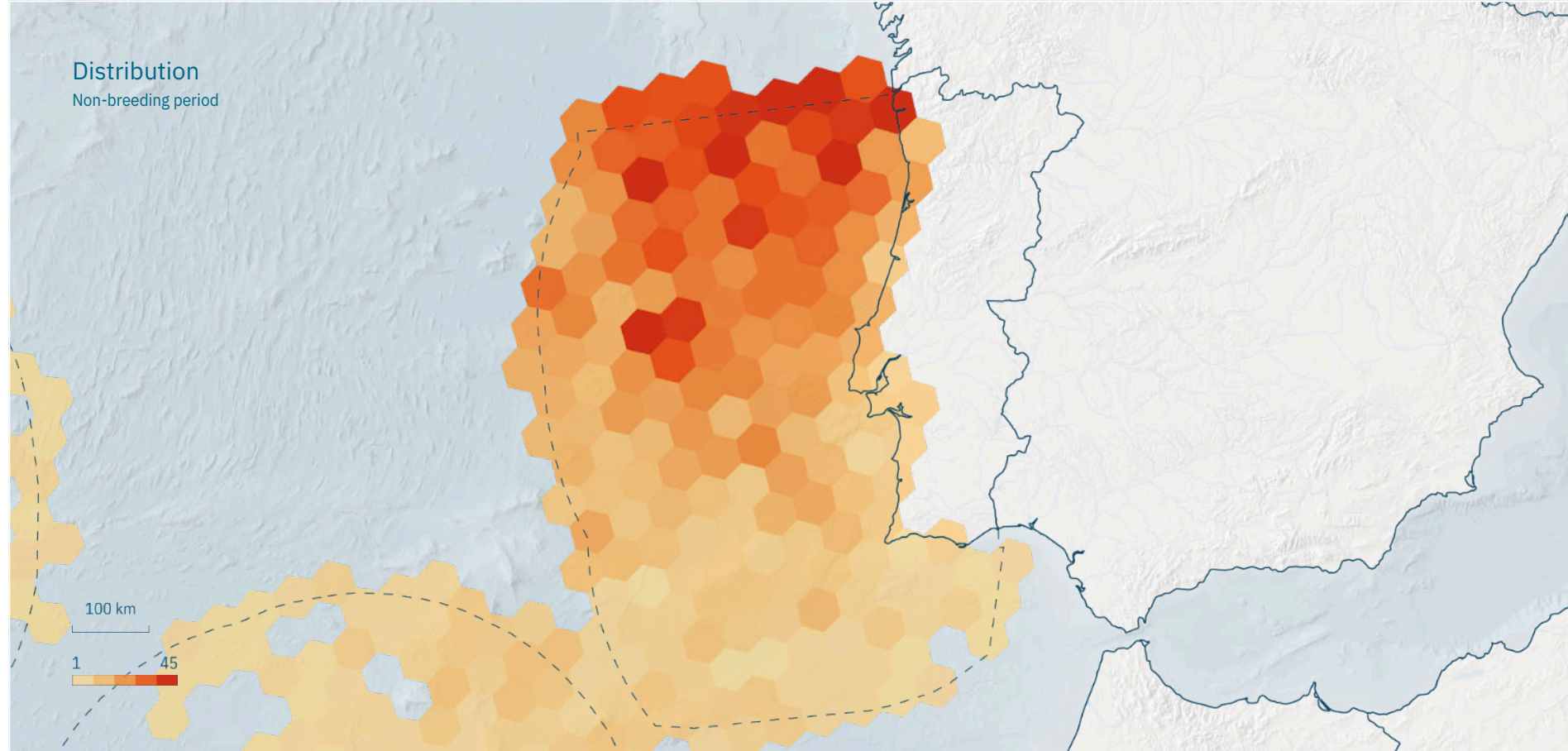
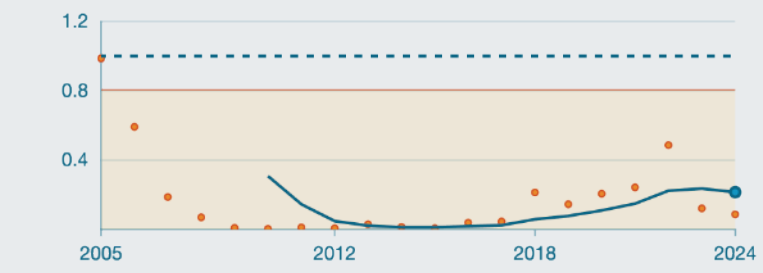
Authors: Kurt K. Burnham, Tânia Nascimento
Owners/sources of tracking data: Burnham *et al.* 2021, Fayet *et al.* 2017, Fayet & Guilford 2014, Hansen & Thorarinsson 2014a, Hansen & Thorarinsson 2014b, Hansen & Thorarinsson 2014c, Jessopp 2013, Jessopp 2021

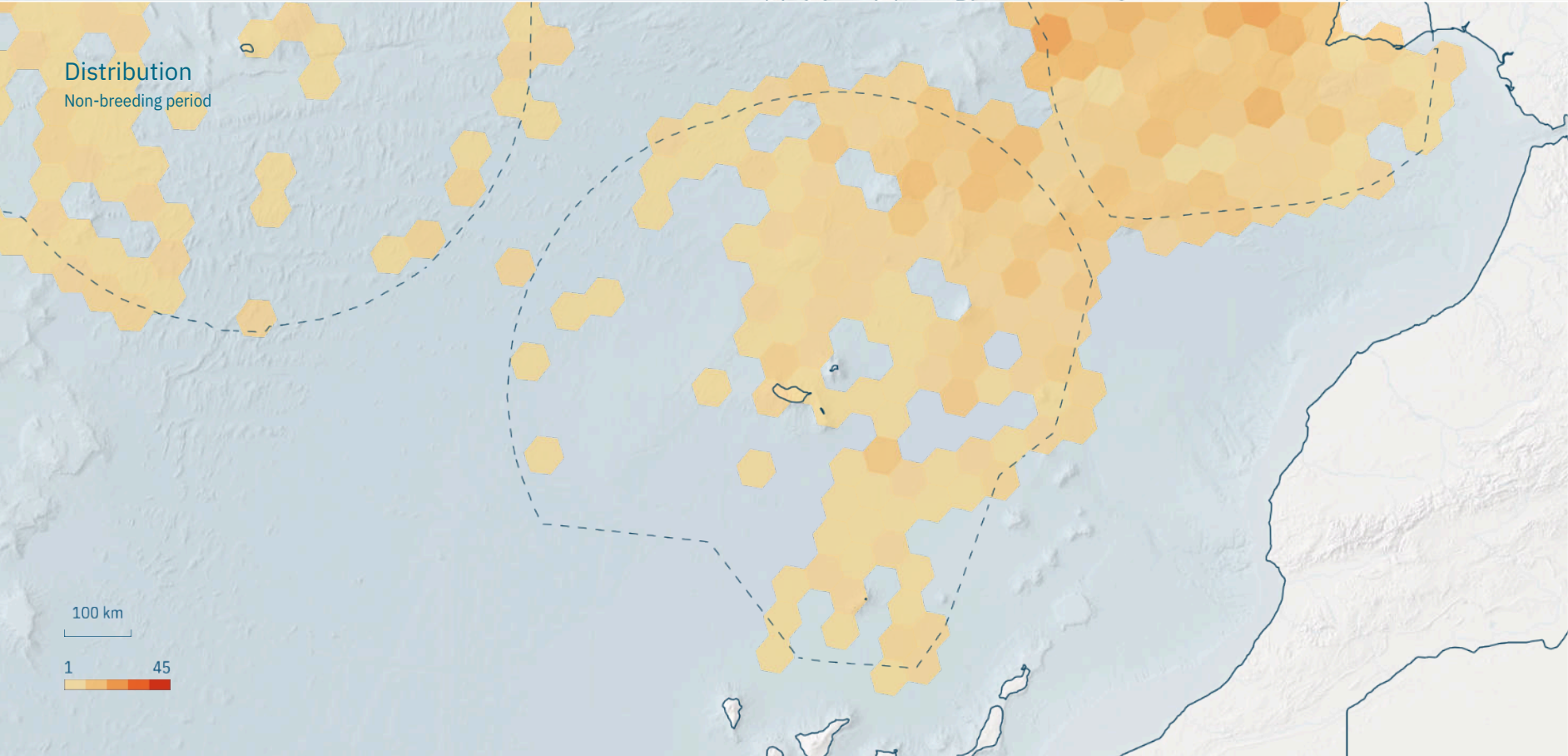
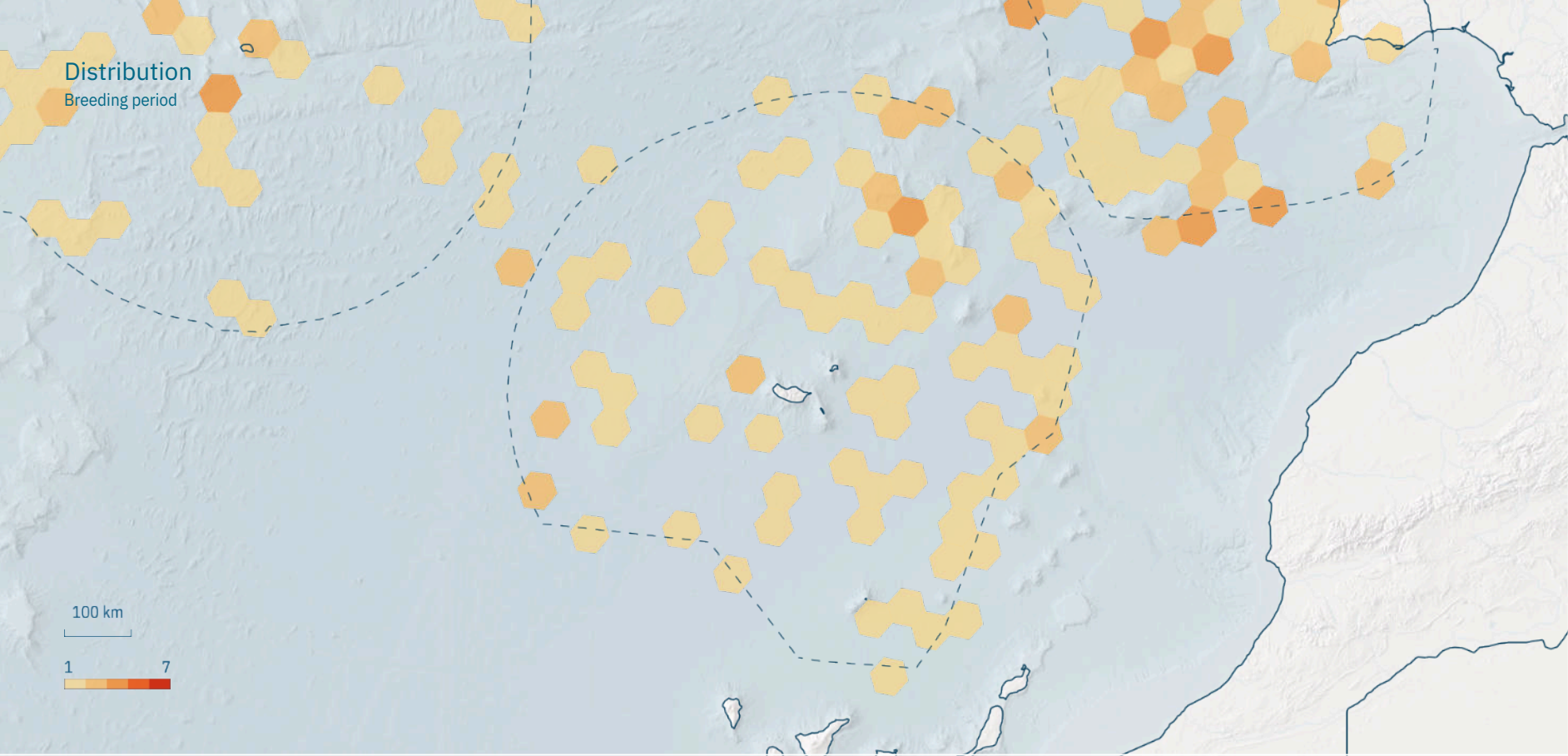
Colony(ies) of origin: Dalrymple Rock (Greenland), Skellig Michael (Ireland), Grimsey, Heimaey, Papey, Westman, Flatey (Iceland), Skomer (UK) | Device: GLS
Data period / number of individuals: January-December 2007-2023 / 97 ind.



Abundance Indicator Assessment

● Relative abundance — 6-years mean & Assessment value - - - Reference value ■ Threshold

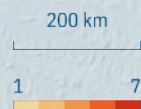






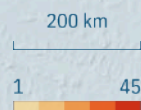
Distribution

Breeding period



Distribution

Non-breeding period



Razorbill

Alca torda

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	NT	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Razorbill breeds between April and July on islands and in coastal areas of the North Atlantic and the lower Arctic. After breeding, most birds migrate south, with European populations reaching their distribution limit in the western Mediterranean and North Africa (Billerman *et al.* 2026).

In Portugal, it occurs as a passage migrant and winter visitor along the entire Mainland coast, with the highest numbers in the north-central part of the country (Meirinho *et al.* 2014). Post-breeding migration begins in October, peaking in November (Fagundes *et al.* 2024). Pre-breeding migration is visible from January, continuing until April. The species has been recorded very sporadically in the Azores (Birding Azores 2022), and no previous records were known for the Madeira archipelago (Meirinho *et al.* 2014; Correia-Fagundes *et al.* 2021).

Individual tracking of birds visiting Portuguese waters is still very limited. Based on data from four birds fitted with GLS tags in Iceland in 2013 and 2014, there was little use of the Portuguese EEZ, restricted to the period between April and September. Most records occurred in the Azores sub-area, with only one record detected on the Mainland and another in Madeira.

Abundance and population trends

The global population has been estimated at between 838,000 and 1,660,000 mature individuals (BirdLife International 2025). The species has shown significant growth in Europe, which is home to over 90% of the global population. However, this increase has not been observed in wintering areas further south. For example, data collected in the Strait of Gibraltar indicate a recent decline (De la Cruz *et al.* 2022b), which may point to a contraction in the winter distribution. In Mainland Portugal, the species is most abundant between November and April, with an estimated 2,000 to 11,000 birds on the continental shelf for the winter of 2024, based on the data used here for the environmental status assessment. Its abundance has shown significant fluctuations (Fagundes *et al.* 2024), which, together with the decline in numbers, has resulted in non-compliance with Good Environmental Status for the abundance indicator, consistent with its current unfavourable conservation status in the region.

Ecology and habitat

It is mainly found in the shallow waters of the continental shelf (Huettmann *et al.* 2005). In Portugal, it is frequently found in areas close to the coast and may enter fishing harbours, marinas or the interior of harbour bars to seek shelter during and after major storms. It is an excellent diver, capable of reaching depths of several tens of metres in search of its prey. It feeds on small pelagic fish, mainly sardines, but also preys on anchovies and sand eels (Beja 1989; Gomes 2015).

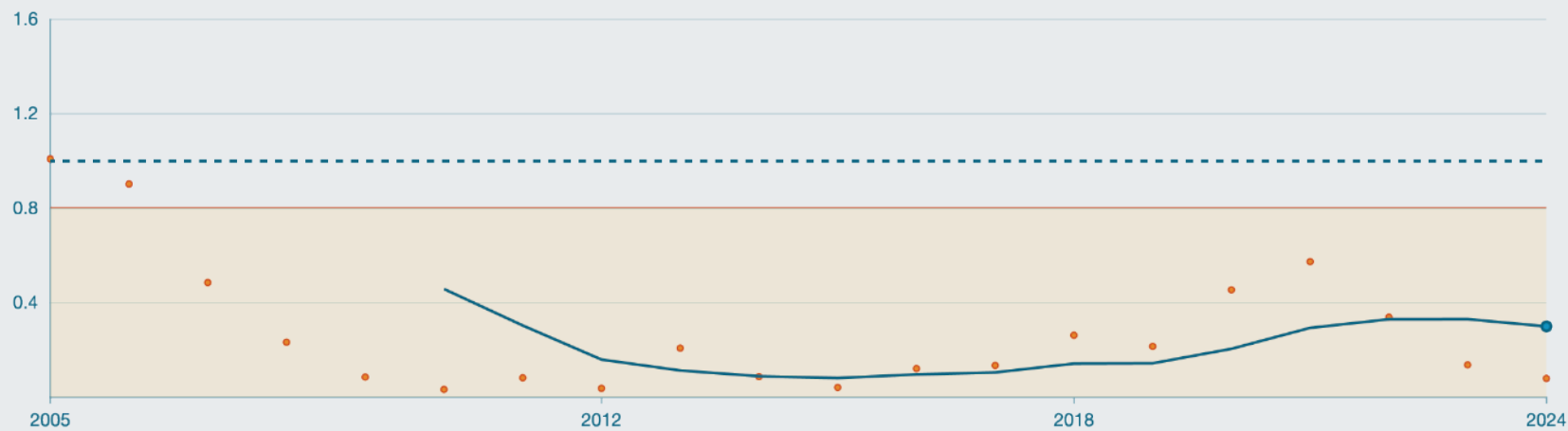
Threats and conservation

The Razorbill is one of the species most frequently found stranded on Portuguese beaches (SPEA 2023). The cause of death is not usually identified due to the advanced state of decomposition of the carcasses. However, bycatch in gillnets and drift-nets is cited as one of the main causes of mortality (Costa *et al.* 2019). Prolonged spells of bad weather can lead to food shortages and cause mass mortality events (Loring 2023; Oliveira *et al.* 2023c). Other notable threats to the species include hydrocarbon contamination resulting from accidental spills (Munilla *et al.* 2011) and reduced prey availability (Costa *et al.* 2019). Conservation priorities focus on minimising bycatch in fishing gear.

Author: Tânia Nascimento
Owners/sources of tracking data: Thorarinsson & Kolbeinsson 2014a, Thorarinsson & Kolbeinsson 2015a, Thorarinsson & Kolbeinsson 2015b

Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold



Distribution

Breeding period

100 km



Distribution

Non-breeding period

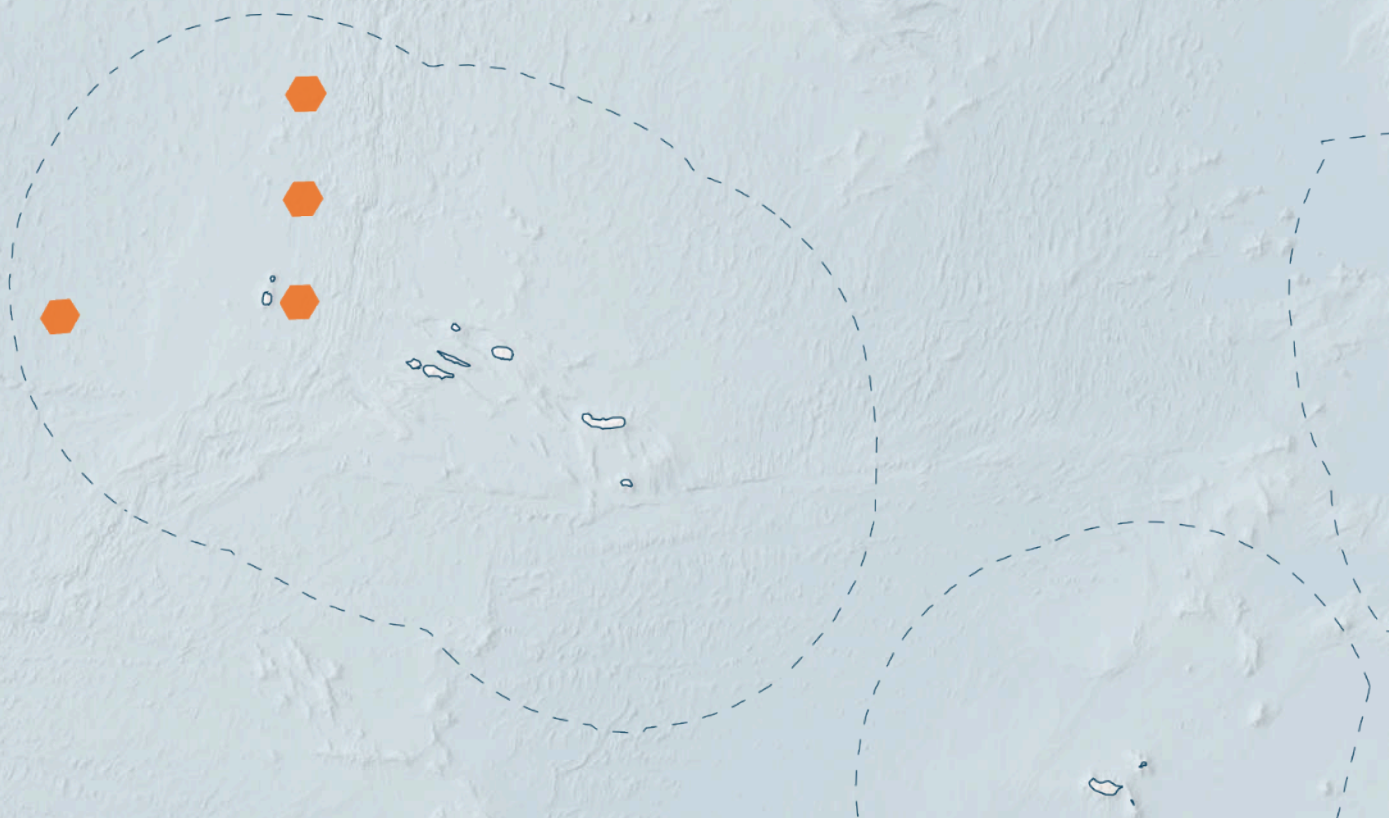


Colony(ies) of origin: Langanes, Grímsey, Látrabjarg (Iceland) | Device: GLS
Data period / number of individuals: October 2013 / 1 ind.



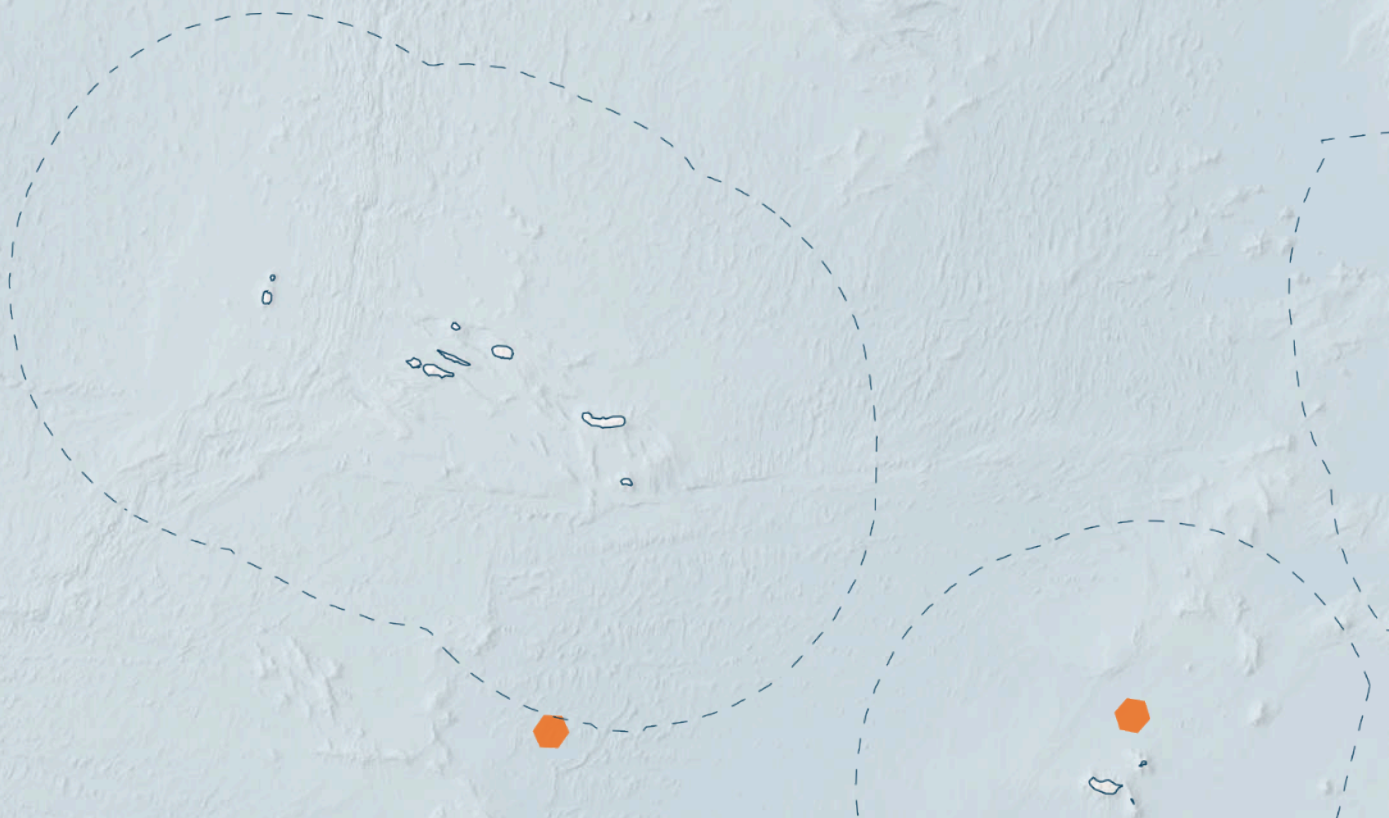
Distribution

Breeding period



Distribution

Non-breeding period



Thick-billed Murre

Uria lomvia

Phenology		Conservation status			
Mainland	Vagrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	NA	NA	NA	LC
Azores	Vagrant				



Distribution, movements and phenology

The Thick-billed Murre breeds in coastal areas and on islands scattered throughout the Arctic (Billerman *et al.* 2026), remaining in these areas throughout the breeding season, between May and August. After this period, birds from some populations migrate to more southerly regions, utilising, for example, the waters of the North Atlantic, and may reach more temperate zones (Frederiksen *et al.* 2016). Based on data from six birds fitted with GLS between 2008 and 2012 and originating from colonies in Canada, Greenland and Iceland, the use of the Portuguese EEZ during the non-breeding period was observed. Records occurred in areas furthest from the coast, with particular emphasis on the Azores sub-area.

Abundance and population trends

The global population has been estimated at over 22,000,000 individuals, of which 1,920,000 to 2,840,000 mature individuals breed in Europe. Although the lack of up-to-date estimates, the population is believed to be increasing (BirdLife International 2025). In Portugal, this species is very rare, and there are no estimates of its abundance or population trend. There are only two records in the Azores accepted by the Portuguese Rarities Committee (Tipper *et al.* 2022).

Ecology and habitat

The Thick-billed Murre is a strictly marine species that feeds on fish, squid and crustaceans. It feeds both near the seabed, at relatively shallow depths, and in the water column (Billerman *et al.* 2026).

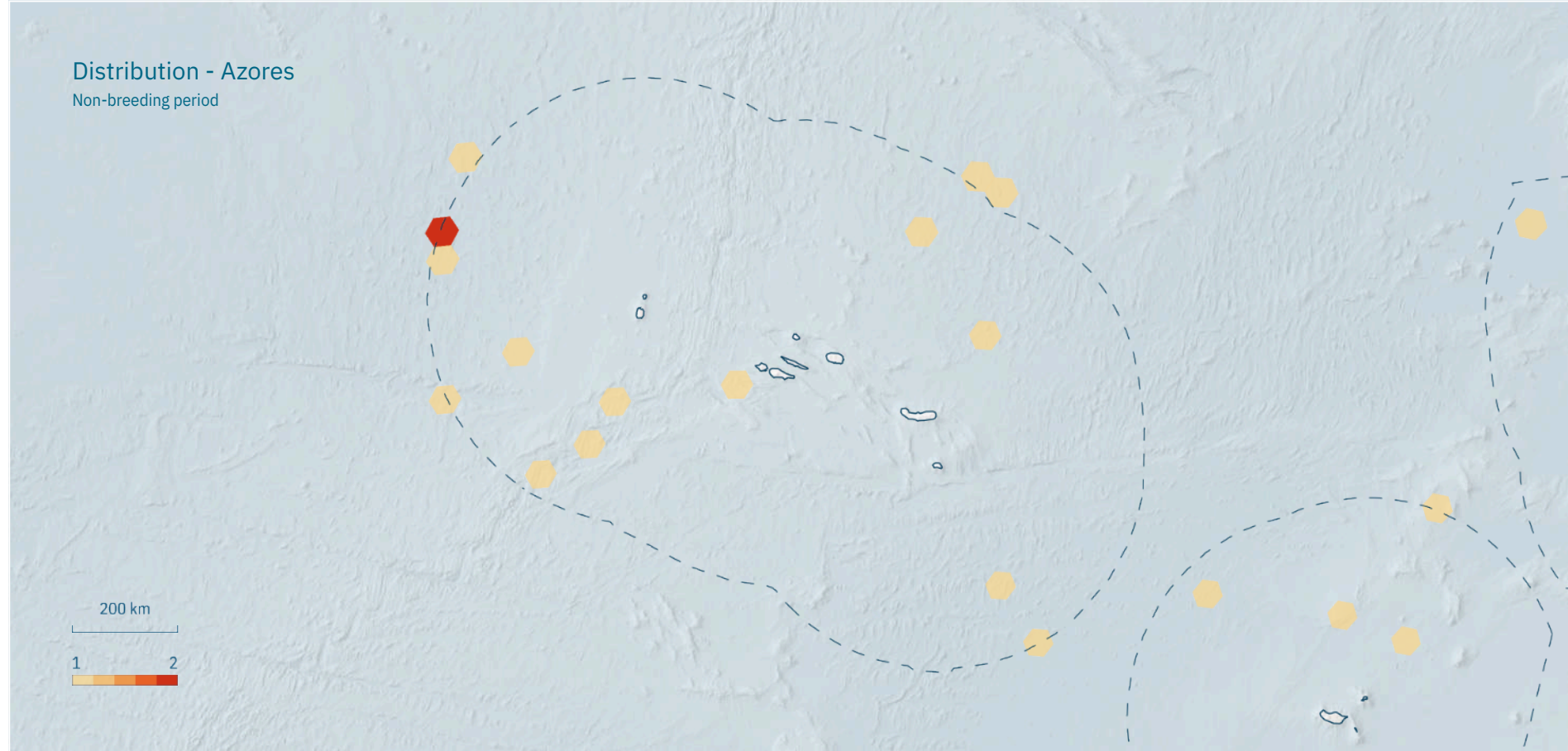
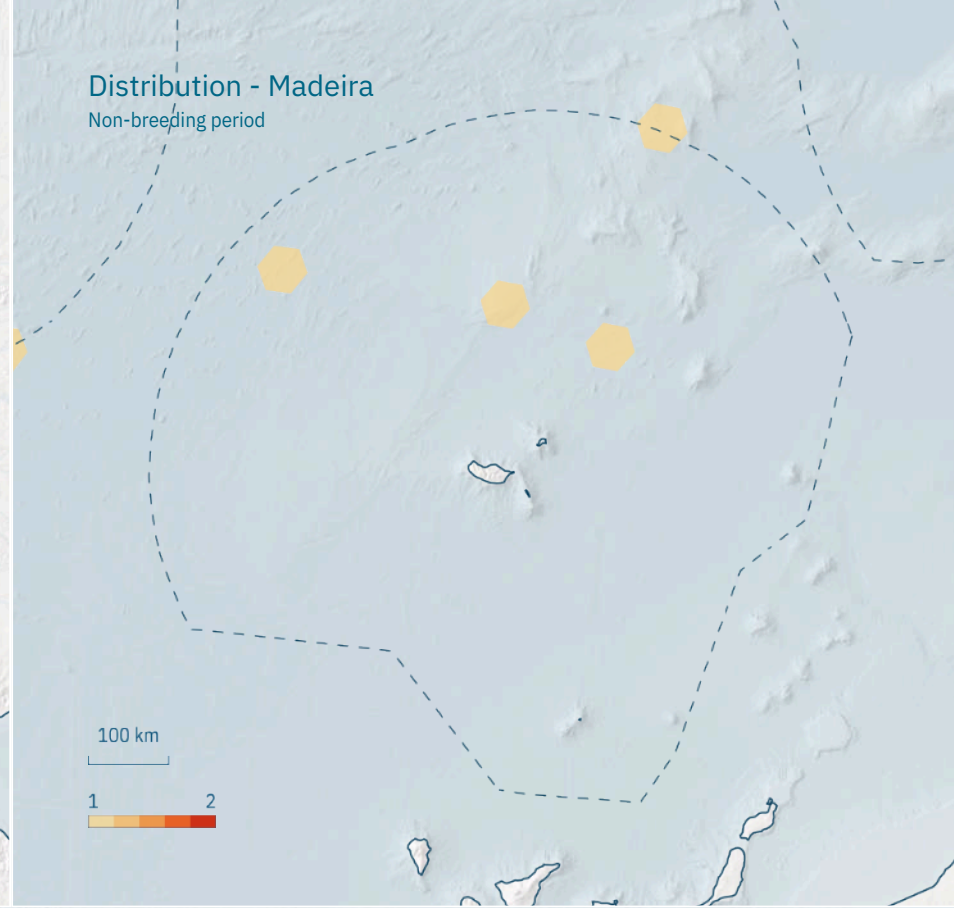
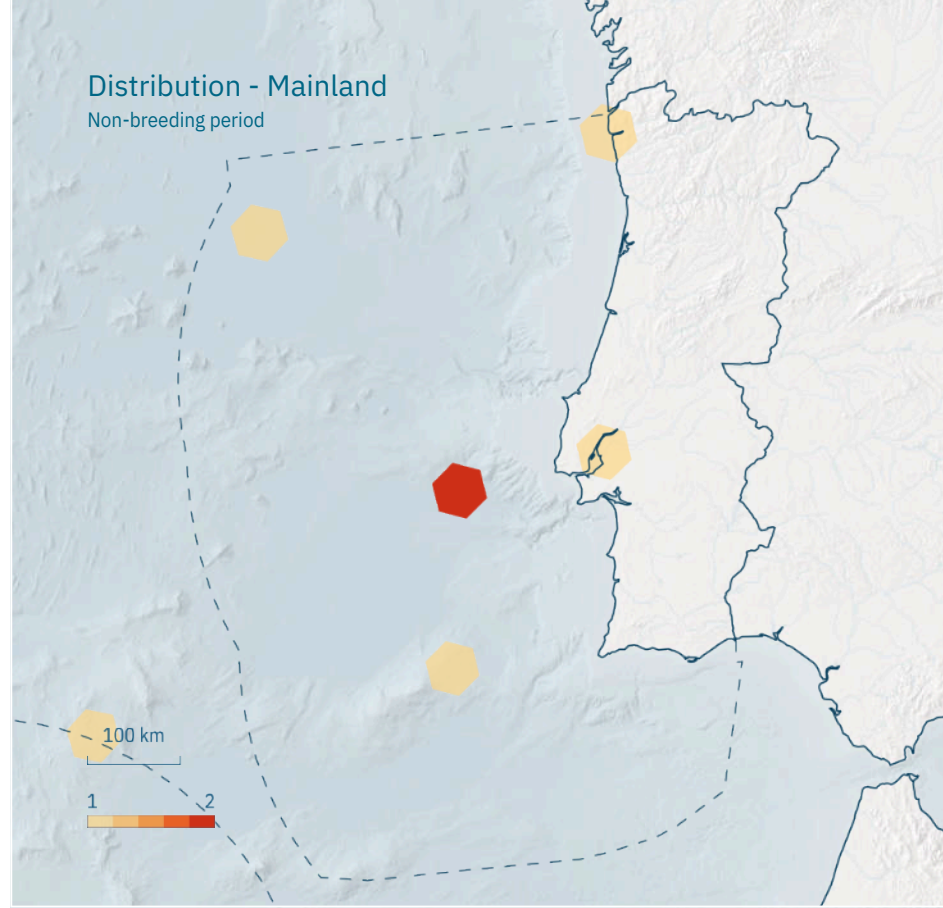
Threats and conservation

The species' large global population suggests that, for the time being, there are no significant conservation concerns. However, some threats have been identified, namely egg harvesting, hunting of adult birds, disturbance of breeding colonies, pollution by oil and other toxic chemicals, bycatch in fishing gear and the degradation of its habitats (Billerman *et al.* 2026). It is also vulnerable to climate change, such as rising sea temperatures, which alter the availability of prey (Irons *et al.* 2008).

Author: Nuno Oliveira

Owners/sources of tracking data: Frederiksen 2013, Linnebjerg & Frederiksen 2011, Merkel 2012, Thorarinsson & Kolbeinsson 2014d, Thorarinsson & Kolbeinsson 2014e, Tranquilla *et al.* 2008, Tranquilla *et al.* 2010, Tranquilla *et al.* 2011

Colony(ies) of origin: Gannet and Prince Leopold Islands, Minarets (Canada), Innaq, Kippaku (Greenland), Grimsey, Langanes (Iceland) | Device: GLS
Data period / number of individuals: Azores (December-February and April 2008-2011 / 4 ind.); Mainland (January-February 2012 / 1 ind.); Madeira
(December 2010 and January-March 2012 / 2 ind.)



Common Murre

Uria aalge

Phenology		Conservation status				
Mainland	Summer breeder and wintering	Mainland		Madeira	Azores	UICN Global
Madeira	Vagrant	CR	NT	NA	NA	LC
Azores	Vagrant	Breeding population	Wintering population			



Distribution, movements and phenology

The Common Murre has a circumpolar distribution, occurring in the North Atlantic and the North Pacific (Billerman *et al.* 2026).

In Mainland Portugal, the species once bred and was common in the Berlengas archipelago, but now occurs only as a wintering species, mostly originating from British and Irish colonies (Teixeira 1983; Silva & Canto e Castro 1992). Its presence is most regular between November and early spring, although the region marks the southern limit of its wintering range. It has a predominantly coastal distribution and may occasionally be observed near beaches, headlands and sheltered areas. In Mainland Portugal, it is more common in the central and northern regions, although it may occur along the entire coast (Meirinho *et al.* 2014). The species was not recorded in past marine censuses conducted in the Azores and Madeira. Available data on individual tracking of the species are very limited. The five birds fitted with GLS in 2013 and 2014, originating from colonies in Iceland, indicate use of the Portuguese EEZ between April and October, with some locations in the Azores sub-area and occasional records along the coast of Madeira and Mainland Portugal.

Abundance and population trends

The global population is on an upward trend and has been estimated at over 18,000,000 birds, with the European population ranging between 2,350,000 and 3,060,000 mature individuals (BirdLife International 2025).

The Portuguese colonies of this species corresponded to the southern limit of its breeding range, having previously had a wider distribution as a breeding bird. However, the population suffered a sharp decline, becoming progressively restricted to a single colony in the Berlengas archipelago, which in 1939 was estimated to comprise around 6,000 pairs (Lockley 1952). This population fell dramatically to 320 adults in 1977 and 70 pairs in 1981 (Teixeira 1983), with the last record of breeding occurring in 2002 (Lecoq 2003). There is no up-to-date information on the abundance or population trends of the wintering population in the Portuguese EEZ, and it has not been possible to assess its environmental status.

Ecology and habitat

The species' distribution is restricted to shallow areas of the continental shelf, and it is rarely observed from land in Portugal. During storms, however, individuals may be sighted taking refuge in harbours or within tidal inlets. It feeds mainly in shallow waters (between 50 and 100 m). It seeks out productive areas such as rocky or sandy bottoms, thermal fronts, schools of prey and areas with strong currents (BirdLife International 2025). In the Iberian Peninsula, its diet may include sardines, anchovies and sand eels (Martínez-Abraín *et al.* 2023).

Threats and conservation

The sharp decline of the Common Murre in the Iberian Peninsula occurred in the second half of the 20th century, as a result of the introduction of synthetic gillnets and high mortality from bycatch (Munilla *et al.* 2007), whilst a reduction in the stocks of its main prey cannot be ruled out (Martínez-Abraín *et al.* 2023). Overfishing may have direct impacts on European populations of the species by compromising food availability (BirdLife International 2025). The Common Murre is also particularly vulnerable to oil spills, which cause very high mortality rates (Munilla *et al.* 2011), as well as to climate change, due to its sensitivity to variations in sea surface temperature (BirdLife International 2025). The priority conservation measure includes minimising bycatch.

Author: Tânia Nascimento
Owners/sources of tracking data: Thorarinsson & Kolbeinsson 2014c

Distribution

Breeding period

100 km



Distribution

Non-breeding period

100 km



Distribution
Breeding period

50 km

0 2

North arrow
Madeira

Colony(ies) of origin: Láttrabjarg (Iceland) | Device: GLS
Data period / number of individuals: June 2014 / 1 ind.

Distribution

Breeding period



Distribution

Non-breeding period



Eurasian Oystercatcher

Haematopus ostralegus

Phenology		Conservation status				
Mainland	Wintering and passage migrant	Mainland		Madeira	Azores	UICN Global
Madeira	Vagrant	RE	VU	NA	NA	NT
Azores	Vagrant	Breeding population	Wintering population			



Distribution, movements and phenology

The Eurasian Oystercatcher breeds from April to September across almost the whole of Europe, particularly along the coast, and in vast areas of Asia (Billerman *et al.* 2026). The majority of the European population migrates relatively short distances; however, a few long-distance migrants reach West Africa (Delany *et al.* 2009). The birds that winter in Mainland Portugal come from Northern Europe (Scandinavia and Iceland) and the coasts of central and northern Europe (the United Kingdom, Germany and the Netherlands). Here, Eurasian Oystercatchers begin to increase in abundance from August, reaching peak numbers in winter. They also occur during the migratory periods, with some non-breeding birds remaining throughout the breeding season (Catry *et al.* 2010a). The species occurs predominantly along the coast, particularly in the Ria Formosa and the Sado estuary, but also in the Minho and Tagus estuaries, the Rias of Aveiro and Alvor, Óbidos Lagoon and the Aljezur coast, with occasional sightings along the remaining non-estuarine coastline (Meirinho *et al.* 2014; Equipa Atlas 2018). In the Azores and Madeira, however, the species occurs accidentally during the winter, particularly during migration.

Abundance and population trends

The global population has been estimated at between 925,000 and 1,030,000 individuals (Wetlands International 2025), with a declining trend (BirdLife International 2025). In Mainland Portugal, the Eurasian Oystercatcher bred during the first half of the 20th century, notably in the Sado estuary, where it became extinct due to probable persecution and egg looting (Catry *et al.* 2010a). The wintering population was estimated at 1,240 individuals (Equipa Atlas 2018), of which around 170 use the Mainland coastline (Lecoq *et al.* 2013). The Ria Formosa, followed by the Sado estuary, hosts three-quarters of the national population. This population is thought to have increased in the late 20th century (Catry *et al.* 2010a), consistent with the Good Environmental Status achieved for the abundance indicator. In the Azores and Madeira, the species occurs very rarely (Equipa Atlas 2018); however, the Azorean population appears to have achieved Good Environmental Status. In the case of Madeira, the available information did not allow for this assessment.

Ecology and habitat

During the wintering period in Portugal, it occurs mainly in coastal wetlands. A smaller proportion utilises the marine coastline, particularly in areas with extensive rocky intertidal zones (Lourenço *et al.* 2013). It feeds primarily on invertebrates in soft sediments, such as clams, razor clams and polychaetes (Cidraes-Vieira 1992). On the Portuguese coast, its diet is likely to be similar to that recorded in other areas, where it is dominated by molluscs, notably mussels, limpets and small whelks (Billerman *et al.* 2026).

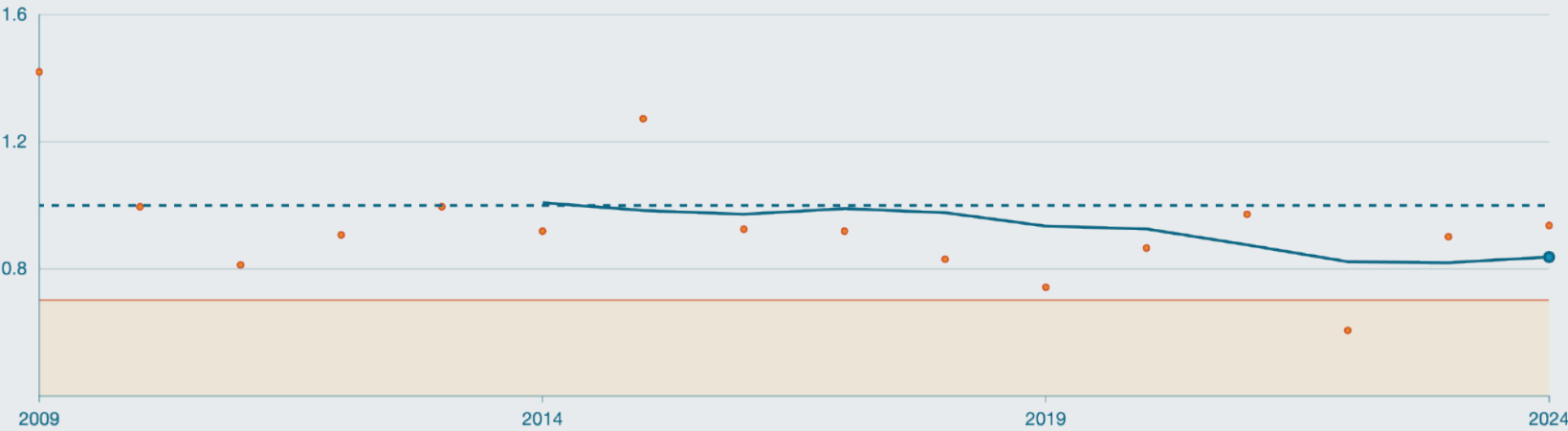
Threats and conservation

Globally, the greatest threat to this species appears to be linked to the over-exploitation of benthic molluscs and the disappearance of some of the key species in its diet (BirdLife International 2025). Habitat degradation, through pollution and changes in coastal dynamics and land use, is another threat to which they are subject at their wintering sites. Eurasian Oystercatchers actively avoid disturbed areas; however, there is no correlation between human presence and the occurrence of this species on the Portuguese coast (Lourenço *et al.* 2013). Nevertheless, it must be acknowledged that the increasing use of beaches during the winter for recreational activities may have some impact on this species.

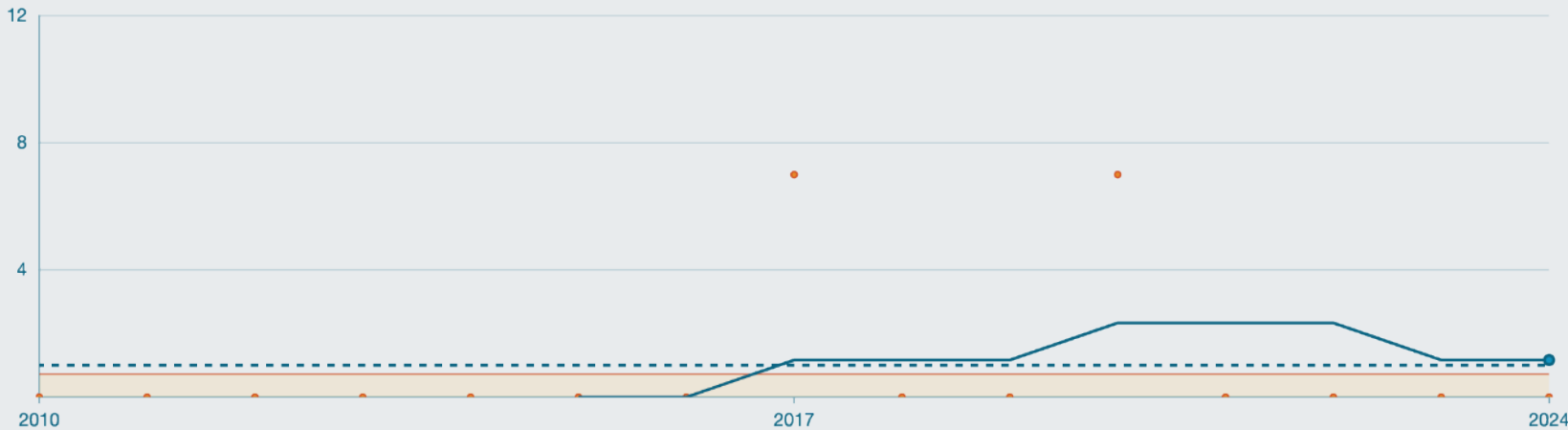
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

Mainland



Azores



Grey Plover

Pluvialis squatarola

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	NT	NA	NA	VU
Azores	Vagrant				



Distribution, movements and phenology

The Grey Plover breeds between May and August in the Arctic regions of Russia and North America (Billerman *et al.* 2026). In Portugal, birds from Siberian populations occur during their migrations, with a significant proportion remaining throughout the winter. Furthermore, some non-breeding individuals remain throughout the year (Lourenço *et al.* 2018). The Grey Plover occurs mainly in the Mainland's wetlands and coastal areas (Equipa Atlas 2018). It is most abundant in the southern half of the region, particularly in the Tagus and Sado estuaries, the Santo André Lagoon and the Ria Formosa. To a lesser extent, it occurs in some estuaries in the north-west and in the Ria de Aveiro. A small proportion also uses much of the non-estuarine coastline (Lecoq *et al.* 2013). In the Azores and Madeira, the species occurs as a vagrant, having been observed mainly along the coastlines of the various islands in these archipelagos.

Abundance and population trends

The global population has been estimated at between 1,000,000 and 2,500,000 breeding birds, with a declining trend (BirdLife International 2025). In Mainland Portugal, the wintering population has been estimated at around 6,500 individuals, of which 1–2% utilise the marine coastline (Lecoq *et al.* 2013). Compared with older records (Catry *et al.* 2010a), the population appears to be stable (Lourenço *et al.* 2018; Belo *et al.* 2023), despite a notable decline in the small proportion using the non-estuarine coast (Lecoq *et al.* 2013). Despite all these uncertainties, this population appears to have achieved Good Environmental Status for the abundance indicator. In the Azores and Madeira, however, the population size is very low, both in winter and during migration (Equipa Atlas 2018). Furthermore, these populations show a negative trend and have not achieved Good Environmental Status.

Ecology and habitat

The Grey Plover is found mainly in estuaries and other coastal wetlands (Equipa Atlas 2018). Although it prefers areas with fine, loose sediments, along the coast it also inhabits rocky areas with a wide intertidal zone (Lourenço *et al.* 2013). In the Azores and Madeira, it has a preference for coastal areas, although it is also observed in more inland parts of the islands. During the wintering period, the diet consists of invertebrates, mainly polychaetes, bivalves and crustaceans, both globally (Billerman *et al.* 2026) and nationally (Moreira 1996; Lopes *et al.* 1998; Lourenço 2019).

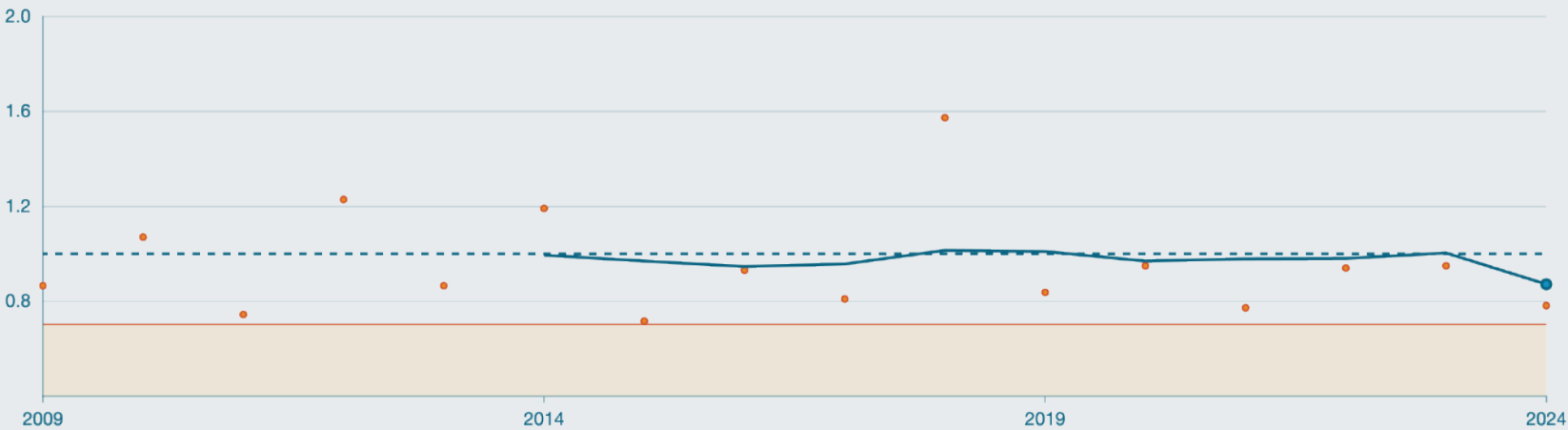
Threats and conservation

Globally, habitat degradation and conversion appear to be the main threats at feeding and resting sites during migration and wintering. Additionally, climate change may compromise breeding success and lead to a significant reduction in nesting habitat. Key sources of pressure include urban development, the expansion of the aquaculture industry, the establishment of hydrocarbon refineries, and disturbance associated with the fishing industry (BirdLife International 2025). In Portugal, disturbance at feeding and resting sites may constitute a threat to the wintering population.

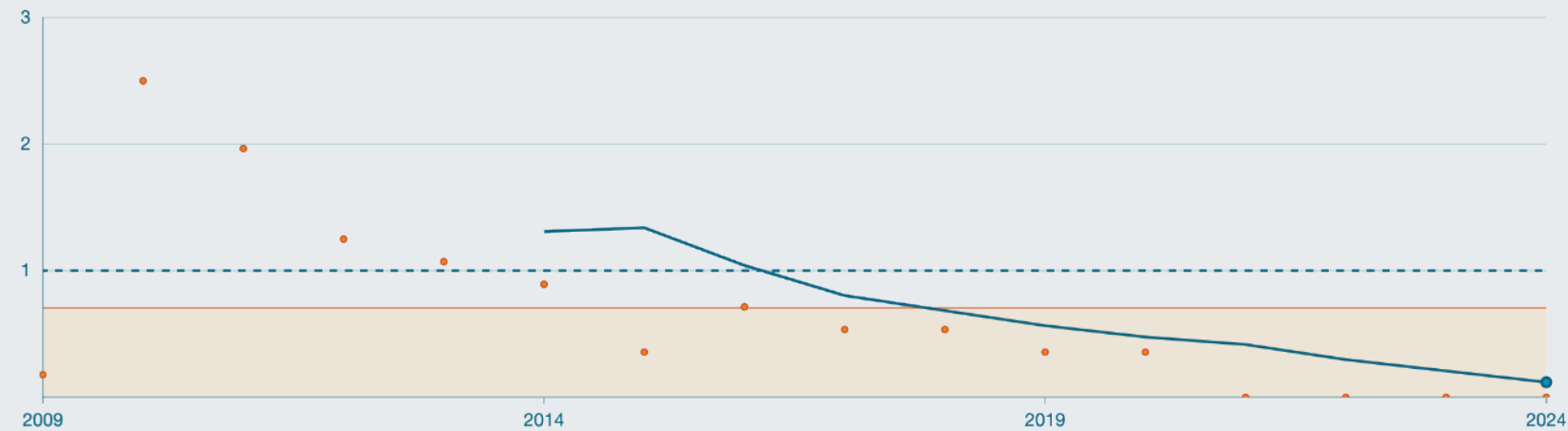
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

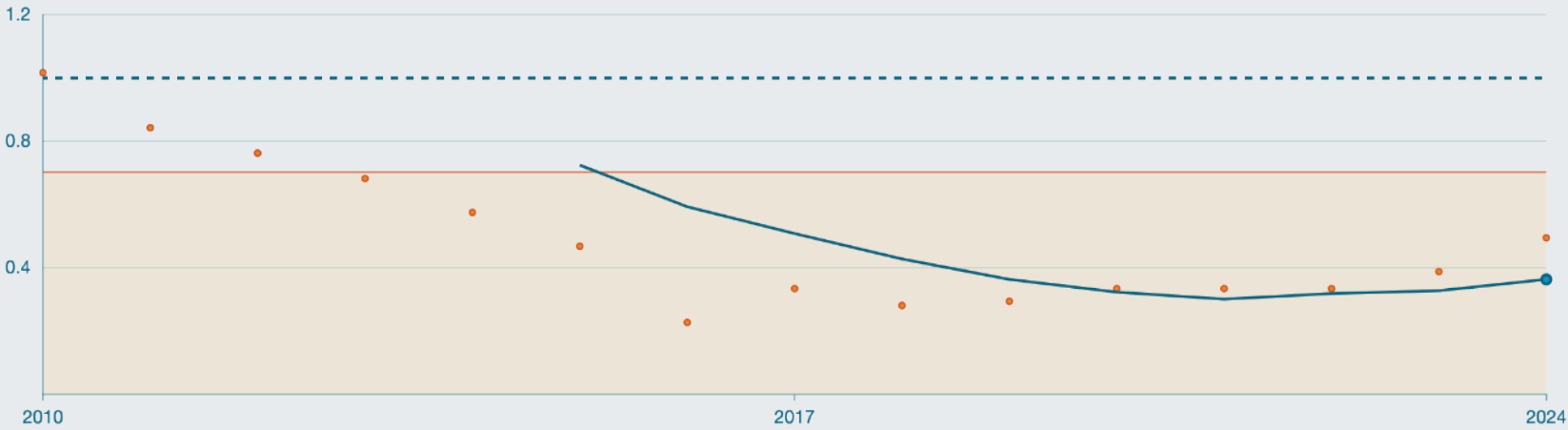
Mainland



Madeira



Azores



Common Ringed Plover

Charadrius hiaticula

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Wintering and passage migrant	LC	NE	NE	LC
Azores	Wintering and passage migrant				



Distribution, movements and phenology

The Common Ringed Plover breeds predominantly from the Arctic (from North-eastern Canada eastwards to Eastern Siberia) to the temperate regions of Western Europe, between late March and August (Delany *et al.* 2009). In Portugal, birds are found originating from most breeding areas, notably Canada (Léandri-Breton *et al.* 2019), Iceland (Thorisson *et al.* 2012), Norway (Lislevand *et al.* 2017) and Western Europe (Taylor 1980). During the migratory passages, birds that winter mainly in Africa predominate, although a proportion of individuals remain in Portugal throughout the winter, notably those that breed in Western Europe (Catry *et al.* 2010a) and Iceland (Fletcher 2022). Passages are pronounced during summer and early autumn, being less evident in spring (Catry *et al.* 2010a). In Mainland Portugal, the Common Ringed Plover is most common in estuarine areas and coastal lagoons, but also occurs along the entire coastline. In the Azores and Madeira, it occurs mainly along the coastlines of all the islands, associated with beaches, natural pools and artificial structures such as harbours and marinas, and may also be observed in inland grasslands.

Abundance and population trends

The global population has been estimated at between 480,000 and 600,000 individuals, with a stable trend (Wetlands International 2025). In January, the population present in Mainland Portugal is around 3,500 individuals, of which about 300 are found on the sandy and rocky beaches of the coast (Lecoq *et al.* 2013). Population trends in this region are not very clear and may be related to local effects. Whilst, for example, the Sado estuary shows a decline in the number of individuals occurring there (Belo *et al.* 2023), the opposite has been observed in the Tagus estuary (Lourenço *et al.* 2018) and along the non-estuarine coast (Lecoq *et al.* 2013). Despite these discrepancies, the Mainland population has generally achieved Good Environmental Status. In the Azores, although information on abundance and population trends is scarce, this population also appears to have achieved Good Environmental Status, unlike the situation observed in Madeira.

Ecology and habitat

Common Ringed Plovers are found mainly in the large coastal wetlands of Mainland Portugal. They prefer areas with sandy sediments, although they also use mudflats (Moreira 1993; Granadeiro *et al.* 2004). On the non-estuarine Mainland coast (Lourenço *et al.* 2013) and on the islands, they are mainly associated with rocky substrates. The diet consists of small invertebrates (Billerman *et al.* 2026), with polychaetes and insects associated with marine or coastal habitats being of particular importance to the birds found in Portugal (Pedro & Ramos 2009; Rocha *et al.* 2017).

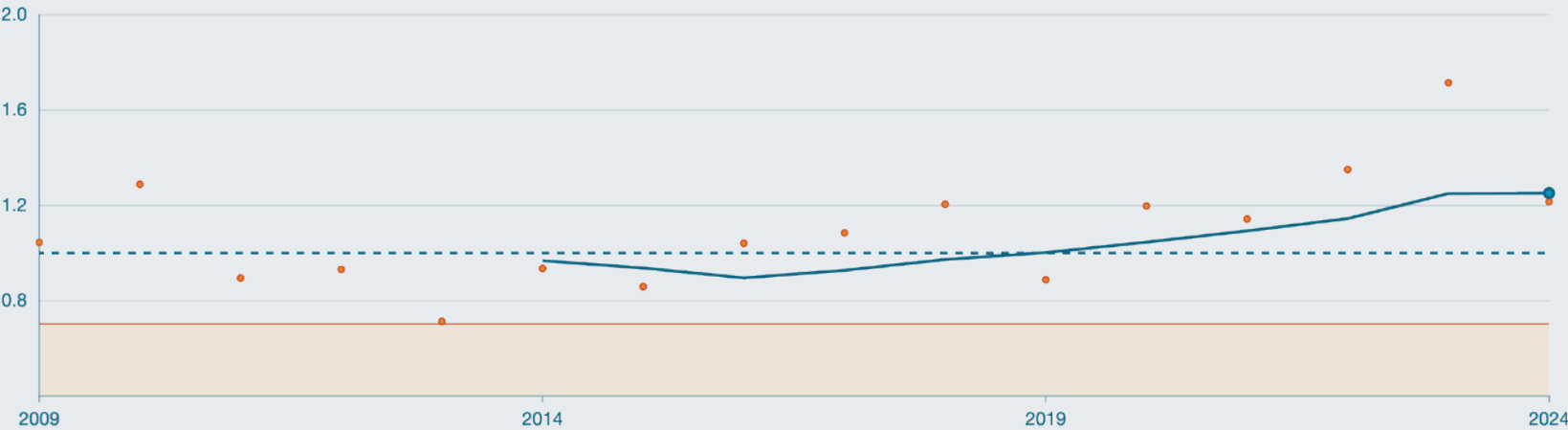
Threats and conservation

Globally, pollution and land-use change are the main threats to feeding and roosting sites during migration and wintering (BirdLife International 2025). In Portugal, no specific threats are known, although disturbance at feeding and roosting sites may potentially have some negative impact on the wintering population.

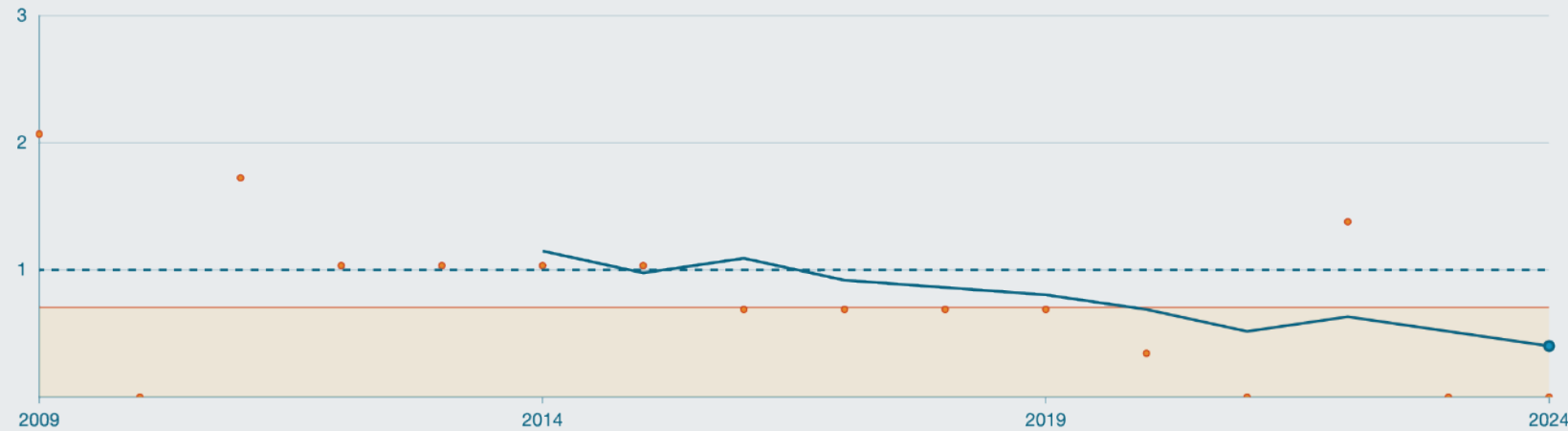
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

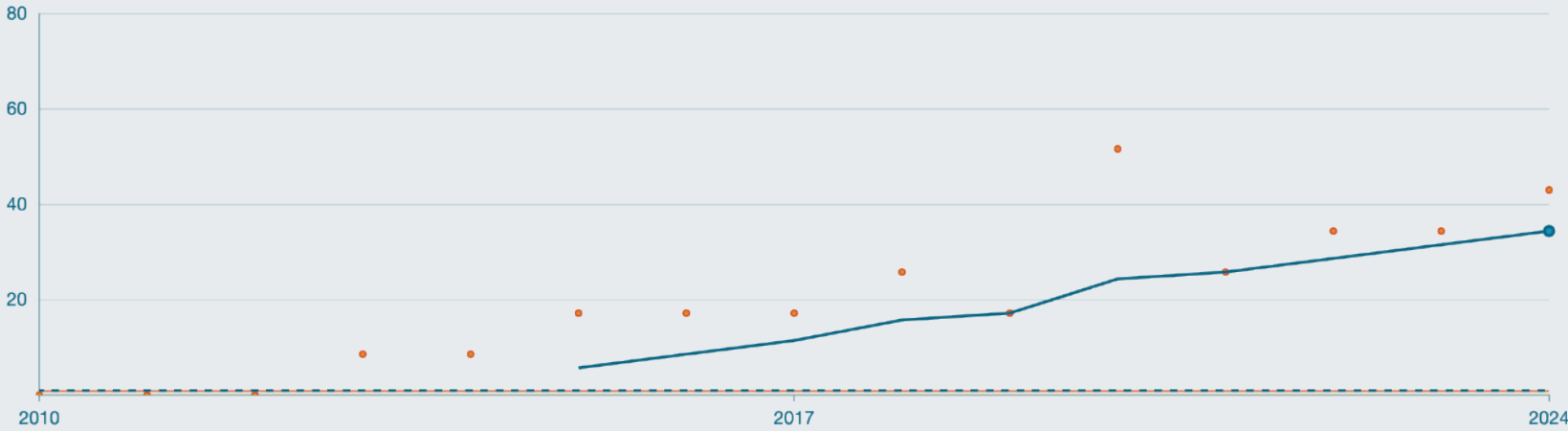
Mainland



Madeira



Azores



Kentish Plover

Charadrius alexandrinus

Phenology

Mainland	Resident, summering, wintering and passage migrant
Madeira	Resident, wintering and passage migrant
Azores	Resident, wintering and passage migrant

Conservation status

Mainland	Madeira	Azores	UICN Global
VU	EN	CR	DD
Breeding population	Wintering population		



Distribution, movements and phenology

The Kentish Plover has a cosmopolitan distribution, breeding on every continent except Oceania. In the Palearctic, it occupies mid- and low-latitudes (Delany *et al.* 2009), including Mainland Portugal and some islands in the Azores and Madeira archipelagos (Equipa Atlas 2022). It occurs along almost the entire coastline, being most common on wide beaches, sandy islands, estuaries, salt pans, lagoons and rice paddies, and less frequent inland. On the island of Santa Maria (Azores), it occupies diverse habitats, including sparse grasslands and the airport runways (Rocha 2022). Despite the largely sedentary nature of the breeding population, a small proportion is migratory, undertaking movements on an Iberian scale (Cimiotti *et al.* 2024) or over longer distances, wintering from Mauritania to Senegal. During the non-breeding season, Portugal serves as a stopover site (late summer and early autumn) for migrants from higher latitudes, also hosting wintering populations from the European coastline, ranging from northern Germany to Galicia.

Abundance and population trends

The global population has been estimated at between 324,000 and 468,000 individuals (Wetlands International 2025), with a declining trend (BirdLife International 2025).

The breeding population in Portugal, estimated at 1,028 to 1,135 pairs in 2021, has suffered a sharp decline of 46% over 19 years. The species is most abundant on the central coast and in the Algarve (Ria de Aveiro, Ria Formosa and Castro Marim), with significant breeding populations remaining in Esposende, the Tagus estuary and on the island of Santa Maria (Rocha 2022). The wintering population, once numbering between 3,000 and 4,000 individuals (Catry *et al.* 2010a), is currently estimated at fewer than 2,500 individuals (Lopes *et al.* 2022), concentrated mainly in the Tagus estuary, the Ria Formosa and Castro Marim. On the non-estuarine marine coast, which hosts 17% of the total (Lecoq *et al.* 2013), a moderate decline has been recorded on the Mainland and islands (Fagundes & Catry 2022), a trend also observed in estuarine areas (Lopes *et al.* 2022). These negative trends are consistent with the results of the environmental assessment, showing that none of the three regions has achieved Good Environmental Status for the abundance indicator.

Ecology and habitat

The species occurs in salt pans, estuaries and beaches with dune systems, avoiding areas with greater human disturbance (Lourenço *et al.* 2013; Rocha 2022). Estuaries are important feeding grounds, supporting birds that nest on beaches. The diet varies with the habitat: in salt pans, dipteran larvae (Chironomidae and Ephydriidae) predominate (Pedro & Ramos 2009); on beaches, crustaceans and insects caught at the water's edge or amongst debris; in estuaries, the gastropod *Hydrobia ulvae*, annelids and small fish (Trigo 2007).

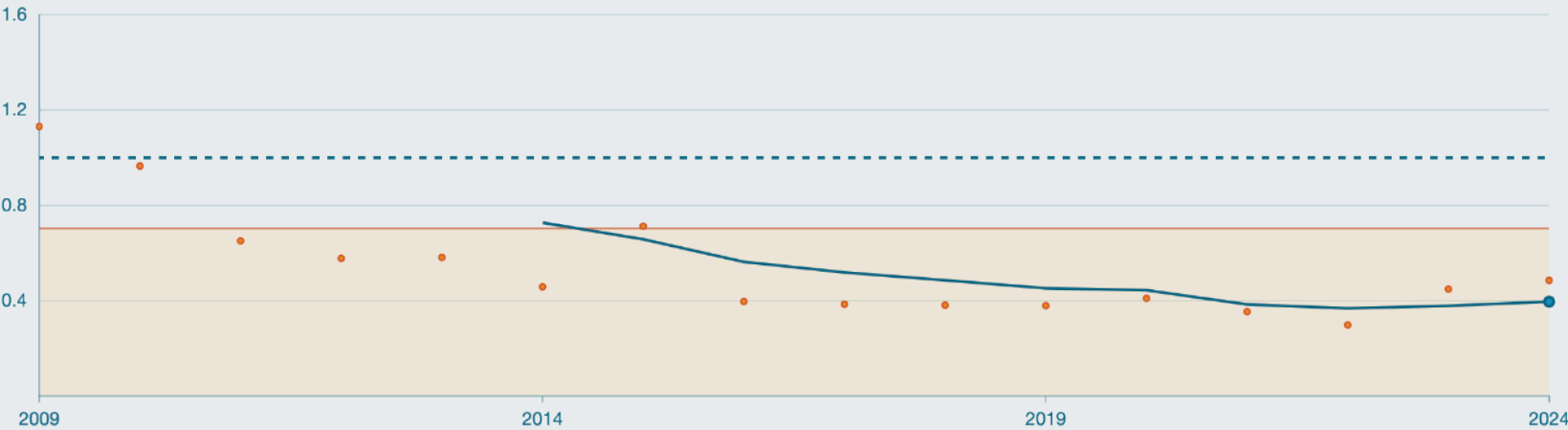
Threats and conservation

European populations have benefited from conservation projects (release of captive-bred birds, habitat management and nest protection) that are driving the species' recovery. However, in Portugal, the species remains vulnerable to human pressure. The 2021 census identified disturbance by beachgoers and fishers as the main threat on Mainland beaches, followed by habitat degradation (mechanical cleaning, coastal erosion and the abandonment of salt pans). Low productivity also results from flooding and predation of clutches by dogs and foxes on beaches, by corvids and foxes in salt pans, and from trampling by livestock on the island of Santa Maria (Norte & Ramos 2004; Rocha *et al.* 2016; Rocha 2022).

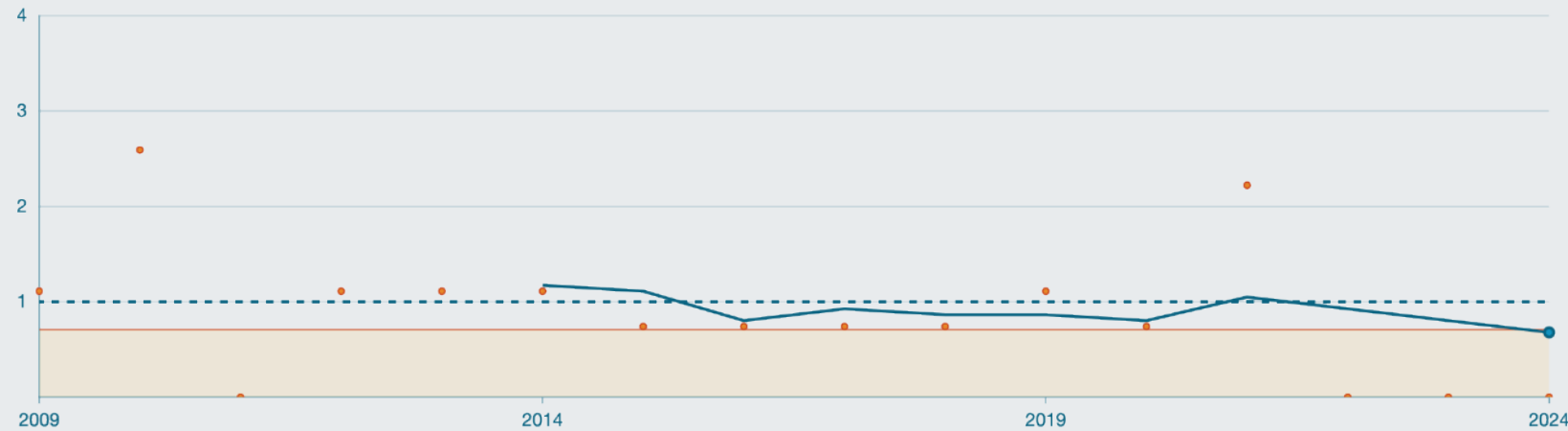
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

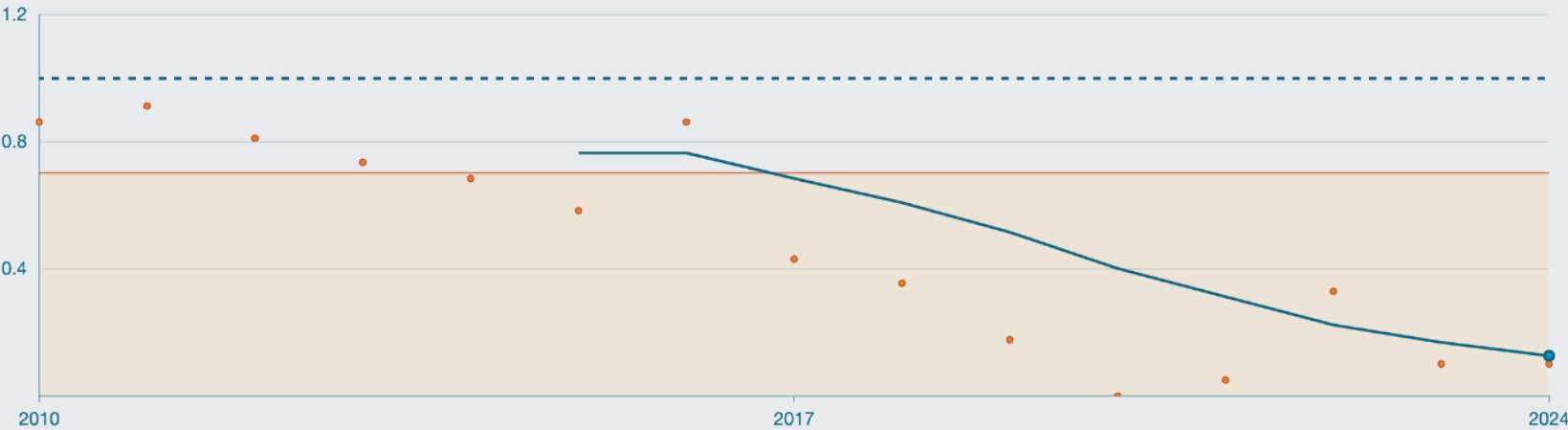
Mainland



Madeira



Azores



Whimbrel

Numenius phaeopus

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Wintering and passage migrant	NT	NE	NE	LC
Azores	Wintering and passage migrant				



Distribution, movements and phenology

The Whimbrel breeds discontinuously between May and August in Alaska, northern Canada, southern Iceland, northern Scotland, Greenland, and eastern Scandinavia to north-eastern Russia, including some isolated populations in northern Kazakhstan (Billerman *et al.* 2026). Most of the birds found in Portugal originate from European populations, with most wintering in West Africa (Catry *et al.* 2010a). It is most frequently observed during migratory passages, although it can be seen throughout the year. The Whimbrel occurs mainly in the coastal areas of Mainland Portugal and large wetlands (the Tagus and Sado estuaries, Ria Formosa and Ria de Aveiro), with a wider distribution in the southern half of the country (Equipa Atlas 2018). In the Azores and Madeira, the species occurs on practically all the islands, both during winter and during migration.

Abundance and population trends

The global population has been estimated at between 1,800,000 and 2,650,000 individuals (Wetlands International 2025), with a declining trend (BirdLife International 2025). In Mainland Portugal, the wintering population on the non-estuarine coast has been estimated at 88 to 92 individuals, comprising more than a third of the total population wintering in the region (Lecoq *et al.* 2013). Despite the limited information on the trend of this population, the number using the coastal strip appears to have increased in recent years, reflecting the Good Environmental Status achieved for the abundance indicator. In the Azores and Madeira, however, the population size is considerably smaller, both in winter and during migration (Equipa Atlas 2018). These populations show a negative trend and have not achieved Good Environmental Status.

Ecology and habitat

The Whimbrel occurs mainly in large coastal wetlands and on rocky shores along the Mainland coast of Portugal (Equipa Atlas 2018). In the Azores and Madeira, it prefers rocky coastal areas, whilst also utilising beaches, grasslands and artificial areas such as harbours and marinas. It feeds on invertebrates, particularly small crabs (Billerman *et al.* 2026), and may also feed on bivalves (Lourenço 2019).

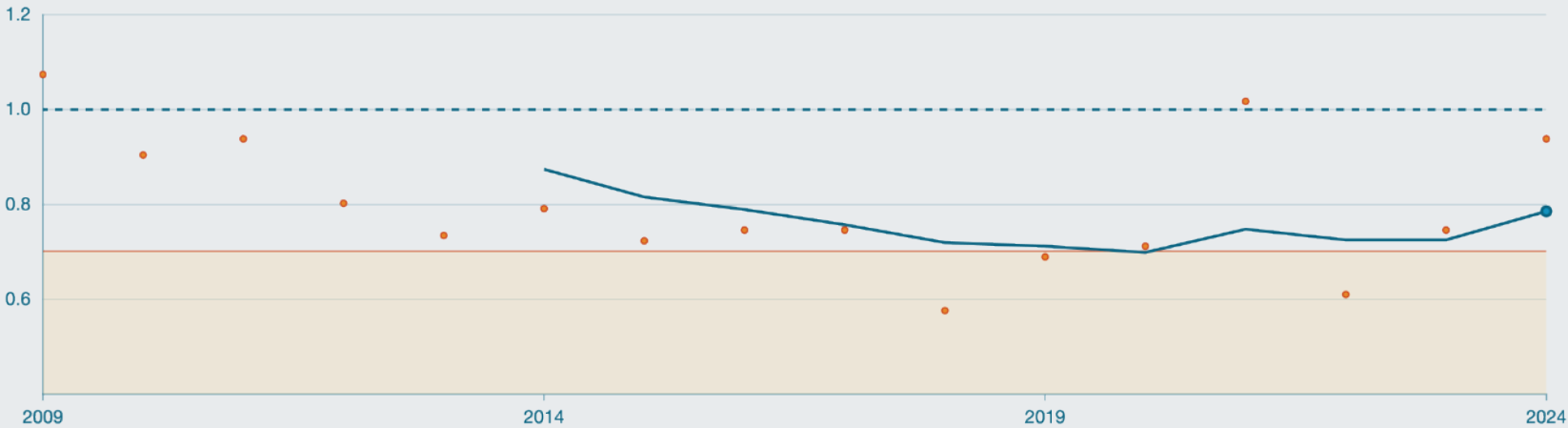
Threats and conservation

Globally, the only identified threats to the species are climate change and extreme weather events; in Portugal, no significant threats have been identified.

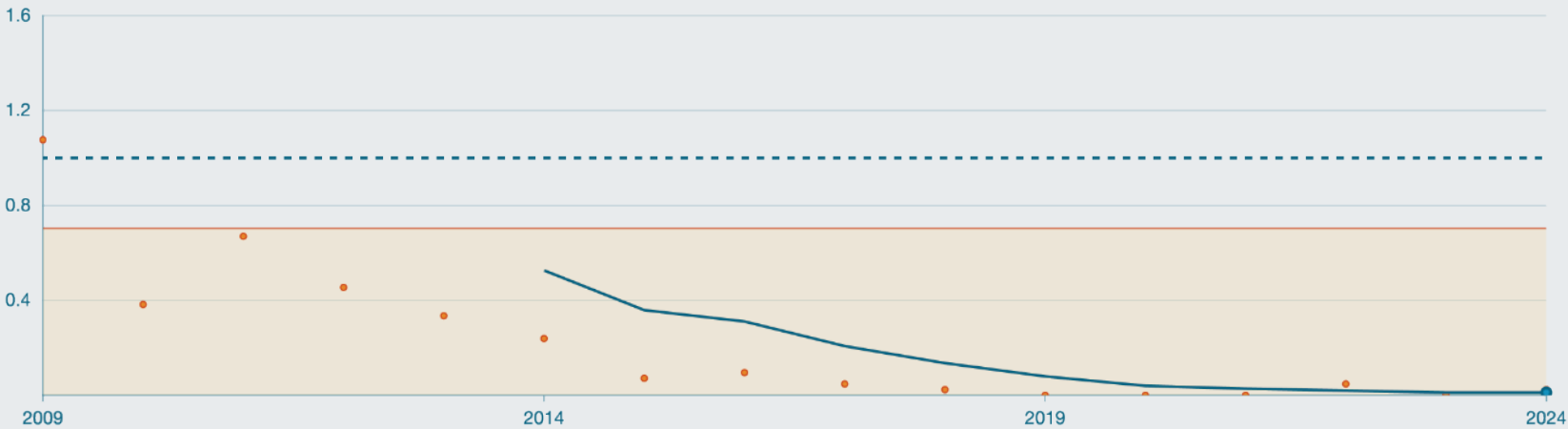
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

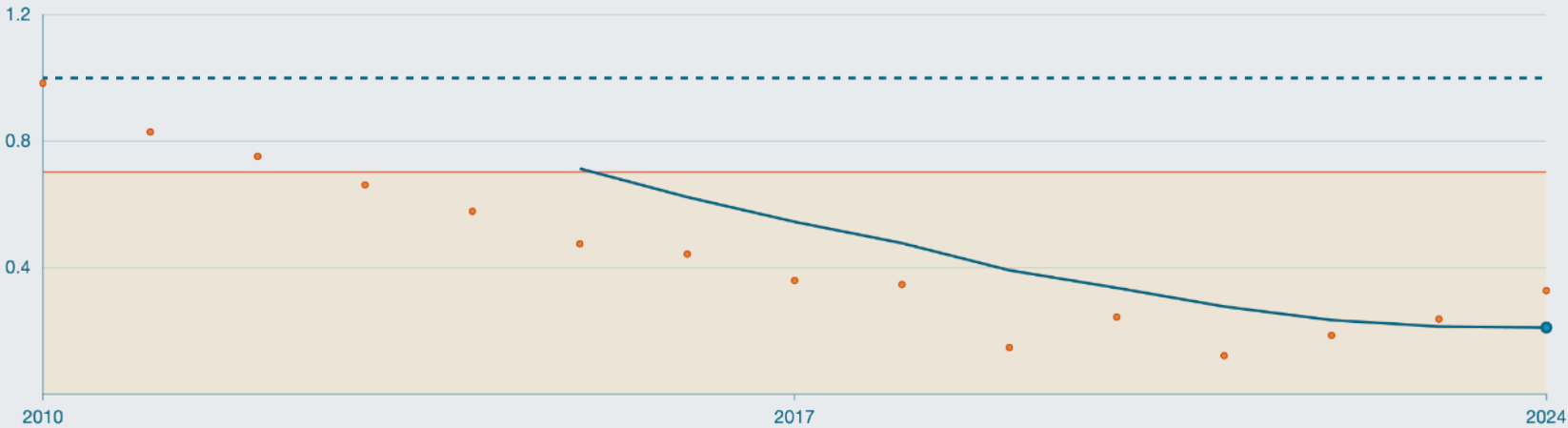
Mainland



Madeira



Azores



Ruddy Turnstone

Arenaria interpres

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Wintering and passage migrant	VU	NE	DD	NT
Azores	Wintering and passage migrant				



Distribution, movements and phenology

The Ruddy Turnstone breeds between May and August in the Arctic and sub-Arctic regions. Its wintering grounds along the eastern Atlantic stretch from Northern Europe to South Africa (Delany *et al.* 2009). In Portugal, migratory and wintering birds are found, originating from Northern Europe, Siberia, Greenland and the Canadian Arctic. Although they can be observed throughout the year, they become more abundant in August due to the passage of birds heading towards Africa, with part of the population remaining in Portugal throughout the winter. In April and May, numbers rise again due to migrants that have wintered further south (Catry *et al.* 2010a). The birds that remain throughout the year are immature or non-breeding individuals. The Ruddy Turnstone can be found along the entire coastline of Mainland Portugal, including estuaries, lagoon areas and beaches. On the latter, the species is absent only from stretches of extensive sandy beaches devoid of rocky intertidal zones, such as the long sandy shores of the districts of Coimbra and Leiria. It very rarely strays from the coastline. The archipelagos of the Azores and Madeira, including the Selvagens Islands, are also part of its migratory routes and wintering grounds, and it can be found on all the islands and many of the islets (Equipa Atlas 2018).

Abundance and population trends

The global population has been estimated at between two and three million mature individuals, with a declining trend (BirdLife International 2025). The wintering population in Europe may have contributed to the decline in recent decades (Delany *et al.* 2009), but the causes are unknown. In Portugal, the wintering population in coastal estuaries and lagoons has been around a thousand individuals (Catry *et al.* 2010a) and approximately 2,300 individuals on the Mainland coast (Lecoq *et al.* 2013). In the archipelagos of the Azores and Madeira, it winters in considerable numbers (Equipa Atlas 2018), although no robust estimates are available. The Mainland and Azores populations have not achieved Good Environmental Status for the abundance indicator, unlike the Madeira population.

Ecology and habitat

The Ruddy Turnstone is closely associated with rocky coastal habitats, as well as similar artificial structures. It prefers areas with a wide intertidal zone where disturbance from people, dogs and birds of prey is minimal (Lourenço *et al.* 2013). In estuarine and lagoon areas, it is also associated with coarse sediments and rocky areas. Occasionally, the species is observed in rice paddies, which are also coastal. It feeds mainly on small invertebrates (Billerman *et al.* 2026). Information on its diet in Portugal is very scarce, although there is evidence that it feeds on gastropods (Lourenço 2019).

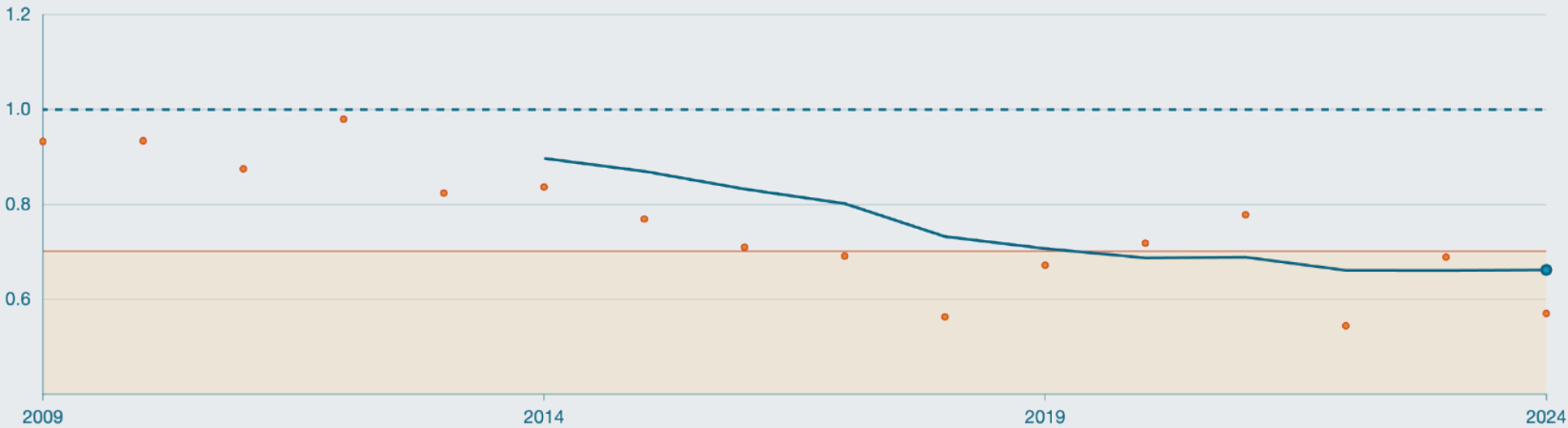
Threats and conservation

Several threats to the species have been identified globally; however, the extent of their effects is unknown (BirdLife International 2025). Habitat degradation and conversion appear to be two of the main threats in the areas used during migration and wintering. In Portugal, the main threats are associated with disturbance at feeding and resting sites.

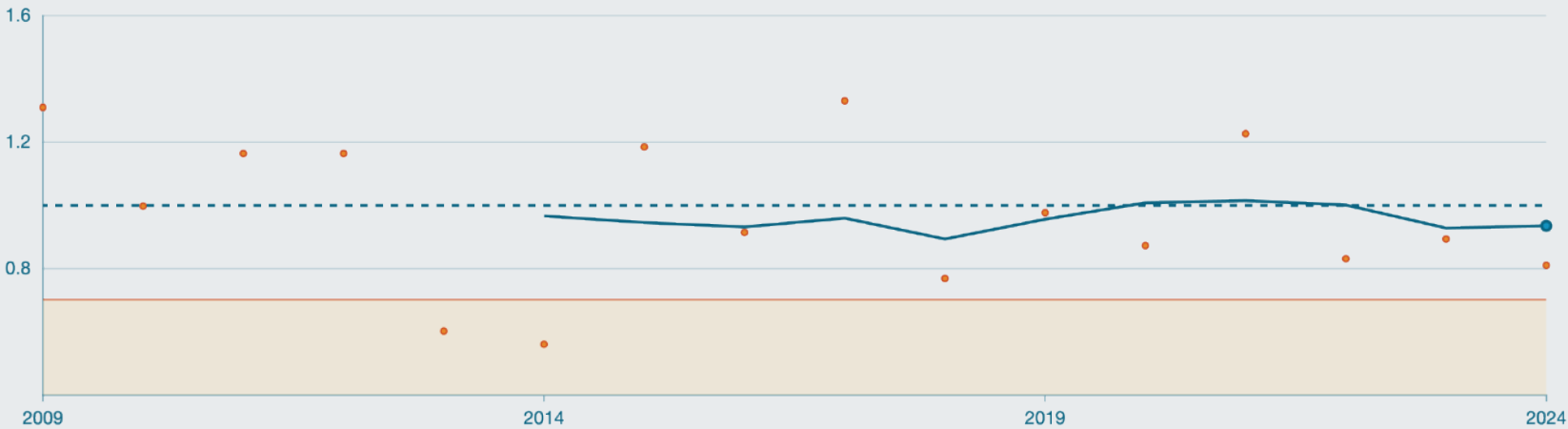
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

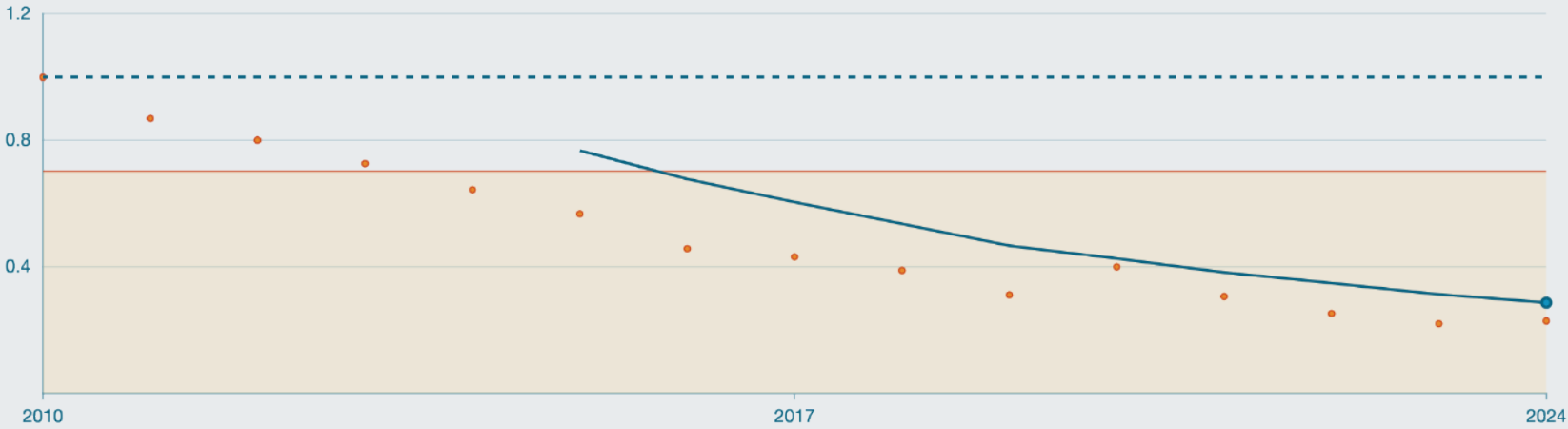
Mainland



Madeira



Azores



Red Knot

Calidris canutus

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	IUCN Global
Madeira	Vagrant	EN	NA	NA	NT
Azores	Vagrant				



Distribution, movements and phenology

The Red Knot breeds in the high Arctic between June and early August, wintering along the coastlines of all continents in both hemispheres (Billerman *et al.* 2026). Birds occurring in Portugal during migration mainly breed in the Siberian Arctic and winter primarily along the coasts of Africa (Delany *et al.* 2009). Birds from Greenland and Canada are also found in Portugal (Catry *et al.* 2010a). The main wintering areas are located almost exclusively in estuaries and coastal lagoons (Equipa Atlas 2018). On the rocky coast, the species is rare and has a localised distribution, appearing either singly or in small flocks. In the Azores and Madeira, the species occurs as a vagrant, and is observed mainly along the coastlines of the islands in these archipelagos.

Abundance and population trends

The global population has been estimated at between 750,000 and 1,750,000 mature individuals, with a declining trend (BirdLife International 2025). In Portugal, the abundance of the Red Knot is variable, ranging from tens to a few hundred individuals in winter (Catry *et al.* 2010a). The wintering population along the marine coast was estimated at only 17 to 18 individuals (Lecoq *et al.* 2013). The populations on the Mainland and in the Azores did not achieve Good Environmental Status for the abundance indicator. It was not possible to carry out this assessment for Madeira.

Ecology and habitat

In Portugal, Red Knots prefer wetlands, both coastal and inland, over the marine coastline. They are specialised predators of molluscs, including bivalves, which they capture mainly in soft sediments (Moreira 1994; Lourenço 2019). Nothing is known about the diet of the few birds that winter on our beaches.

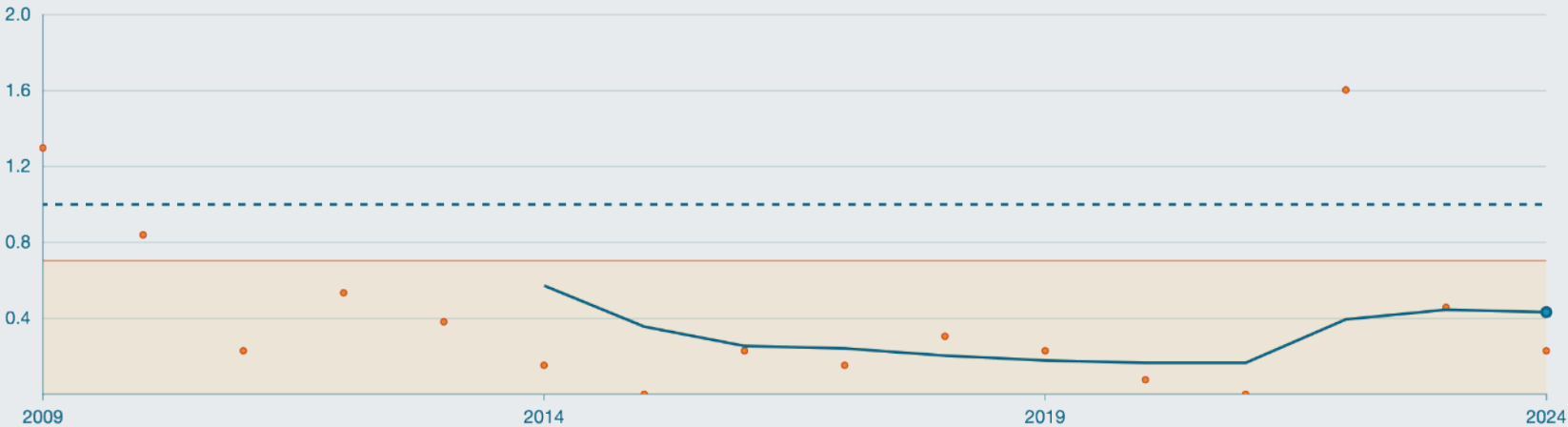
Threats and conservation

The Red Knot is classified globally as Near Threatened, due to rapid declines observed in several populations. Among the main threats are habitat loss or degradation due to human activity, climate change affecting productivity, over-exploitation of bivalves and human disturbance (BirdLife International 2025). In Portugal, it may be particularly affected by the abandonment or degradation of salt pans, the conversion of salt pans into marine aquaculture facilities, and the destruction or degradation of intertidal zones.

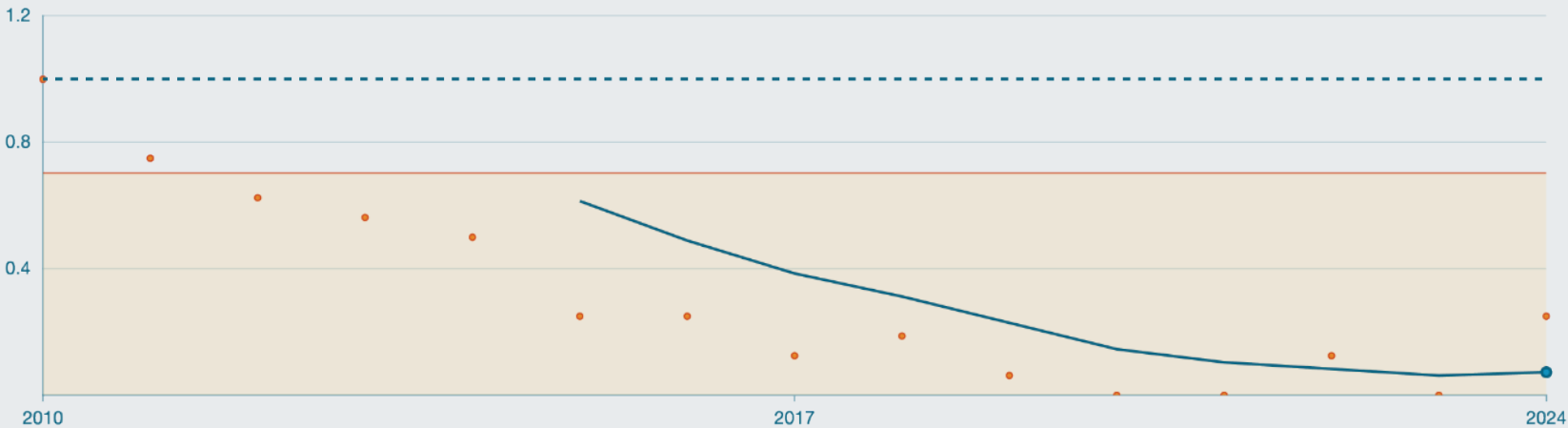
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

Mainland



Azores



Sanderling

Calidris alba

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Wintering and passage migrant	LC	NE	NE	LC
Azores	Wintering and passage migrant				



Distribution, movements and phenology

The Sanderling is a long-distance migrant that breeds in the Arctic tundra and winters in coastal areas around the world, with the exception of the Antarctic continent (Billerman *et al.* 2026). In Portugal, it occurs mainly along the Mainland coast, being less abundant in the Azores and Madeira (Equipa Atlas 2018; Fagundes & Catry 2022). It can be found along the entire Mainland coast, from Caminha to Vila Real de Santo António, being clearly more abundant in the northern region and in the vicinity of the major wetlands in the centre and south, such as the Tagus estuary and the Ria Formosa (Meirinho *et al.* 2014). It occurs in greater numbers along our coast during its post-breeding migrations, in the summer and early autumn months, and is also relatively abundant during the winter and mid-spring months. The population occurring in Portugal appears to originate mainly from Greenland and the Canadian Arctic (Reneerkens *et al.* 2009).

Abundance and population trends

The global population of the Sanderling has been estimated at between 900,000 and 1,200,000 mature individuals (BirdLife International 2025). It is the most abundant wader on the beaches of Mainland Portugal, with an estimated 3,000 individuals recorded in the winter of 2021-2022 (Fagundes & Catry 2022). It also occurs in estuarine areas, but in smaller numbers, with around 650 to 700 individuals counted in the winters of 2024 and 2025 (IWC 2026). Annual censuses under the Project Arenaria, carried out since 2009 (Lourenço *et al.* 2013), indicate a stable trend in the wintering population of the Sanderling on Mainland Portugal (Fagundes & Catry 2022), with the population having achieved Good Environmental Status for the abundance indicator. This trend contrasts with the global decline of the species (BirdLife International 2025). Although not very abundant on the islands (Equipa Atlas 2018; Fagundes & Catry 2022), the population in Madeira has also achieved Good Environmental Status for the abundance indicator, unlike the population in the Azores.

Ecology and habitat

During the winter, Sanderlings inhabit mainly sandy or muddy-sandy beaches, though they are also sometimes found in rocky shelf areas (Lourenço *et al.* 2013). They feed mainly in areas of exposed sediment at low tide or near the surf zone (Mazzochi *et al.* 2021). Their diet consists of small invertebrates, which live buried in or on the surface of the sediment, such as polychaetes, bivalves and mosquito larvae, or small fish (Lourenço *et al.* 2015; Lourenço 2019).

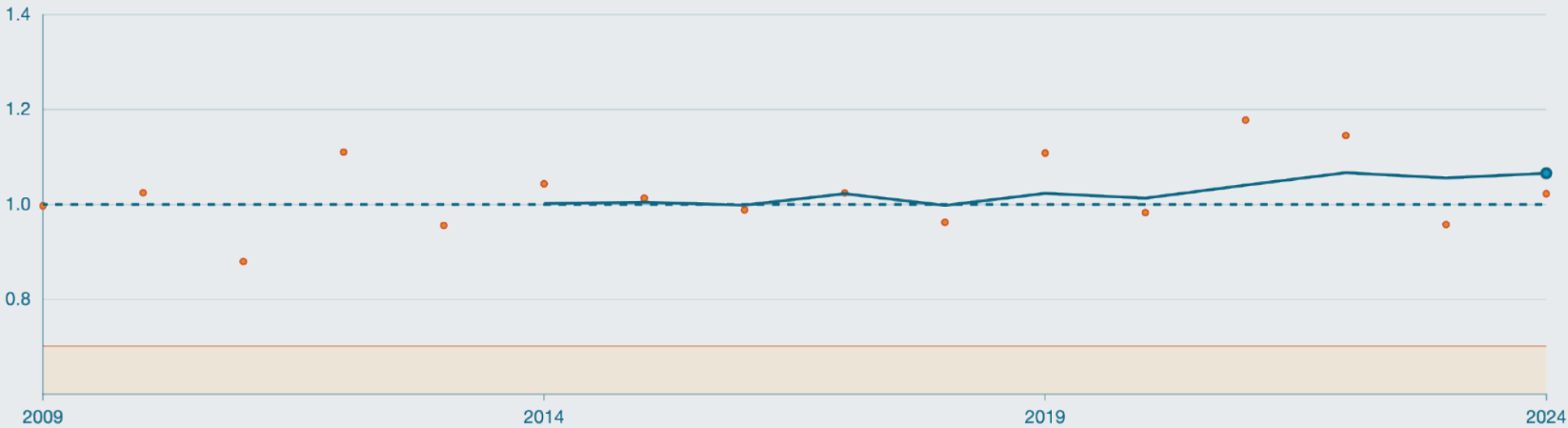
Threats and conservation

Although they occur on beaches near urban centres, which are often located close to estuaries and other highly productive wetlands (Lourenço *et al.* 2013), Sandpipers are particularly sensitive to direct human disturbance associated with the presence of people and, above all, of off-leash dogs in their foraging areas (Lourenço *et al.* 2013; Lopes 2024). The species is also affected by plastic pollution; a study conducted in the Tagus estuary revealed the presence of microplastics in 80% of samples from this species, in concentrations surpassed only by those found in Avocets *Recurvirostra avosetta* (Lourenço *et al.* 2017).

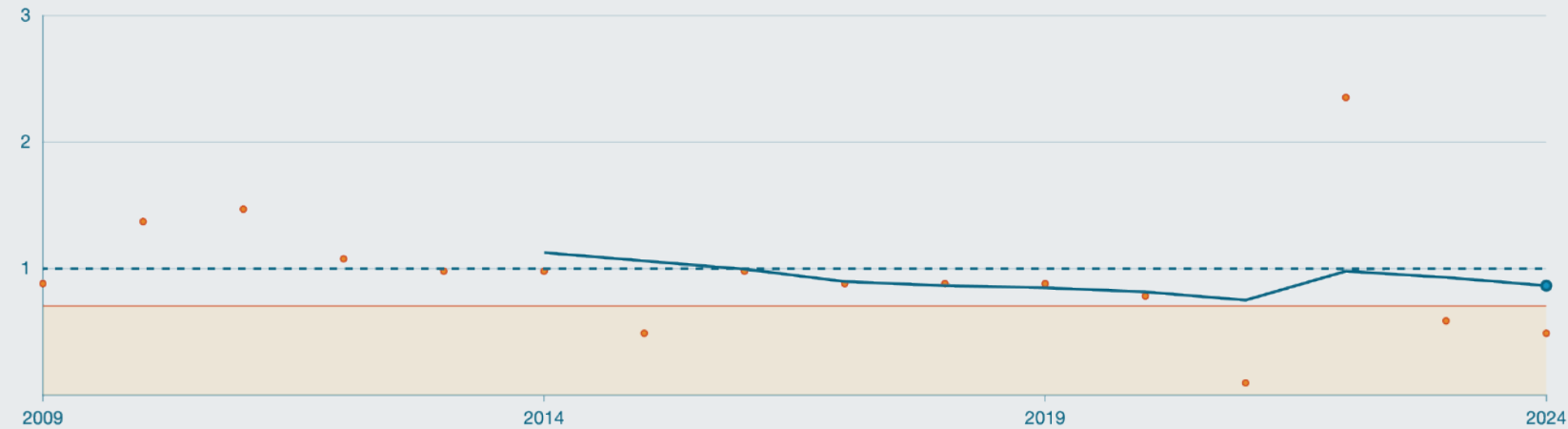
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

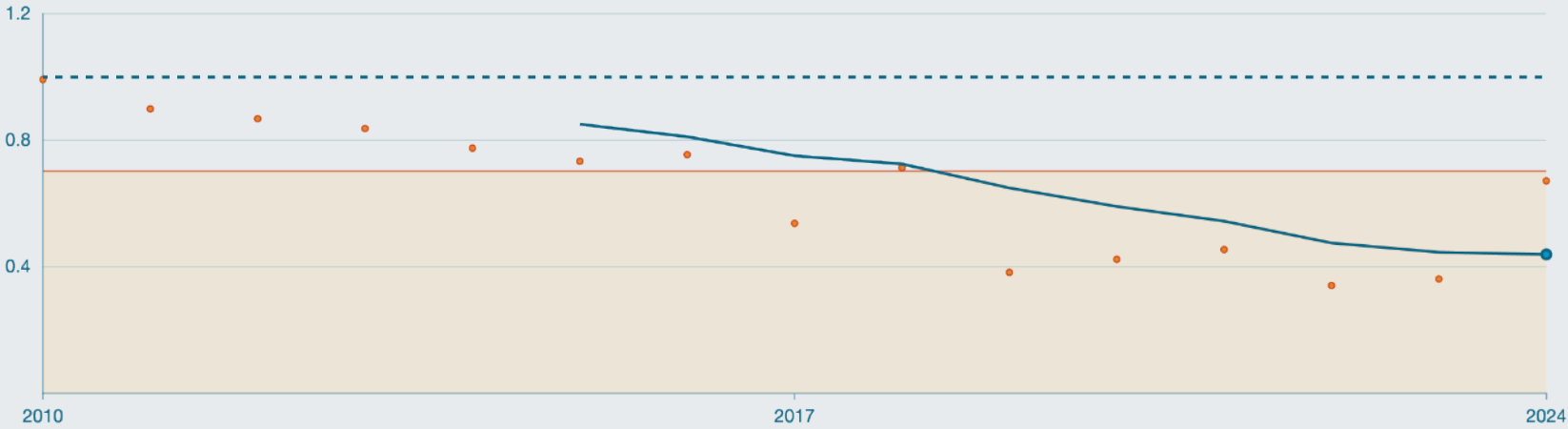
Mainland



Madeira



Azores



Dunlin

Calidris alpina

Phenology		Conservation status			
Mainland	Wintering and passage migrant	Mainland	Madeira	Azores	UICN Global
Madeira	Passage migrant	LC	NE	NE	NT
Azores	Passage migrant				



Distribution, movements and phenology

The Dunlin breeds between May and July in the Arctic and in subarctic and cold temperate regions of Eurasia and North America. It subsequently migrates to temperate and tropical areas of the Northern Hemisphere (Billerman *et al.* 2026).

In Portugal, wintering birds originate mainly from Scandinavia and Russia, including a small proportion from the Baltic region and the United Kingdom (Delany *et al.* 2009). Temporarily, they are joined by birds passing through on migrations towards the north-west African coast, mostly originating from colonies in Iceland (Catry *et al.* 2010a; Lopes *et al.* 2006). The species occurs mainly in estuarine areas on the Mainland, notably in the Tagus and Sado estuaries, the Ria Formosa and the Ria de Aveiro, and is also a regular visitor to the Mondego and Guadiana estuaries. It is less common in coastal lagoons, in some reservoirs in the Alentejo interior and on the non-estuarine coast (Lecoq *et al.* 2013; Equipa Atlas 2018). In the Azores and Madeira, it occurs only sporadically, due to their distance from the main migratory route used and the limited availability of suitable habitat on the islands.

Abundance and population trends

The global population has been estimated at between three and seven million mature individuals, with a declining trend (BirdLife International 2025). In Portugal, over 90% of the wintering population is concentrated in the Tagus and Sado estuaries, Ria Formosa and Ria de Aveiro, totalling around 40,000 birds in the early 2010s (Equipa Atlas 2018). The small proportion that uses the non-estuarine coast represents only 1% of this population (Lecoq *et al.* 2013). Despite the increasing trend observed in Europe (Wetlands International 2025), in Portugal the species appears to be in decline in the Tagus and Sado estuaries and in the Ria Formosa, where 70 to 80% of the national population occurs (Catry *et al.* 2011b; Alonso *et al.* 2022; Belo *et al.* 2023; Araújo 2025), alongside a negative trend on the non-estuarine coast (Velde 2025); the species has consequently failed to achieve Good Environmental Status for the abundance indicator on the Mainland. In the Azores and Madeira, the species occurs in very small numbers (Equipa Atlas 2018). Nevertheless, the Azores population has not achieved Good Environmental Status, unlike the Madeira population.

Ecology and habitat

The Dunlin is the most common wader in the estuaries and other coastal wetlands of Mainland Portugal. It makes very little use of the non-estuarine coast, visiting the beaches adjacent to coastal lagoons and estuaries sporadically. It also actively uses salt pans and flooded agricultural fields. It feeds on small invertebrates, mainly bivalves, annelids, insect larvae, amphipods and polychaetes (Lopes *et al.* 1998; Lourenço 2019; Billerman *et al.* 2026).

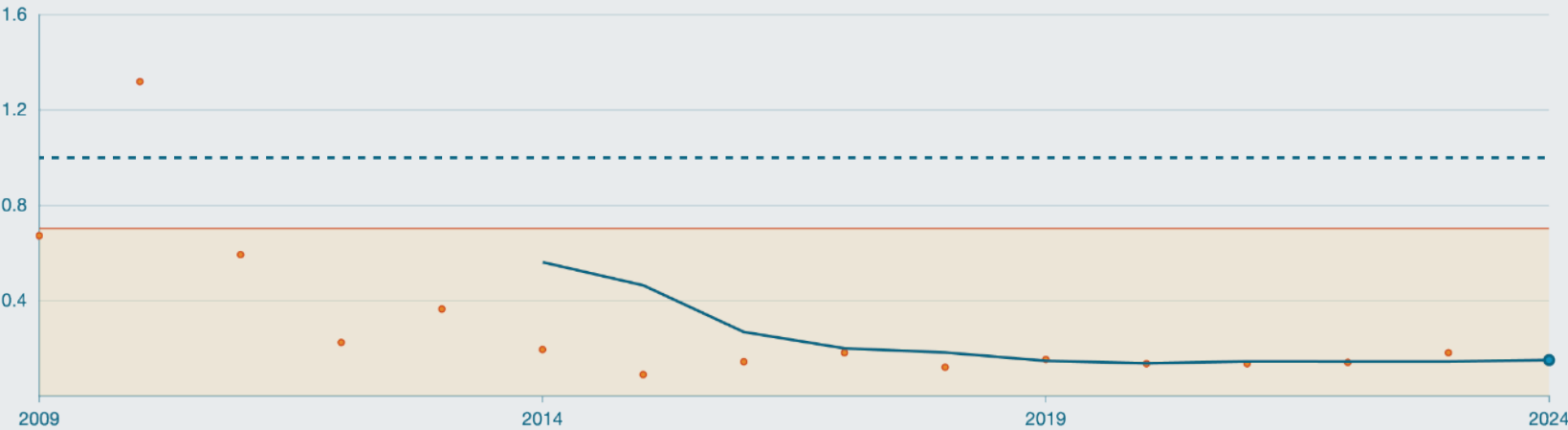
Threats and conservation

The causes of the global population decline are unknown (BirdLife International 2025). At a national level, the decline in populations may stem from local factors, or from changes in their migratory and wintering areas (Catry *et al.* 2011b), potentially shared along the East Atlantic Flyway (Lourenço *et al.* 2018; Schekerman *et al.* 2018; Belo *et al.* 2023). The degradation of some wintering areas and the potential for infrastructure development in these areas constitute significant threats, with the potential to reduce the quality of foraging areas (Catry *et al.* 2021). Climate change may also cause waders to shift their wintering grounds to latitudes closer to their breeding grounds, contributing to a decline in populations in more southerly regions (Rehfishch *et al.* 2004).

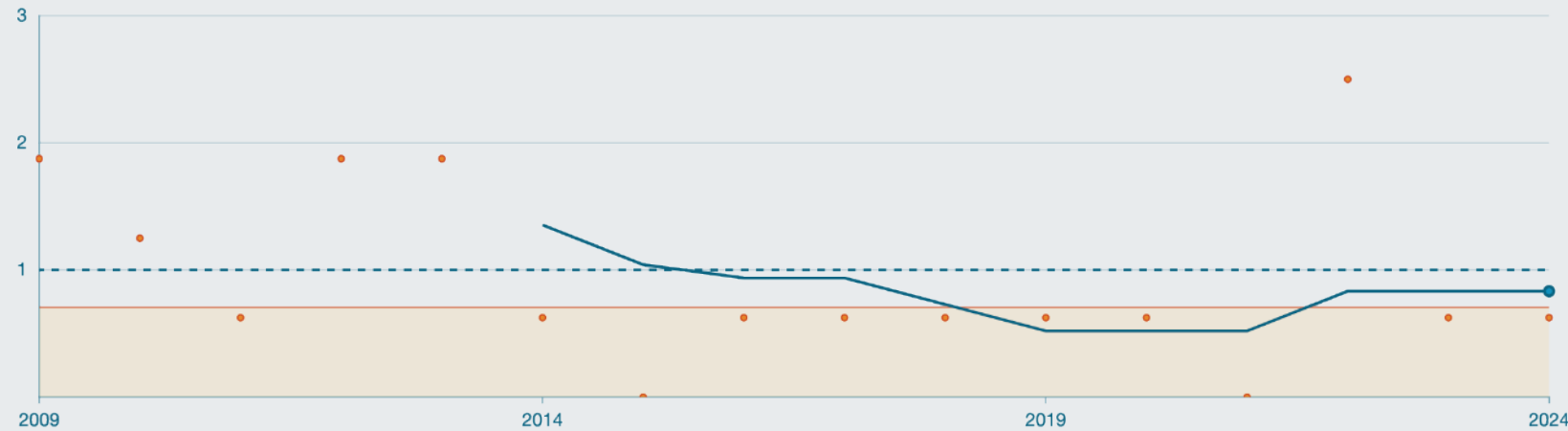
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

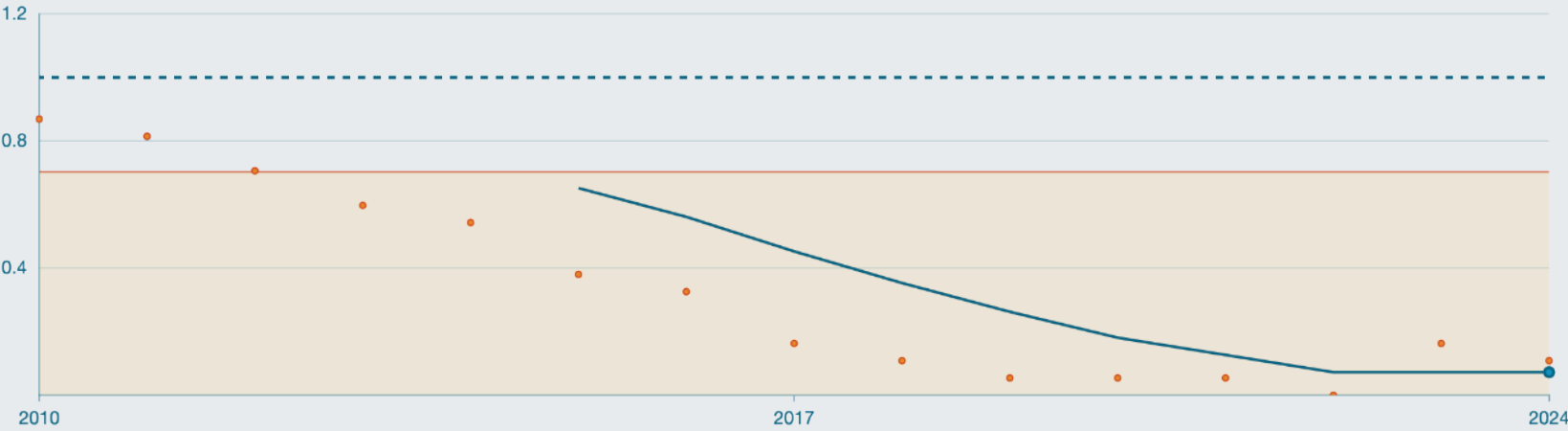
Mainland



Madeira



Azores



Purple Sandpiper

Calidris maritima

Phenology		Conservation status			
Mainland	Wintering	Mainland	Madeira	Azores	UICN Global
Madeira	Vagrant	EN	NA	NE	LC
Azores	Wintering				



Distribution, movements and phenology

The Purple Sandpiper breeds in Arctic and sub-Arctic regions of the Americas, Asia and Europe, from May to July (Billerman *et al.* 2026). It winters preferentially in cold temperate latitudes, with Portugal lying close to the southern limit of its range (Delany *et al.* 2009). Birds occurring in our country are assumed to originate from European or Canadian populations (Catry *et al.* 2010a). On the Mainland, it is a regular visitor to the rocky coast, although with a very localised distribution (Equipa Atlas 2018). The first birds arrive at an advanced stage of migration, in November, and may remain until April or May. The species also occurs regularly in the Azores during autumn and winter. The Madeira archipelago lies outside its typical distribution area, and the species may occur there as a vagrant.

Abundance and population trends

The global population has been estimated at between 204,000 and 287,000 individuals (Wetlands International 2025), with a declining trend (BirdLife International 2025). The species is scarce in Portugal, with counts of fewer than twenty individuals recorded on the Mainland coast as part of Project Arenaria. As it is a wader that is difficult to detect, the population may be slightly underestimated. The high number of Purple Sandpipers recorded in the past (Catry *et al.* 2010a) may also reflect a fluctuation in the species' abundance in the country (Lecoq *et al.* 2013). In fact, the values estimated in the present work indicate that this population has achieved Good Environmental Status for the abundance indicator. In the Azores, although information on abundance and population trends is scarce, the population appears not to have achieved Good Environmental Status.

Ecology and habitat

During winter, the Purple Sandpiper is a true specialist of rocky shores exposed to the ocean. It also utilises similar artificial structures, such as fishing harbour jetties or piers built along sandy shores. At this time of year, it feeds mainly on gastropods, insects, crustaceans, annelids and small amounts of marine vegetation (Billerman *et al.* 2026), with barnacles and mussels playing a key role (Johnston *et al.* 2025).

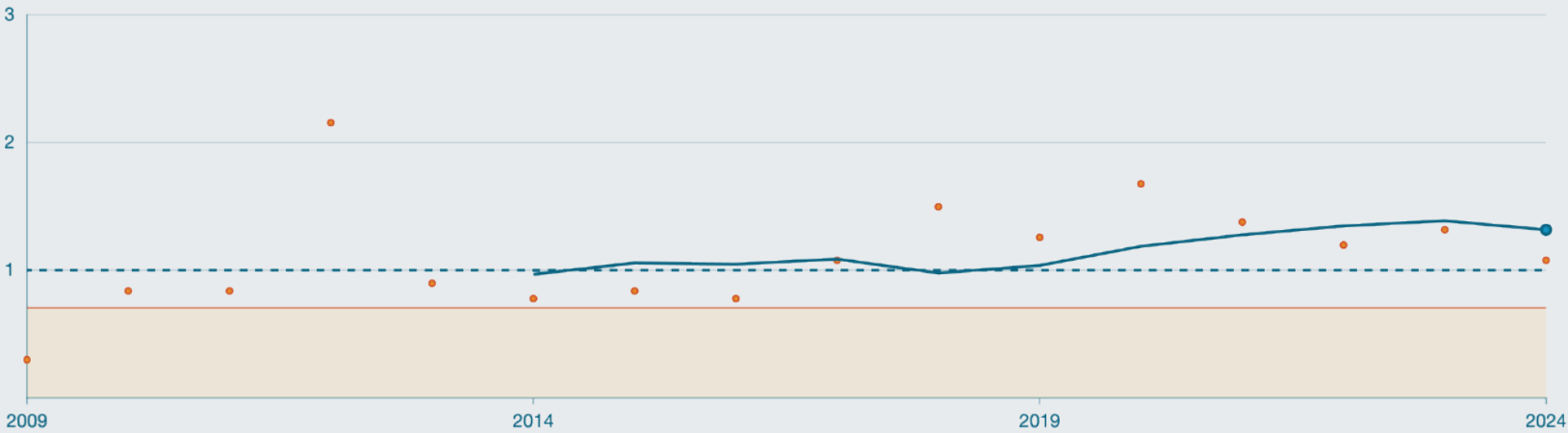
Threats and conservation

Human activities and the loss or degradation of coastal habitat have been identified as the main threats to this species in its wintering grounds. A sharp decline in the population is also predicted due to the effects of climate change (Rehfishch *et al.* 2004).

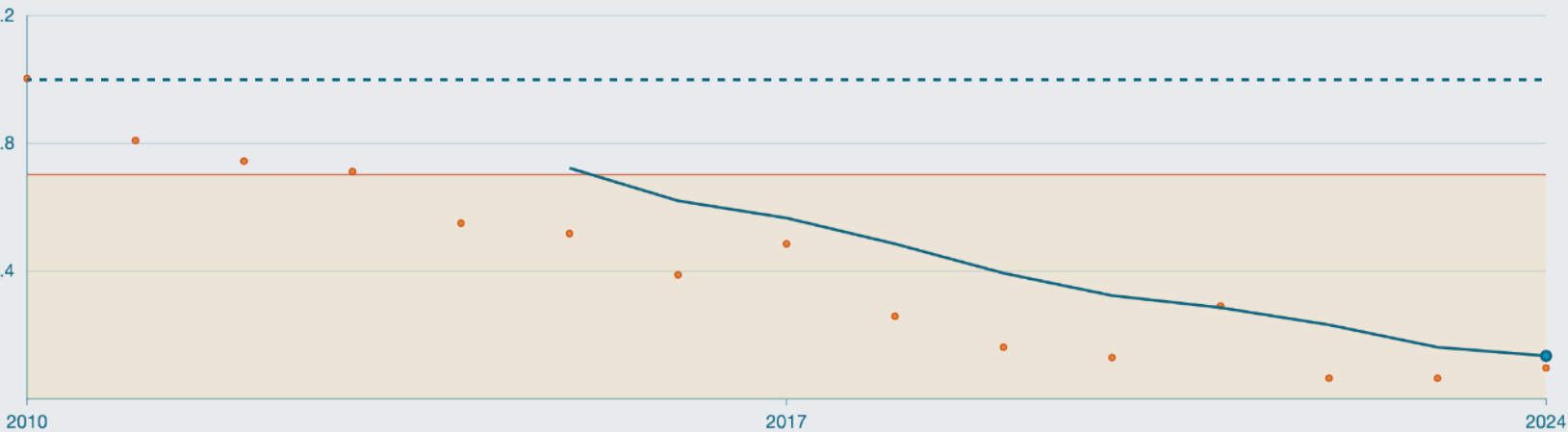
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

Mainland



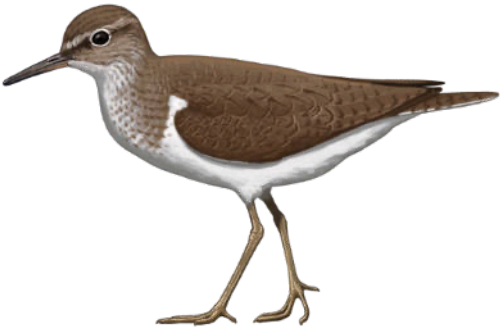
Azores



Common Sandpiper

Actitis hypoleucos

Phenology		Conservation status				
Mainland	Summer breeder, wintering and passage migrant	Mainland	Madeira	Azores	UICN Global	
Madeira	Wintering and passage migrant	VU Breeding population	NT Wintering population	NE	NA	LC
Azores	Vagrant					



Distribution, movements and phenology

The Common Sandpiper breeds across Eurasia, including Mainland Portugal, although its distribution is localised and fragmented, and it is most commonly found in the southern and eastern regions (Catry *et al.* 2010a; Billerman *et al.* 2026). There is a considerable migratory flow through Portugal, particularly between summer and early autumn (Alves *et al.* 2010; Catry *et al.* 2010a; Alves *et al.* 2011), of birds likely originating from countries in Western and Northern Europe. In winter, it occurs in Southern Europe, with the majority of the population concentrated in Africa and Southern Asia (Delany *et al.* 2009). During these periods, the Portuguese Mainland coast, particularly in the south, becomes a significant area of occurrence, including estuaries, coastal inlets and coastal lagoons. The migratory behaviour of breeding birds is poorly understood (Catry *et al.* 2010a), though dispersive movements are assumed. On the islands, it occurs occasionally, during winter or migration (Madeira), or as a vagrant (Azores) (Equipa Atlas 2018).

Abundance and population trends

The European population has been estimated at between 2,060,000 and 2,980,000 mature individuals, appearing to be stable (BirdLife International 2025), though it may have experienced a slight decline in the past (Delany *et al.* 2009). In Portugal, the available data are insufficient to produce reliable population estimates. However, there are thought to be 500–1,000 breeding pairs. The trend of the breeding population on the Mainland is considered uncertain or possibly stable, although there is evidence of a contraction in its distribution (Equipa Atlas 2022). The assessment of the environmental status for the indicator of wintering population abundance indicates this stability, having achieved Good Environmental Status. In contrast, there is a marked decrease in Madeira and a gradual decline in the Azores, neither of which have achieved Good Environmental Status.

Ecology and habitat

During the breeding season in Portugal, it is mainly found in lowland streams with stony or sandy substrates and open banks, without dense riparian vegetation. It is also associated with weirs and dams. Outside this season, it occurs in estuaries, coastal lagoons, salt pans, and along the marine coast. On beaches, it is associated with rocky areas with a narrow intertidal zone, usually in isolated groups (Lourenço *et al.* 2013). It feeds on amphipods, polychaetes and decapods (Arcas 2004).

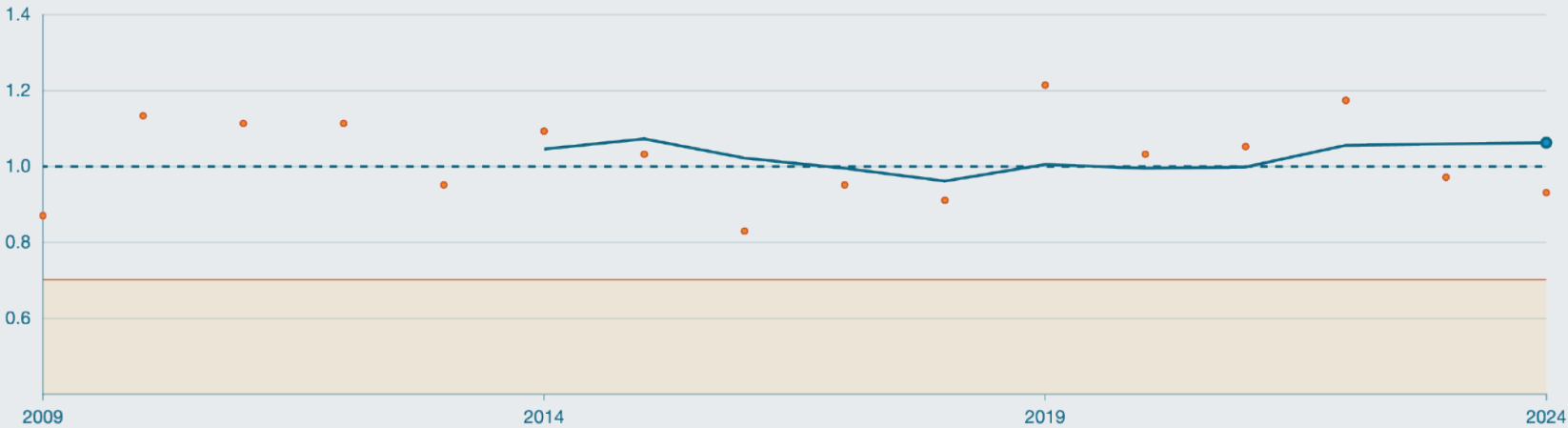
Threats and conservation

The Common Sandpiper is classified as Vulnerable for the breeding population and Near Threatened for the wintering population, in both cases due to an estimated population of fewer than 1,000 individuals (Almeida *et al.* 2022). There is no concrete information on threats to the species, and it is likely to suffer from increasing changes to riverbanks and disturbance from human activities. The presence of recreational anglers or walkers, particularly in nesting areas, may unintentionally disturb the birds, leading to breeding failure. These threats extend to other European populations (Delany *et al.* 2009).

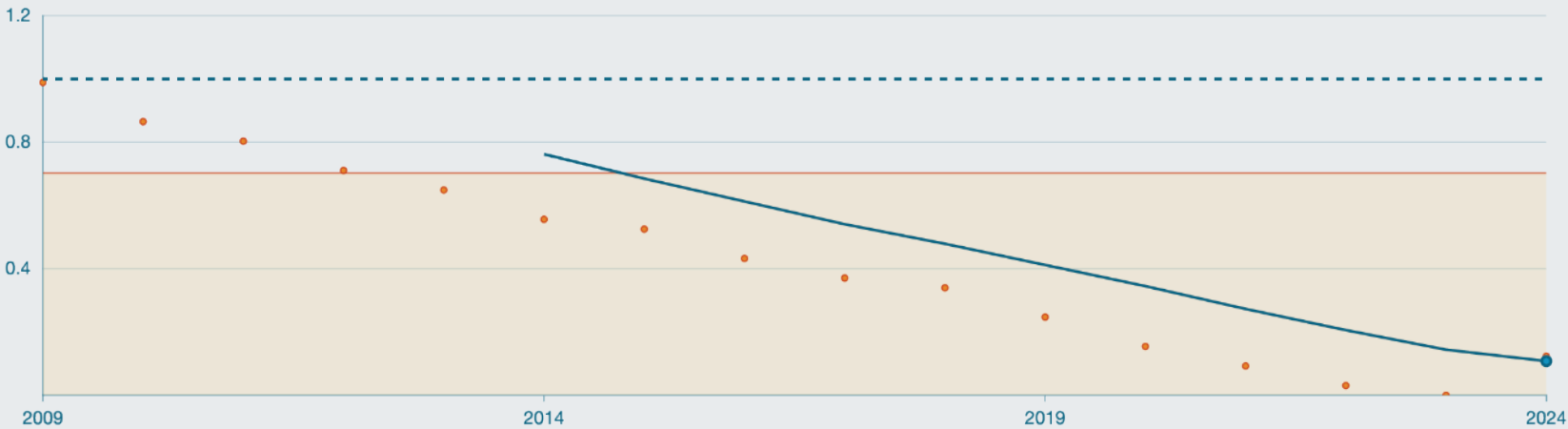
Abundance Indicator Assessment

Relative abundance 6-years mean & Assessment value Reference value Threshold

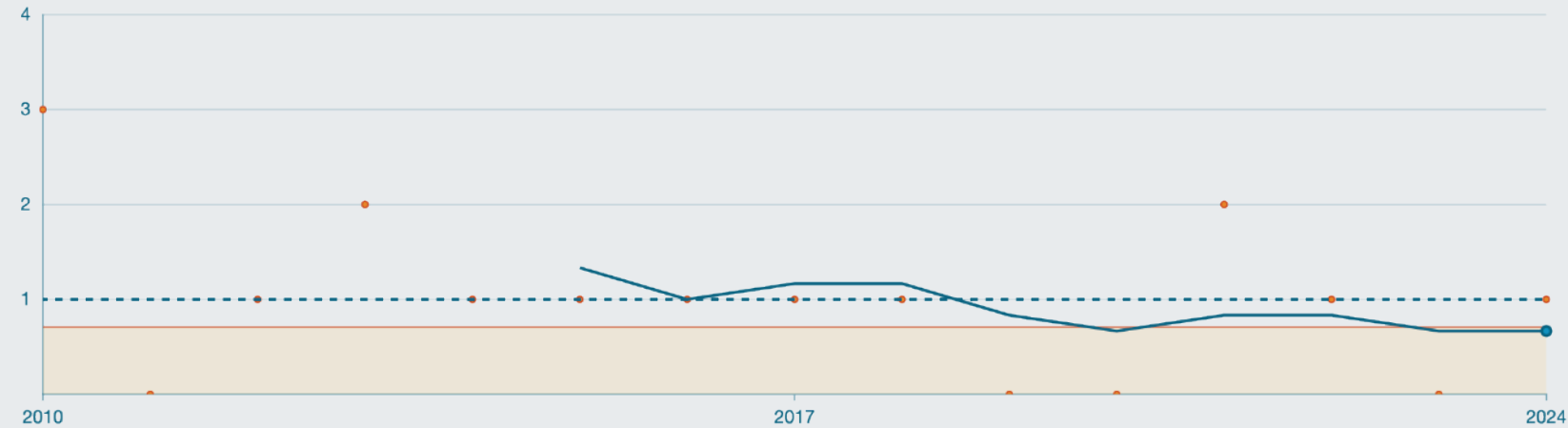
Mainland



Madeira



Azores



16. Glossary

Amphipods

Small crustaceans abundant in aquatic and intertidal environments, important in the marine food chain.

Anchovy

A small bony fish of the family Engraulidae, whose scientific name is *Engraulis encrasicolus*, also known as the European anchovy.

Anthropogenic pressures

Negative impacts caused directly by human activities on the environment, affecting terrestrial and aquatic ecosystems and the atmosphere. These include pollution, changes in land use, resource extraction, atmospheric emissions and disturbance, resulting in biodiversity loss and ecosystem degradation.

Antioxidant capacity

The ability to neutralise free radicals and reduce cellular damage.

Avian influenza

A contagious viral disease affecting birds (both wild and domestic, with a high mortality rate) and which can, in rare cases, infect mammals, including humans. It is caused by the Influenza A (H5N1) virus and transmitted through direct contact with infected animals or contaminated environments.

Beach seine

A fine-meshed and generally visible net used by small vessels to catch small pelagic fish such as sardines, mackerel and horse mackerel, as well as demersal or benthic species. This fishing gear is typically deployed from a vessel and may be operated either from shore (usually a beach) or from the vessel itself.

Benthic organisms

Organisms that live associated with the seabed or sediments.

Bioaccumulation

The process by which chemical substances build up in the tissues of an organism over time.

Bioindicator

A species or group of species whose presence, abundance or physiological state reflects the environmental conditions of an ecosystem.

Biomass

The total quantity of an animal or plant population present in a given ecosystem, usually expressed in units of weight.

Biome

A group of ecosystems that share a certain degree of homogeneity.

Biotope

An environment in which the biotic community carries out its activities. It generally exhibits regularity in environmental conditions and in animal and plant populations. Forests, lakes, a puddle of water, tree canopies, or even the backs of animals can be considered biotopes.

BirdLife International

An international non-governmental organisation (NGO) that promotes the conservation of birds, their habitats and global biodiversity, with representation in 120 countries through other local and national NGOs. SPEA is the representative in Portugal of BirdLife International.

Birds Directive

European Directive 79/409/EEC on the conservation of wild bird species occurring within the European Union, through various measures and the creation of Special Protection Areas (SPAs). Annex I of this directive lists the species for which SPAs must be established.

Bivalves

Molluscs with two valves, such as clams and cockles, common in intertidal environments.

Black tide

A phenomenon resulting from an accidental or deliberate discharge of petroleum products into the sea, usually from an oil tanker. It leads to contamination of the marine environment, with highly destructive and sometimes irreversible effects.

Breeding strategy

A set of characteristics and behaviours that determine how a species invests in breeding, including number of chicks, breeding frequency and parental care.

Bycatch

Refers to the unintentional capture of marine species during fishing. Animals may become entangled in hooks or fishing nets. It is usually associated with commercial fishing, but can also occur in recreational fishing. Bycatch is one of the main threats to seabirds at sea.

Capture-recapture

A statistical method for estimating population size based on marked and recaptured individuals.

Cephalopods

A group of marine molluscs that includes squids, cuttlefish and octopuses.

Chlorophyll a

An indicator of phytoplankton biomass and primary productivity.

Chronic effects

Long-term effects resulting from prolonged exposure to toxic agents.

Circadian cycles

Internal biological rhythms of approximately 24 hours regulated by light and darkness.

Climate change

Persistent changes in global or regional climate patterns, influenced by natural and anthropogenic factors.

Coastal surveys

Systematic surveys conducted along the coastline to detect dead or weakened birds and other environmental indicators.

Coastal upwelling

A phenomenon involving interaction between the ocean and the atmosphere, in which warm surface waters move away from the coast and are replaced by cooler, nutrient-rich waters from the depths.

Conservation status

Classification of the threat level of a species according to its probability of extinction. The criteria for this classification generally follow internationally recognised rules defined by the International Union for Conservation of Nature (IUCN) (<http://www.redlist.org>) and are based on population size, range and population trend. This status may be national or international.

Continental shelf

The portion of the seabed that begins at the coastline and slopes gently downwards to the continental slope (where the slope is much steeper). On average, the continental shelf extends to a depth of 200 metres.

Continental slope

A portion of the seabed with a very steep gradient lying between the continental shelf and the continental margin, where the abyssal plains begin.

Crustaceans

A group of marine arthropods that are important in the marine food chain.

Decapods

Order of crustaceans including crabs, prawns and crayfish.

Decarbonisation

Reduction of carbon emissions associated with energy production.

Demersal

A marine organism, usually a fish, that spends most of its life on the seabed, associated with the marine substrate, which may be sandy or rocky. However, these organisms are capable of active swimming, thus differing from benthic organisms.

Discards

The portion of the catch taken by commercial fishing vessels that is returned to the sea, often dead or dying. Discarded fish often belong to species of no commercial value, individuals below the minimum legal landing size, or individuals whose landing is not permitted, for example due to quota restrictions. Discards may also consist of parts of the catch, namely offal and heads, which, after on-board processing, are rejected and discarded at sea. Discards have a strong impact on marine ecosystems and influence many aspects of the distribution, foraging behaviour and population dynamics of seabirds, particularly species and individuals that habitually follow vessels.

Disease outbreaks

A sudden increase in the incidence of a disease within a population or region.

ESAS censuses

Standardised methodology for counting seabirds from vessels (“European Seabirds At Sea”), used to estimate distribution and density on the open sea.

East Atlantic Flyway

A migratory route used by birds travelling between their breeding grounds in the United States, Canada, Greenland, Siberia and northern European countries, and their wintering grounds stretching from Western Europe to the South African coast. This is one of the eight major routes used by waders and coastal birds worldwide, and is used by tens of millions of birds annually.

Ecological connectivity

The degree of connection between different areas or components of an ecosystem, allowing the flow of organisms, energy or matter.

Ecological indicator

A species or parameter that reflects the state of an ecosystem or environmental changes.

Ecological restoration

The process of recovering degraded ecosystems with the aim of restoring their original structure and function.

Ecological threshold

A reference value used to determine whether or not a population has reached a desired state.

Endemic species

A term used in biology (endemism, from the Greek *endemos*, meaning indigenous) to describe living organisms whose range is confined to a restricted region (e.g. a mountain, an island or a country).

Environmental status

A concept defined under the Marine Strategy Framework Directive (MSFD), referring to the condition of the elements of the marine environment, including birds. It aims to assess whether ecosystems are healthy, balanced and capable of supporting ecological functions and human uses in a sustainable manner. The ultimate goal is for the components and ecosystems to achieve Good Environmental Status.

Epipelagic

Relating to the surface layer of the ocean (up to a depth of around 200 m), where high biological productivity occurs.

Eradication

Complete removal of an invasive species from a specific area.

Eutrophication

Excessive enrichment of water with nutrients, leading to uncontrolled algal growth.

Exclusive Economic Zone (EEZ)

Under the United Nations Convention on the Law of the Sea, coastal states are entitled to declare an EEZ comprising maritime area beyond their territorial waters. The national EEZ is delimited by an imaginary line situated 200 nautical miles from the coast, separating national waters from international or shared waters. Within its EEZ, each state has rights such as the exploitation of marine resources, the conduct of scientific research and the regulation of fishing by foreign vessels.

Extreme weather events

Intense meteorological phenomena such as storms, heatwaves or droughts.

Fish stock

A term used in fisheries science referring to a population unit of fish (or shellfish) that is commercially exploited, belonging to the same species, within a given geographical area, and harvested by a specific fishery.

Fishing gear

Equipment used to catch marine animals, such as nets, longlines or traps.

Free radicals

Unstable molecules that can cause cellular damage.

GPS

A small device attached to birds to study their movements at a finer scale (usually during the breeding season). These devices use the Global Positioning System (GPS) to obtain information on position, latitude, longitude and altitude at any point on Earth, using a network of orbiting satellites.

GPS-GSM

A small device similar to a GPS, but which includes the additional functionality of sending data via the GSM network (mobile telecommunications network), thereby avoiding the need to retrieve the device to access the recorded data. Consequently, this device allows the study of bird movements over longer periods of time, whilst maintaining the accuracy of GPS systems. These devices usually also have a small solar panel to ensure they remain operational for several months or even years.

Gastropods

A group of molluscs that includes snails and whelks, common in coastal habitats and frequently consumed by waders.

Geolocator (GLS)

A small device attached to birds to study their large-scale movements (usually migration), which works by recording light intensity (from which the duration of night and the local midday time are estimated, and consequently the latitude and longitude on each day).

Gillnet

A static net, often nearly invisible and with variable mesh size, used to catch a wide variety of fish. It is set in the sea at varying depths and later retrieved. It is a non-selective fishing gear that frequently catches seabirds, marine mammals and reptiles.

Gran Sol

The Sole Bank is a fishing ground located in the North Atlantic, to the west and south-west of the British Isles. Due to its great fish abundance, it is an area heavily exploited by European fishing fleets, particularly by vessels from Galicia, Spain.

Habitats Directive

European Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora occurring within the European Union, with the exception of birds (protected under the Birds Directive) through various measures and the establishment of Special Areas of Conservation (SACs), contributing to the Natura 2000 network.

Harmful algal blooms (HAB)

Excessive proliferation of microalgae that produce toxins or cause negative ecological impacts.

Headland

A rocky, steep and prominent geographical area that projects into the sea, often forming a cape.

Important Bird and Biodiversity Areas (IBAs)

Sites of global importance for bird conservation, forming a vital network for the conservation of birds with an unfavourable conservation status. They are identified by BirdLife International using scientific criteria.

Individual tracking

Monitoring the movements of individuals using tracking devices.

Intertidal substrate

Coastal zone between high and low tide, subject to alternating submersion and exposure.

Intertidal zone

The coastal area that is exposed at low tide and submerged at high tide.

Introduced or exoticspecies

A term generally applied to a species introduced deliberately or accidentally into a specific location or region outside its original range. Depending on its adaptation to the new environment, an introduced species may or may not become naturalised and proliferate.

Invasive species

An introduced or non-native species that, due to its successful adaptation to new conditions, is able to achieve exceptional population growth. This increase may be so significant that it can threaten native species that share the same resources.

Invasive species control

Population management of invasive species without total elimination.

Kleptoparasitism

A feeding method in which one individual steals food from another.

Krill

Small crustaceans of the order Euphausiacea found in all oceans. Krill are considered an important prey source for many vertebrate species such as birds, seals, whales and fish that inhabit sub-Antarctic waters, forming the base of the food chain.

LIFE

The LIFE+ Programme funds projects that contribute to the development and implementation of environmental policy and legislation. In particular, this programme facilitates the integration of environmental issues into other policies and, more broadly, contributes to sustainable development.

Lemming

Name given to a group of small herbivorous rodents found in the Arctic tundra and sub-Arctic regions, belonging to the family Cricetidae.

Light pollution

Alteration of natural night-time light levels due to artificial lighting.

Longline

A fishing gear consisting of a main line (mother line) from which secondary lines with hooks attached branch off. It is left in the sea and can be placed on the seabed to catch deep-sea species (e.g. scabbardfish) or at the surface to catch large pelagic fish (e.g. swordfish).

Macaronesia

A biogeographical region comprising the archipelagos of the Azores, Madeira, the Canary Islands and Cape Verde.

Marine Strategy Framework Directive (MSFD)

European Directive 2008/56/EC to protect the marine ecosystem and biodiversity within the European Union, helping Member States achieve good environmental status of the marine environment.

Marine censuses

Standardised bird counts carried out at sea to estimate abundance and distribution.

Marshes

Freshwater wetlands, often temporary or shallow, used by waterbirds.

Mature individuals

Individuals capable of breeding, used as a reference in population estimates.

Mesopelagic

A marine organism living in the water column generally between 200 and 1,000 metres in depth.

Mesopelagic zone

Intermediate oceanic layer (approximately 200–1,000 m deep), characterised by low light levels and vertical migration of organisms.

Microplastics

Plastic particles smaller than 5 mm.

Migratory corridors

Preferred routes and geographical areas where the movement of individuals is concentrated during migrations.

Mitigation measures

Actions designed to reduce or minimise negative impacts on species or ecosystems.

Moult

A biological phenomenon characteristic of birds, through which the plumage is renewed. It can be partial or total and generally occurs at specific times of the year, depending on the species in question.

Mustelids

Carnivorous mammals belonging to the family Mustelidae. This family, the largest in the order Carnivora, includes ferrets, weasels, martens, otters, badgers and many more.

NACES

North Atlantic Current and Evlanov Sea Basin Marine Protected Area (NACES) designated in 2021 under the scope of the OSPAR Convention and with the specific aim of conserving migratory seabirds. NACES is located in the centre of the North Atlantic, between the Azores, the United Kingdom, Canada and Greenland.

Natura 2000 Network

A network of areas designated to conserve habitats and wild species in the European Union. It results from the implementation of two EU directives: the Birds Directive and the Habitats Directive, concerning the protection of habitats and wild fauna and flora.

Nest boxes (artificial nests)

Artificial structures installed to provide alternative nesting sites and increase breeding success.

OSPAR

An international convention for the protection of the marine environment of the North-East Atlantic, responsible for defining environmental indicators and targets.

Oceanic fronts

Transition zones between water masses with different characteristics (temperature, salinity), frequently associated with high biological productivity.

Oceanic waters (Offshore)

Waters situated away from the coast, beyond the continental shelf. It is used in matters relating to maritime activities, such as fishing, the oil industry and the exploitation of renewable energy. These waters are characterised by being located in the open sea, at great depths and far from coastal influences such as rivers and estuaries. They are thus distinguished from coastal waters.

Offshore wind farms

Wind energy production infrastructures installed at sea.

Oligotrophic waters

Waters that are low in nutrients and generally have low biological productivity.

Osmoregulation

The process by which organisms regulate the balance of water and salts in the body.

Overfishing

A form of fishing in which fish stocks (or populations) are exploited to levels that are biologically and ecologically unsustainable. Overfishing of certain key species, such as sharks, can lead to the collapse of marine ecosystems.

Oxidative stress

An imbalance between the production of free radicals and the organism's antioxidant capacity.

PTT

The PTT (platform transmitter terminal) is a small device attached to birds to study their large-scale movements (generally migration and wintering, but also breeding). These devices use the Argos satellite system to obtain information on position, latitude, longitude and altitude, anywhere on Earth, via a network of satellites in orbit. They are as accurate as GPS devices.

Pantropical distribution

Geographical distribution covering tropical regions of various oceans or continents.

Paretic syndrome

A set of neurological symptoms characterised by weakness and partial paralysis.

Passive acoustic monitoring

A method of detecting species through the continuous recording of vocalisations in a natural environment.

Peatlands

Wetland ecosystems characterised by the accumulation of partially decomposed organic matter, of high ecological importance.

Pelagic

The area or environment where organisms that do not depend on the seafloor normally live. It is the typical ecological environment of open ocean waters. The pelagic ecosystem does not include only the open sea; it also comprises the waters covering the continental shelf. The pelagic zone begins below the influence of tides and extends into the open ocean, at depths ranging from a few tens of metres to approximately 6,000 metres, and is divided into different layers.

Persistent organic pollutants (POPs)

Chemical compounds resistant to degradation that accumulate in organisms and the environment.

Phenology

The study of periodic phenomena in living organisms and their relationship with the environment, such as temperature, light and humidity. Some of these cyclical phenomena include, for example, bird migration or plant flowering.

Philopatry

The behaviour of returning to the place of birth to breed.

Plankton

Aquatic organisms, generally small, which are suspended in the water and drift with the currents. Plankton may consist of plants (phytoplankton), animals (zooplankton) or other organisms such as bacteria.

Polychaetes

Annelid worms belonging to the class Polychaeta.

Polycyclic aromatic hydrocarbons (PAHs)

A group of toxic organic compounds found in petroleum with carcinogenic and endocrine-disrupting potential.

Population trend

The direction of change in the size of a population over time (increase, decline or stability).

Post-breeding

Referring to the period following breeding.

Pre-breeding

Referring to the period preceding breeding.

Productivity

Quantity of organic matter produced per unit of time (usually one year). Primary productivity refers to the quantity of organic matter produced by primary producers: algae in aquatic or marine environments, or plants in terrestrial environments.

Productivity (seabirds)

A measure of a population's breeding success, generally expressed as the average number of chicks produced per pair.

Purse seine

A typically small-mesh, highly visible net used by purse seiners to catch small pelagic fish such as sardines or mackerel. After locating a school, the net is deployed from a vessel and encircles it completely, preventing the fish from escaping, and is then hauled in. When properly operated, it is a selective fishing gear.

RAM censuses

Coastal observation network for seabirds and marine mammals, based on systematic counts along the coastline.

Raft

A gathering of seabirds resting on the sea surface (mostly medium-sized or large Procellariiformes). As they bring together a large number of individuals in a relatively confined space, these groups give the illusion of being rafts.

Riparian gallery

Tree or shrub vegetation associated with riverbanks and watercourses.

Salt glands

Specialised structures that allow birds to eliminate excess ingested salt, essential for marine life.

Sand eel

A generic common name given to various species of bony fish of the genus *Ammodytes*.

Scavenger

An animal that feeds on carcasses or parts of them, actively seeking them out but without hunting.

Seamount

An underwater mountain rising from the ocean floor without reaching the surface, usually of volcanic origin, with a conical shape and a circular, elliptical or slightly elongated base. Only elevations exceeding 1,000 metres are considered seamounts.

Site of Community Importance (SCI)

An area considered important for the conservation of habitats and species characteristic of a European biogeographical region, in accordance with the Habitats Directive.

Snapshot method

Instantaneous sampling technique used to count birds in flight, avoiding double counting.

Southern range limit

The southernmost extent of a species' range.

Special Protection Area (SPA)

An area of Community importance where measures are applied to maintain or restore the conservation status of populations of wild bird species listed in Annex I of the Birds Directive. These are intended for the species mentioned in that annex and aim to ensure their survival and breeding, the conservation of their eggs, nests and habitats, as well as for migratory bird species not referred to in that annex but which occur regularly within the national territory.

Species distribution modelling (SDM)

A statistical approach that relates the occurrence/abundance of species to environmental variables.

Stranding

A dead or moribund animal that is brought ashore by the action of winds and ocean currents.

Submarine outfall

A structure that discharges wastewater into the sea after it has undergone a certain level of treatment at a wastewater treatment plant (WWTP). The dynamics of marine waters promote the natural processes of dilution, dispersion and degradation of these waters.

Synanthropic

Species that live in association with human environments or benefit from them.

Thyroid homeostasis

The physiological regulatory process that ensures the balanced production and release of hormones essential for metabolism, growth and the functioning of most organs in the body.

Time series

A set of data collected consistently over time, used to analyse trends.

Top predator

A species occupying the highest levels of the food chain and having no significant natural predators.

Transoceanic migration

Long-distance migratory movement across vast oceans, linking breeding and wintering grounds separated by thousands of kilometres.

Trophic niche

The position of a species within the food chain, including the type of food it consumes and its ecological role.

Tundra

The name given to the extensive plains with low-growing vegetation and no trees, characteristic of Arctic and sub-Arctic regions. The tundra is generally a very cold region with low precipitation.

Uropygial gland

A gland located at the base of a bird's tail that produces an oily substance, known as uropygial oil, used for the maintenance and waterproofing of the feathers.

Vertical migration

Daily movement of organisms between deep and surface layers of the water column.

WWTP

Abbreviation used to refer to a wastewater treatment plant.

Wader

A group of birds associated with coastal or inland wetlands, generally found in habitats such as mudflats, saltmarshes, estuaries, lagoon margins, sandy areas and flooded zones. Some of these species also use the sandy and rocky coasts of Portugal.

Wintering grounds

Areas where birds remain outside the breeding season, generally associated with favourable conditions for feeding and survival.

Wintering period

A period generally corresponding to the winter months, which may include part of autumn.

17. References

- Abelló P & Esteban A (2012). Trawling bycatch does affect Balearic Shearwaters *Puffinus mauretanicus*. *Revista Catalana D'ornitologia* 28: 34-39.
- Adalsteinsson S, Petersen IK & Fox AD (2025). Wintering area and experience effects on spring migration strategies, timing and breeding success in Icelandic-nesting Common Scoters (*Melanitta nigra*). *Ibis* 167: 945-961.
- AEMET - Agencia Estatal de Meteorología (2011). Análisis preliminar de la situación del 22-25 de enero de 2009. Un caso de ciclogénesis explosiva extraordinaria.
- Alava JJ, Cheung WW, Ross PS & Sumaila UR (2017). Climate change–contaminant interactions in marine food webs: Toward a conceptual framework. *Global change biology* 23(10): 3984-4001.
- Albores-Barajas YV, Soldatini C & Furness RW (2009). Are burrow nesting seabird chicks affected by human disturbance? *Waterbirds* 32(4): 572-578.
- Alerstam T, Bäckman J, Grönroos J, Olofsson P, Strandberg R & Sjöberg S (2025). Migration of black terns *Chlidonias niger* and common terns *Sterna hirundo* between south Sweden and the Atlantic coast of Africa. *Journal of Avian Biology* 2025: e03348.
- Alfrey P & Legrand V (2025). Pelagic birding at Banco da Fortuna, Azores. *Dutch Birding* 47: 104-113.
- Alho M, Catty P, Silva MC, Nunes VL & Granadeiro JP (2022). Revealing the foraging movements and diet of the White-faced Storm Petrel *Pelagodroma marina* in the NE Atlantic. *Marine Biology* 169(7): 91.
- Alho M, Granadeiro JP, Rando JC, Gerales P & Catty P (2021). Characterization of an extinct seabird colony on the island of Santa Luzia (Cabo Verde) and its potential for future recolonizations. *Journal of Ornithology* 163: 301-313.
- Almeida A, Alonso H, Oliveira N, Silva E & Andrade J (2023). Using a visual deterrent to reduce seabird interactions with gillnets. *Biological Conservation* 285: 110236.
- Almeida J, Godinho C, Leitão D & Lopes RJ (2022). *Lista Vermelha das Aves de Portugal Continental*. SPEA, ICNF, Labor/UÉ, CIBIO/BIOPOLIS, Portugal.
- Almeida JL (2008). Primeiros casos de nidificação do corvo-marinho *Phalacrocorax carbo* em Portugal. *Anuário Ornitológico* 6: 94.
- Alonso A, Granadeiro JP, Paiva VH, Dias AS, Ramos JA & Catty P (2012). Parent–offspring dietary segregation of Cory's shearwaters breeding in contrasting environments. *Marine Biology* 159: 1197-1207.
- Alonso H, Andrade J, Teodósio J & Lopes A (coord.) (2022). *O estado das aves em Portugal, 2022*. 2ª edição. Sociedade Portuguesa para o Estudo das Aves, Lisboa.
- Alonso H, Granadeiro JP, Dias MP, Catty T & Catty P (2018). Fine-scale tracking and diet information of a marine predator reveals the origin and contrasting spatial distribution of prey. *Progress in Oceanography* 162: 1-12.
- Álvarez-Fernández I, Fernández N, Sánchez-Carnero N & Freire J (2017). The management performance of marine protected areas in the North-east Atlantic Ocean. *Marine Policy* 76: 159-168.
- Alves F, Ferreira R, Fernandes M, Halicka Z, Dias L & Dinis A (2018). Analysis of occurrence patterns and biological factors of cetaceans based on long-term and fine-scale data from platforms of opportunity: Madeira Island as a case study. *Marine Ecology* 39(2): e12499.
- Alves JA, Dias M, Catty T, Costa H, Fernandes P, Martins R, Moniz F & Rocha A (2010). Monitorização das populações de aves aquáticas dos Estuários do Tejo e do Guadiana. Relatório do ano de 2009. *Anuário Ornitológico* 7: 109-119.
- Alves JA, Dias M, Rocha A, Barreto B, Catty T, Costa H, Fernandes P, Ginja B, Glen K, Jara J, Martins R, Moniz F, Pardal S, Pereira T, Rodrigues J & Rolo M (2011). Monitorização das populações de aves aquáticas dos estuários do Tejo, Sado e Guadiana. *Anuário Ornitológico* 8: 118-133.
- Alves MG (2024). *Estudo das Capturas Acidentais e Interações de Aves Marinhas em Redes de Emalhar e de Cerco e Avaliação de Medidas de Mitigação na Zona de Proteção Especial Aveiro-Nazaré*. Universidade de Lisboa.
- Alves RJV, da Silva NG, Aguirre-Muñoz A, Veitch C, Clout M & Towns D (2011). Return of endemic plant populations on Trindade Island, Brazil, with comments on the Fauna. *International Conference on Island Invasives*, Auckland.
- Amaral JJS, Almeida S, Sequeira M & Neves VC (2010). Black rat *Rattus rattus* eradication by trapping allows recovery of breeding roseate tern *Sterna dougallii* and common tern *S. hirundo* populations on Feno Islet, the Azores, Portugal. *Conservation Evidence* 7: 16-20.
- Amélineau F, Fort J, Mathewson PD, Speirs DC, Courbin N, Perret S, Porter WP, Wilson RJ & Grémillet D (2018). Energyscapes and prey fields shape a North Atlantic seabird wintering hotspot under climate change. *Royal Society Open Science* 5(1): 171883.
- Anderson DM (2009). Approaches to monitoring, control and management of harmful algal blooms (HABs). *Ocean & coastal management* 52(7): 342-347.
- Anderson DM, Burkholder, JM, Cochlan WP, Glibert PM, Gobler CJ, Heil CA, Kudela RM, Parsons ML, Rensell JEJ, Townsend DW, Trainer VL & Vargo GA (2008). Harmful algal blooms and eutrophication: examining linkages from selected coastal regions of the United States. *Harmful algae* 8(1): 39-53.
- Anderson OR, Small CJ, Croxall JP, Dunn EK, Sullivan BJ, Yates O & Black A (2011). Global seabird bycatch in longline fisheries. *Endangered Species Research* 14: 91-106.
- Araújo AMP (2025). *Long term changes in the Ria Formosa's intertidal system: has the tide changed beyond repair?* Tese de Mestrado em Biologia Marinha, Pescas e Conservação. Faculdade de Ciências e Tecnologia. Universidade do Algarve.
- Araújo H, Correia-Rodrigues P, Bastos-Santos J, Ferreira M, Pereira AT, Martinez-Cedeira J, Vingada J & Eira C (2022a). Seabird abundance and distribution off western Iberian waters estimated through aerial surveys. *Marine Ornithology* 50: 71-80.
- Araújo H, Rodrigues PC, Bastos-Santos J, Ferreira M, Pereira A, Martínez-Cedeira J, Vingada J & Eira C (2022b). Monitoring abundance and distribution of northern gannets *Morus bassanus* in Western Iberian waters in autumn by aerial surveys. *Ardeola* 69(2): 179-202.
- Arcas J (2004). Dieta y selección de presas del andarríos chico *Actitis hypoleucos* durante el invierno. *Ardeola* 51(1): 203-213.
- Arcos JM (2001) *Foraging ecology of seabirds at sea: Significance of commercial fisheries in the NW Mediterranean*. PhD thesis. University of Barcelona.
- Arcos JM (2011). *International species action plan for the Balearic shearwater*, *Puffinus mauretanicus*. SEO /BirdLife & BirdLife International.
- Arcos JM & Oro D (2004). Pardela Balear (*Puffinus mauretanicus*). In Madroño A, González C & Atienza JC (eds.). *Libro Rojo de las Aves de España*. Dirección General para la Biodiversidad-SEO /BirdLife, Madrid: 46-50.
- Arcos JM, Arroyo G, Bécáres J, Mateos-Rodríguez M, Rodríguez B, Muñoz A, Ruiz A, De la Cruz A, Cuenca D & Onrubia A (2012). New estimates at sea suggest a larger global population of the Balearic Shearwater *Puffinus mauretanicus*. *Proceedings of the 13th Medmaravis Pan Mediterranean Symposium*: 84–94.
- Arcos JM, Bécáres J, Rodríguez B & Ruiz A (2009). *Áreas Importantes para la Conservación de las Aves marinas en España*. LIFE04NAT/ES/000049. Sociedad Española de Ornitología SEO/BirdLife, Madrid.
- Arcos JM, López I, Alonso J & Mayol J (2017). Study, monitoring, and conservation of the Balearic shearwater in Spain: An update. *Fourth Meeting of the Population and Conservation Status Working Group, Agreement on the Conservation of Albatrosses and Petrels*. Wellington, New Zealand. 7–8 September 2017.
- Arroyo GM, Mateos-Rodríguez M, Munõz AR, De La Cruz A, Cuenca D & Onrubia A (2016). New population estimates of a critically endangered species, the Balearic Shearwater *Puffinus mauretanicus*, based on coastal migration counts. *Bird Conservation International* 26 (1): 87–99.
- Atchoi E (2021). *Relatório Final LuMinAves – FRCT, 2021*. Okeanos-UAç. Horta, Azores.

- Atchoi E, Mitkus M Rodríguez A (2020). Is seabird light-induced mortality explained by the visual system development? *Conservation Science and Practice* 2(6): e195.
- Austad M, Michel L, Masello, JF, Cecere JG, de Pascalis F, Bustamante P, Dell’Omo G, Griep S & Quillfeldt P (2025). Diet of two mediterranean shearwaters revealed by DNA metabarcoding. *Marine Biology* 172: 104.
- Aznar R, Sotillo MG, Cailleau S, Lorente P, Levier B, Amo-Baladrón A, Reffray G & Alvarez Fanjul E (2016). Strengths and weaknesses of the CMEMS forecasted and reanalyzed solutions for the Iberia-Biscay-Ireland (IBI) waters. *Journal of Marine Systems* 159: 1–14.
- Baert JM, Stienen EW, Heylen BC, Kavelaars MM, Buijs R-J, Shamoun-Baranes J, Lens L & Müller W (2018). High-resolution GPS tracking reveals sex differences in migratory behaviour and stopover habitat use in the Lesser Black-backed Gull *Larus fuscus*. *Scientific reports* 8(1): 5391.
- Baldwin JR (2009). Harvesting seabirds and their eggs on the Irish Sea islands (Part 1: the Welsh islands, Lundy and Scilly). *Folk Life* 47(1): 76–96.
- Barros N, Vulcano A, Almeida A, Alonso H & Andrade J (2024). *Seabirds and offshore wind development in Portugal: mapping the way forward*. Portuguese Society for the Study of Birds, Lisboa.
- Barton ED (2001). Canary and Portugal Currents. In Steele JH, Turekian KK & Thorpe SA (eds.) *Encyclopaedia of Ocean Sciences* (380–389). Academic Press, London: 380–389.
- Batey C (2013). The effectiveness of management options in reducing human disturbance to wetland and coastal birds. *The Plymouth Student Scientist* 6(2): 340–354.
- Batista MI & Cabral HN (2016). An overview of marine protected areas in SW Europe: factors contributing to their management effectiveness. *Ocean & Coastal Management* 132: 15–23.
- Beal M, Dias MP, Phillips RA, Oppel S, Hazin C, Pearmain EJ, Adams J, Anderson DJ, Antolos M, Arata JA, Arcos JM, Arnould JPY, Awkerman J, Bell E, Bell M, Carey M, Carle R, Clay TA, Cleeland J, Colodro V, Conners M, Cruz-Flores M, Cuthbert R, Delord K, Deppe L, Dille BJ, Dinis H, Elliott G, De Felipe F, Felis J, Forero MG, Freeman A, Fukuda A, González-Solís J, Granadeiro JP, Hedd A, Hodum P, Igual JM, Jaeger A, Landers TJ, Le Corre M, Makhado A, Metzger B, Militão T, Montevocchi WA, Morera-Pujol V, Navarro-Herrero L, Nel D, Nicholls D, Oro D, Ouni R, Ozaki K, Quintana F, Ramos F, Reid T, Reyes-González JM, Robertson C, Robertson G, Romdhane MS, Ryan PG, Sagar P, Sato F, Schoombie S, Scofield RP, Shaffer SA, Shah NJ, Stevens KL, Surman C, Suryan RM, Takahashi A, Tatayah V, Taylor G, Thompson DR, Torres L, Walker K, Wanless R, Waugh SM, Weimerskirch H, Yamamoto T, Zajkova Z, Zango L & Catry P (2021). Global political responsibility for the conservation of albatrosses and large petrels. *Science Advances* 7(10): eabd7225.
- Beja R (1989). A note on the diet of Razorbills *Alca torda* wintering off Portugal. *Seabird* 12: 11–13.
- Belo JR, Dias MP, Jara J, Almeida A, Morais F, Silva C, Valadeiro J & Alves JA (2023). Synchronous declines of wintering waders and high-tide roost area in a temperate estuary: Results of a 10-year monitoring programme. *Waterbirds* 45(2): 141–149.
- Bennett S, Phillips RA & Green JA (2025). Quantifying the effect of time on geolocation accuracy in seabirds. *Marine Ornithology* 53(2): 331–335.
- Bermejo A, Carrera E, de Juana E & Teixeira AM (1986). Primer censo general de gaviotas y charranes (Laridae) invernantes en la Península Ibérica (Enero de 1984). *Ardeola* 33: 47–68.
- Bernard A, Courbin N, Tornos J, Martin TJ, Lejeune M, Prudor A, Provost P, Lambrechts A, Gaskin CP, Cabelguen J, Bécot M, Jiguet F & Grémillet D (2026). The responsibility of Western European coastal states for the conservation of two emblematic migratory seabirds in the context of offshore wind farms. *Biological Conservation* 314: 111678.
- Bernard A, Rodrigues ASL, Cazalis V & Grémillet D (2021). Toward a global strategy for seabird tracking. *Conservation Letters* 14(3): e12804.
- Bernis F (1967). *Aves Migradoras Ibéricas Según Anillamientos en Europa, fasc. 5*. Publicación especial de la Sociedad Española de Ornitología. SEO, Madrid.
- Bertrand S, Joo R, Arbulu Smet C, Tremblay Y, Barbraud C & Weimerskirch H (2012). Local depletion by a fishery can affect seabird foraging. *Journal of Applied Ecology* 49(5): 1168–1177.
- Billerman SM, Keeney BL, Kirwan GM, Medrano F, Sly ND & Smith MG (eds.) (2026). *Birds of the World*. Cornell Laboratory of Ornithology, Ithaca, NY, USA.
- Birding Azores (2014). <http://www.birdingazores.com/>
- Birding Azores (2022). *Birding Azores database*. Downloaded from <https://www.azoreswildlife.com/> on 23.12.2025.
- BirdLife International (2004). *Birds in Europe: population estimates, trends and conservation status*. BirdLife International (BirdLife Conservation Series No. 12), Cambridge
- BirdLife International (2014). <http://www.birdlife.org/europe-and-central-asia/european-red-list-birds-0>
- BirdLife International (2021). *European Red List of Birds*. Publications Office of the European Union, Luxembourg.
- BirdLife International (2025). *IUCN Red List for birds*. Downloaded from <https://datazone.birdlife.org> on 30.11.2025.
- Bolton M (1999). Swinhoe’s Storm Petrel *Oceanodroma monohris* ringed at Ponta de Almada, Algarve, 10th July 1998. *The A Rocha Observatory Report for 1998*: 38–40.
- Bolton M & Thomas R (1999). Northward migration of European Storm-Petrel *Hydrobates pelagicus* captured in Portuguese coastal waters. *Actas do II Congresso de Ornitologia da Sociedade Portuguesa para o Estudo das Aves*. SPEA, Lisboa.
- Bolton M, Medeiros R, Hotherhall B & Campos A (2004). The use of artificial breeding chambers as a conservation measure for cavity-nesting procellariiform seabirds: a case study of the Madeiran Storm Petrel (*Oceanodroma castro*). *Biological Conservation* 116: 73–80.
- Bolton M, Smith AL, Gómez-Díaz E, Friesen VL, Medeiros R, Bried J, Roscales JL & Furness RW (2008). Monteiro’s Storm Petrel *Oceanodroma monteiroi*: a new species from the Azores. *Ibis* 150(4): 717–727.
- Bonadonna F & Bretagnolle V (2002). Smelling home: a good solution for burrow-finding in nocturnal petrels? *Journal of Experimental Biology* 205(16): 2519–2523.
- Bonnaud E, Bourgeois K, Vidal E, Legrand J & Le Corre M (2009). How can the Yelkouan shearwater survive feral cat predation? A meta-population structure as a solution? *Population Ecology* 51: 261–270.
- Bonter DN, MacLean SA, Shah SS & Moglia MC (2014). Storm-induced shifts in optimal nesting sites: a potential effect of climate change. *Journal of Ornithology* 155(3): 631–638.
- Borg JJ, Raine H, Raine AF & Barbara N (2010). *Protecting Malta’s wind chaser: the EU LIFE Yelkouan Shearwater project report*. BirdLife Malta, Malta.
- Borges PA, Bried J, Costa AC, Cunha RT, Gabriel R, Gonçalves V, Martins AF, Melo I, Parente M, Raposeiro P, Rodrigues P, Santos RS, Silva L, Vieira P, Vieira V, Mendonça E & Boieiro M (2010). Description of the terrestrial and marine biodiversity of the Azores. In Borges PAV, Costa A, Cunha R, Gabriel R, Gonçalves V, Martins AMF, Melo I, Parente M, Raposeiro P, Rodrigues P, Santos RS, Silva L, Vieira P & Vieira V (eds.). *A list of the terrestrial and marine biota from the Azores*. Principia, Cascais: 9–33.
- Bourgeois K & Vidal E (2008). The endemic Mediterranean yelkouan shearwater *Puffinus yelkouan*: distribution, threats and a plea for more data. *Oryx* 42(2): 187–194.
- Bourgeois K, Dromzée S, Legrand J & Vidal E (2016). Seabird population recovery following rat eradication on a small Mediterranean island. *Animal Conservation* 19(6): 423–432.
- Bourgeois K, Vorenger J, Faulquier L, Legrand J & Vidal E (2011). Diet and contamination of the yelkouan shearwater *Puffinus yelkouan* in the Hyères archipelago, Mediterranean basin, France. *Journal of Ornithology* 152(4): 947–953.
- Bradbury G, Trinder M, Furness B, Banks AN, Caldow RWG & Hume D (2014). Mapping seabird sensitivity to offshore wind farms. *PLoS ONE* 9(9): e106366.
- Bray L, Reizopoulou S, Voukouvlas E, Soukissian T, Alomar C, Vázquez-Luis M, Deudero S, Attrill MJ & Hall-Spencer JM (2016). Expected effects

- of offshore wind farms on Mediterranean marine life. *Journal of Marine Science and Engineering* 4(1): 18.
- Bregnballe T, Noer H, Christensen TK, Clausen P, Asferg T, Fox AD & Delany S (2006). Sustainable hunting of migratory waterbirds: the Danish approach. In Boere G, Galbraith C, Stroud D (eds.). *Waterbirds around the world*. The Stationary Office, Edinburgh, UK: 854-860.
- Bretagnolle V, Carruthers M, Cubitt M, Bioret F & Cuillandre JP (1991). Six captures of a dark-rumped, fork-tailed storm-petrel in the northeast Atlantic. *Ibis* 133: 351-356.
- Bried J & Bourgeois K (2005). Which future for Bulwer's petrel in the Azores? *Airo* 15: 51-55.
- Bried J & Magalhães MC (2004). First palearctic record of the endangered Bermuda Petrel *Pterodroma cahow*. *Bulletin of the British Ornithologists' Club* 124: 202-206.
- Bried J & Neves VC (2015). Habitat restoration on Praia islet, Azores archipelago, proved successful for seabirds, but new threats have emerged. *Airo* 23: 25-36.
- Bried J, Magalhães M & Neves V (2009b). Aspectos da Ornitologia Marinha nos Açores. *Boletim do Núcleo Cultural da Horta* 18: 61-83.
- Bried J, Magalhães MC, Bolton M, Neves VC, Bell E, Pereira JC, Aguiar L, Monteiro LR & Santos RS (2009a). Seabird habitat restoration on Praia Islet, Azores Archipelago. *Ecological Restoration* 27(1): 27-36.
- Brooke M (2004). *Albatrosses and petrels across the world*. Oxford University Press, Oxford, UK.
- Bugoni L, Neves TS, Leite NO, Carvalho D, Sales G, Furness RW, Stein CE, Peppes FV, Giffoni BB & Monteiro DS (2008). Potential bycatch of seabirds and turtles in hook-and-line fisheries of the Itaipava Fleet, Brazil. *Fisheries Research* 90: 217-224.
- Burger J & Gochfeld M (2000). Metal levels in feathers of 12 species of seabirds from Midway Atoll in the northern Pacific Ocean. *Science of the Total Environment* 257(1): 37-52.
- Bustnes JO (2006). Environmental pollutants in endangered vs. increasing subspecies of the lesser black-backed gull on the Norwegian Coast. *Environmental Pollution* 144: 893-901.
- Bustnes JO, Tveraa T, Henden JA, Varpe Ø, Janssen K & Skaare JU (2006). Organochlorines in Antarctic and Arctic avian top predators: a comparison between the south polar skua and two species of northern hemisphere gulls. *Environmental science & technology* 40(8): 2826-2831.
- Cabral MJ (coord.), Almeida J, Almeida PR, Dellinger T, Ferrand de Almeida N, Oliveira ME, Palmeirim JM, Queiroz AI, L Rogado L & Santos-Reis M (eds.) (2005). *Livro Vermelho dos Vertebrados de Portugal*. Instituto da Conservação da Natureza, Lisboa
- Calado JG, Ramos JA, Almeida A, Oliveira N & Paiva VH (2021). Seabird-fishery interactions and bycatch at multiple gears in the Atlantic Iberian coast. *Ocean & Coastal Management* 200: 105306.
- Calderón J & Fagundes AI (2022). *Seabird and Marine Mammal Monitoring Network (RAM)*. Report for 2020-2021 in Portugal mainland. Sociedade Portuguesa para o Estudo das Aves. Lisboa.
- Camphuysen KCJ & Garthe S (2004). Recording foraging seabirds at sea standardised recording and coding of foraging behaviour and multi-species foraging associations. *Atlantic Seabirds* 6: 1-32.
- Campioni L, Ventura F, Granadeiro JP, Madeiros J, Gjerdrum C & Silva MC (2023). Combining bio-logging, stable isotopes and DNA metabarcoding to reveal the foraging ecology and diet of the endangered Bermuda petrel *Pterodroma cahow*. *Marine Ecology Progress Series* 723: 151-170.
- Campos A & Granadeiro JP (1999). Breeding Biology of White-faced Storm-Petrel *Pelagodroma marina* in Selvagem Grande Island, North-east Atlantic. *Waterbirds* 22: 199-206
- Carboneras C, Derhé M & Ramírez I (2013). *Update on the population status and distribution of Mediterranean shearwaters*. Report to Seventh Meeting of the ACAP Advisory Committee. La Rochelle, France, 6-10 May 2013.
- Cardoso PG, Dolbeth M, Sousa R, Relvas P, Santos R, Silva A & Quintino V (2019). The Portuguese coast. In *World Seas: an Environmental Evaluation* (2ª edição, Volume 1). Academic Press: 189-208.
- Careen NG, Collins SM, D'Entremont KJN, Wight J, Rahman I, Hargan KE, Lang AS & Montevicchi WA (2024). Highly pathogenic avian influenza virus resulted in unprecedented reproductive failure and movement behaviour by northern gannets. *Marine Ornithology* 52(1): 121-128.
- Carneiro APB, Dias MP, Clark BL, Pearmain EJ, Handley J, Hodgson AR, Croxall JP, Phillips RA, Oppel S, Morten JM, Lascelles B, Cunningham C, Taylor FE, Miller MGR, Taylor PR, Bernard A, Grémillet D & Davies TE (2024). The BirdLife Seabird Tracking Database: 20 years of collaboration for marine conservation. *Biological Conservation* 299: 110813.
- Carney K & Sydeman W (1999). A Review of Human Disturbance Effects on Nesting Colonial Water-birds. *Waterbirds* 22(1): 68-79.
- Carreiro AR, Bried J, Deakin Z, Jones KB, Thomas RJ, Symondson WOC, Ramos JA & Medeiros R (2022). First Insights into the diet composition of Madeiran and Monteiro's Storm Petrels (*Hydrobates castro* and *H. monteiroi*) Breeding in the Azores. *Waterbirds* 44: 300-307.
- Carreiro AR, Paiva VH, Medeiros R, Franklin KA, Oliveira N, Fagundes AI & Ramos JA (2020) Metabarcoding, stables isotopes, and tracking: unraveling the trophic ecology of a winter-breeding storm petrel (*Hydrobates castro*) with a multimethod approach. *Marine Biology* 167:14.
- Carvalho AT (2012). *Ecologia alimentar de duas aves pelágicas das Ilhas Selvagens*. Dissertação para obtenção de grau de Mestre em Biologia da Conservação. Faculdade de Ciências da Universidade de Lisboa, Lisboa.
- Casero MV, Turner AD, Ben-Gigirey B, Alexander RP, Dean KJ, Hatfield RG, Maskrey BH, Mazuet C, Karamendin K & Mateo R (2025). Identifying causative agents of a parietic syndrome in waterbirds in Southern Portugal. *Toxins* 17(2) 62: 1-17.
- Casero MVM, Ramos JA & Pereira L (2022). Seabirds and biotoxins. In Ramos JA & Pereira L (eds.). *Seabird Biodiversity and Human Activities*. CRC Press: 125-133.
- Catry P (2011). Breve resenha sobre o rabijunco-riscado *Phaethon aethereus* no mar português: uma espécie em expansão? *Airo* 21: 24-30.
- Catry P, Campos A, Catry T, Assis CA, Pereira S & Granadeiro JP (2017). Diet of great cormorants *Phalacrocorax carbo* in the Sado estuary, Portugal, and possible impacts on local fisheries and aquaculture. *Airo* 24: 36-46.
- Catry P, Costa H, Elias G & Matias R (2010a). *Aves de Portugal, Ornitologia do Território Continental*. Assírio e Alvim, Lisboa
- Catry P, Dias M, Catry T, Pedro P, Tenreiro P, Menezes D (2015). Bulwer's petrels breeding numbers on the Desertas Islands (Madeira): improved estimates indicate the NE Atlantic population to be much larger than previously thought. *Airo* 23: 10-14.
- Catry P, Dias M, Menezes D, Oliveira P, Lopes D, Alho M, Campioni L, Catry T, Gatt MC, Ventura F, Romero J & Granadeiro JP (2025). Fixed-plot monitoring as a tool to assess population trends of underground nesting seabirds: an example with Cory's Shearwater at its world's largest colony. *Bird Conservation International* 35: e3.
- Catry P, Dias M, Phillips RA & Granadeiro JP (2011a). Different means to the same end: long-distance migrant seabirds from two colonies differ in behaviour, despite common wintering grounds. *PLoS ONE* 6: e26079
- Catry P, Geraudes P, Pio JP & Almeida A (2010b). Aves marinhas da Selvagem Pequena e do Ilhéu de Fora: censos e notas, com destaque para a dieta da gaivota-de-patas-amarelas. *Airo* 20: 29-35
- Catry P, Tomé R & Cardoso AC (1997). Biologia da reprodução e estatuto da Gaivina-dos-pauis *Chlidonias hybridus* no Paul do Boquilobo. *Airo* 8: 7-15.
- Catry T, Alves JA, Andrade J, Costa H, Dias MP, Fernandes P, Leal A, Lourenço PM, Martins RC, Moniz F, Pardal S, Rocha A, Santos CD, Encarnação V & Granadeiro JP (2011b). Long-term declines of wader populations at the Tagus estuary, Portugal: a response to global or local factors? *Bird Conservation International* 21: 438-453.
- Catry T, Ramos JA, Catry I, Allen-Revez M & Grade M (2004). Are salinas a suitable alternative breeding habitat for Little Terns? *Ibis* 146: 247-257.
- Catry T, Ramos JA, Catry I, Allen-Revez M & Grade M (2004). Are salinas a suitable alternative breeding habitat for Little Terns? *Ibis* 146: 247-257.
- Catry T, Ramos JA, Martins J, Peste F, Trigo S, Paiva VH, Almeida A, Luís A, Palma J & Andrade PJ (2006). Intercolony and annual differences in the diet and feeding ecology of little tern adults and chicks in Portugal. *Condor* 108: 366-376.
- Catry T, Ventura F, Dias MP, Santos CD, Martins RC, Palmeirim JM & Granadeiro JP (2021). Estimating the conservation cost of the projected new international Lisbon airport for migratory shorebirds of the Tagus estuary, Portugal. *Bird Conservation International* 32(2): 232-245.
- Ceia FR, Silva NC, Paiva VH, Morais L, Serrão EA & Ramos JA (2023). Gulls as indicators of environmental changes in the North Atlantic: A long-term study on Berlenga Island, Western Portugal. *Diversity* 15: 1148.

- Cerveira L, Pereira JM, Verissimo SN, Paiva VH & Ramos JA (2025). Spatial and trophic ecology of the estuarine Little Tern *Sternula albifrons*. *Current Zoology* 71: 603-612.
- Chatwin TA, Joy R & Burger AE (2013). Set-back distances to protect nesting and roosting seabirds off Vancouver Island from boat disturbance. *Waterbirds* 36(1): 43-52.
- Christel I, Certain G, Cama A, Vieites, DR & Ferrer X (2013). Seabird aggregative patterns: A new tool for offshore wind energy risk assessment. *Marine pollution bulletin* 66(1-2): 84-91.
- Cidraes-Vieira N (1992). *Ecologia do ostraceiro Haematopus ostralegus na Ria Formosa - flutuações populacionais, alimentação e impacto na moluscicultura*. Relatório de Estágio. Faculdade de Ciências da Universidade de Lisboa, Lisboa.
- Cimiotti DV, Eberhart-Hertel L, Audevard A, Garcias Salas PJ, Gelinaud, G, Günther K, Rocha AD, Schulz R, van der Winden J, Schmaljohann H, & Küpper C (2024). Dispersal in Kentish Plovers (*Charadrius alexandrinus*): adult females perform furthest movements. *Journal of Ornithology* 165: 301–314.
- Clark BL, Carneiro AP, Pearmain EJ, et al. (2023). Global assessment of marine plastic exposure risk for oceanic birds. *Nature Communications* 14:3665.
- Codina-García M, Militão T, Moreno J & González-Solís J (2013). Plastic debris in Mediterranean seabirds. *Marine pollution bulletin* 77(1): 220-226.
- Copping AE, Hemery LG, Overhus DM, Garavelli L, Freeman MC, Whiting JM, Gorton AM, Farr HK, Rose DJ & Tugade LG (2020). Potential environmental effects of marine renewable energy development—the state of the science. *Journal of Marine Science and Engineering* 8(11): 879.
- Correia A, Ramos JA & Paiva VH (2016). Identifying the diet of the Little Tern (*Sternula albifrons*). *Waterbirds* 39: 318-322.
- Correia-Fagundes C, Romano H, Zino FJA & Biscoito M (2021). Birds of the archipelagos of Madeira and the Selvagens III. New records and checklist update (2010–2020). *Boletim do Museu de História Natural do Funchal* LXXI: 5-20.
- Cortés V, Arcos JM & González-Solís J (2017). Seabirds and demersal longliners in the northwestern Mediterranean: factors driving their interactions and bycatch rates. *Marine Ecology Progress Series* 565: 1-16.
- Costa H, Araújo A, Farinha JC, Poças MC & Machado AM (2000). Nomes Portugueses das Aves do Paleártico Ocidental. Assírio & Alvim, Lisboa.
- Costa LT & Granadeiro JP (1997). The cormorant *Phalacrocorax carbo* in Portugal. *Ekologia Polska* 45(1): 39-42.
- Costa LT & Rufino R (1996). Contagens de aves aquáticas em Portugal – Janeiro de 1996. *Airo* 7:69-76.
- Costa R, Sá S, Pereira A, Ângelo A, Vaqueiro J, Ferreira M & Eira C (2020). Prevalence of entanglements of seabirds in marine debris in the central Portuguese coast. *Marine Pollution Bulletin* 161: 111746.
- Costa RA, Pereira AT, Costa E, Henriques AC, Miodonski J, Ferreira M, Vingada JV & Eira C (2019). Razorbill *Alca torda* mortality in the Portuguese west coast. *European Journal of Wildlife Research* 65: 1-7.
- Costa RA, Sá S, Pereira AT, Ferreira M, Vingada J & Eira C (2021). Threats to seabirds in Portugal: integrating data from a rehabilitation centre and stranding network. *European Journal of Wildlife Research* 67: 41.
- Costa RA, Tavares AS, Hilário FV, Vaqueiro J, Ferreira M, Sá S, Monteiro SS, Torres-Pereira A & Eira C (2026). Atlantic Puffin *Fratercula arctica* mortality along the Portuguese west coast in early 2023. *Marine Ornithology* 54(2): 21–28.
- Coulson JC (2016). A Review of philopatry in seabirds and comparisons with other waterbird species. *Waterbirds* 39(3): 229-240.
- Courchamp F, Chapuis JL & Pascal M (2003). Mammal invaders on islands: impact, control and control impact. *Biological reviews* 78(3): 347-383.
- Cramp S & Simmons KEL (eds.) (1977). *The birds of the Western Palearctic*, Vol.I. Oxford University Press, Oxford, New York
- Crawford RJ, Makhado AB, Waller LJ & Whittington PA (2014). Winners and losers—responses to recent environmental change by South African seabirds that compete with purse-seine fisheries for food. *Ostrich* 85(2): 111-117.
- Croxall JP, Butchart SH, Lascelles BE, Stattersfield AJ, Sullivan BE, Symes A & Taylor PH (2012). Seabird conservation status, threats and priority actions: a global assessment. *Bird Conservation International* 22(1): 1-34.
- Cruz-Flores M, Pradel R, Bried J, González-Solís J, Ramos R. (2021). Sex-specific costs of reproduction on survival in a long-lived seabird. *Biology Letters* 17: 20200804.
- Cruz-Flores M, Pradel R, Bried J, Militão T, Neves VC, González-Solís J & Ramos R (2022). Will climate change affect the survival of tropical and subtropical species? Predictions based on Bulwer's petrel populations in the NE Atlantic Ocean. *Science of The Total Environment* 847:157352.
- Cruz-Flores M, Ramos R, Sardà-Serra M, López-Souto S, Militão T & González-Solís J (2019). *Migración y ecología espacial de la población española de petrel de Bulwer*. Monografía n.º 4 del programa Migra. SEO/BirdLife. Madrid.
- Crymble J, Mula-Laguna, J., Austad M, Borg JJ, Sultana J, Barbara N, Tribe A, Lago P & Metzger B (2020). Identifying light-induced grounding hotspots for Maltese seabirds. *Il-Merill* 34: 23-43.
- Cuthbert RJ (2005). Breeding biology, chick growth and provisioning of Great Shearwaters (*Puffinus gravis*) at Gough Island, South Atlantic Ocean. *Emu* 105 (4): 305-310.
- Daunt F & Mitchell I (2013). Impacts of climate change on seabirds. *MCCIP Science Review* 2013: 125-133.
- Davies TE, Carneiro APB, Tarzia M, Wakefield ED, Hennicke JC, Frederiksen M, Hansen ES, Campos B, Hazin C, Lascelles B, Anker-Nilssen T, Arnardóttir H, Barrett RT, Biscoito M, Bollache L, Boulinier T, Catry P, Ceia FR, Chastel O, Christensen-Dalsgaard S, Cruz-Flores M, Danielsen J, Daunt F, Dunn E, Egevang C, Fagundes AI, Fayet al, Fort J, Furness RW, Gilg O, González-Solís J, Granadeiro JP, Grémillet D, Guilford T, Hanssen SA, Harris MP, Hedd A, Huffeldt NP, Jessopp MJ, Kolbeinsson Y, Krietsch J, Lang J, Linnebjerg JF, Lorentsen S-H, Madeiros J, Magnúsdóttir E, Mallory ML, McFarlane L, Merkel FR, Militão T, Moe B, Montevecchi WA, Morera-Pujol V, Mosbech A, Neves VC, Newell MA, Olsen B, Paiva VH, Peter H-U, Petersen A, Phillips RA, Ramírez I, Ramos JA, Ramos R, Ronconi RA, Ryan PG, Schmidt NM, Sigurðsson IA, Sittler B, Steen H, Stenhouse IJ, Strøm H, Systad GHR, Thompson PM, Thórarinnsson TL, van Bemmelen RSA, Wanless S, Zino F & Dias MP (2021). Multispecies tracking reveals a major seabird hotspot in the North Atlantic. *Conservation Letters* 14(5): e12824.
- Dawson RJG, Parkin DT, Cubitt M, Won P-O & Zino FJA (1995). DNA amplification and sequencing of unidentified dark-rumped *Oceanodroma* Storm-petrels (Aves) in the North Atlantic Ocean. *Boletim Museu Municipal Funchal* 4: 201-210.
- De la Cruz A, Pereira JM, Arroyo GM, Ramos JA, Alonso H, Arcos JM, Ramos F, Tornero J, Saavedra C, Vázquez JA, García-Barón I, Astarloa A, Louzao M, Laran S, Dorémus G, Waggitt J & Paiva VH (2025). Global distribution, threats and population trends of the critically endangered Balearic shearwater *Puffinus mauretanicus*. *Biological Conservation* 305: 111047.
- De la Cruz A, Pereira JM, Paiva VH, Ramos JA, Oliveira N, Alonso H, Saavedra C, Vázquez JA, García-Barón I, Arcos JM & Arroyo GM (2023). Using long-term data series to design adequate protected areas that ensure the conservation of inconspicuous small petrel species. *Journal of Applied Ecology* 60: 2586–2601.
- De la Cruz A, Ramos F, Tornero J, Rincón MM, Jiménez MP & Arroyo GM (2022a). Seabird distribution is better predicted by abundance of prey than oceanography. A case study in the Gulf of Cadiz (SW, Iberian Peninsula). *ICES Journal of Marine Science* 79: 204–217.
- de la Cruz A, Rollán L, Pérez B, Guerrero M, Elorriaga J, Benjumea R, González M, Seminario Y, Arroyo GM & Ramírez J (2022b). Phenology and wintering population estimates of auks in the Mediterranean Sea based on counts from a strategic coastal location in the Strait of Gibraltar. *Ardeola* 69 (2): 303-317.
- Defos du Rau, Bourgeois K, Thévenet M, Ruffino L, Dromée S, Ouni O, Abiadh A, Estève R, Durand J-P, Anselme L, Faggio G, Yahya JM, Rguibi H, Renda M, Miladi B, Hamrouni H, Alilech S, Neffa A, Jaouadi W, Agrebi S & Renou S (2015). Reassessment of the size of the Scopoli's Shearwater population at its main breeding site resulted in a tenfold increase: implications for the species conservation. *Journal of Ornithology* 156: 877-892.
- Degraer S, Carey DA, Coolen JW, Hutchison ZL, Kerckhof F, Rumes B & Vanaverbeke J (2020). Offshore wind farm artificial reefs affect ecosystem structure and functioning. *Oceanography* 33(4): 48-57.
- del Hoyo J, Elliot A & Sargatal J (eds.) (1996). *Handbook of the birds of the world*. Vol. 3. Lynx Edicions, Barcelona
- del Hoyo J, Elliott A & Sargatal J (eds.) (1992). *Handbook of the birds of the world*. Vol. 1. Lynx Edicions, Barcelona, Spain

- del Moral JC & Oliveira N (2019). *A galheta na Península Ibérica. População reprodutora em 2017 e método de censo*. SEO/BirdLife. Madrid
- Delany S & Scott D (2006). *Waterbird population estimates*. Wetlands International, Wageningen, The Netherlands.
- Delany S, Dodman T, Stroud D & Scott D (2009). *An atlas of wader population in Africa and western Eurasia*. Wetlands International, Wageningen.
- Derhé M (2012). Developing a population assessment for Scopoli's and Cory's Shearwaters *Calonectris diomedea/Calonectris borealis*. In Yésou P, Bacetti N & Sultana J (eds.). Ecology and Conservation of Mediterranean Seabirds and other bird species under the Barcelona Convention. *Proceedings of the 13th Medmaravis Pan-Mediterranean Symposium*. Alghero (Sardinia): 29-38.
- Di Cintio A, Niccolini F, Scipioni S & Bulleri F (2023). Avoiding “paper parks”: a global literature review on socioeconomic factors underpinning the effectiveness of marine protected areas. *Sustainability* 15(5): 4464.
- Dias E, Morais P, Leopold M, Campos J & Antunes C (2012). Natural born indicators: great cormorant *Phalacrocorax carbo* (Aves: Phalacrocoracidae) as monitors of river discharge influence on estuarine ichthyofauna. *Journal of Sea Research* 73: 101–108.
- Dias MP, Alho M, Granadeiro JP & Cattry P (2015a). Wanderer of the deepest seas: migratory behaviour and distribution of the highly pelagic Bulwer's petrel. *Journal of Ornithology* 156(4): 955-962.
- Dias MP, Granadeiro JP, Phillips RA, Alonso H & Cattry P (2011). Breaking the routine: individual Cory's shearwaters shift winter destinations between hemispheres and across ocean basins. *Proceedings of the Royal Society B* 278: 1786–1793
- Dias MP, Martin R, Pearmain EJ, Burfield IJ, Small C, Phillips RA, Yates O, Lascelles B, Garcia Borboroglu P & Croxall JP (2019). Threats to seabirds: a global assessment. *Biological Conservation* 237: 525-537.
- Dias MP, Oppel S, Bond AL, Carneiro APB, Cuthbert RJ, González-Solís J, Wanless RM, Glass T, Lascelles B, Small C, Phillips RA & Ryan PG (2017). Using globally threatened pelagic birds to identify priority sites for marine conservation in the South Atlantic Ocean. *Biological Conservation* 211: 76-84.
- Dias MP, Romero J, Granadeiro JP, Cattry T, Pollet IL & Cattry P (2016). Distribution and at-sea activity of a nocturnal seabird, the Bulwer's Petrel *Bulweria bulwerii*, during the incubation period. *Deep Sea Research Part I: Oceanographic Research Papers* 113: 49-56.
- Dierschke V, Markones N & Mercker M. (2022a). Pilot Assessment of Marine Bird Abundance – Non-Breeding Offshore Birds. In OSPAR (2023). *The 2023 Quality Status Report for the North-East Atlantic*. OSPAR Commission, London.
- Dierschke V, Marra S, Parsons M, Fusi M & French G (2022b). Marine Bird Abundance. In OSPAR (2023). *The 2023 Quality Status Report for the North-East Atlantic*. OSPAR Commission, London.
- Doherty TS, Glen AS, Nimmo DG, Ritchie EG & Dickman CR (2016). Invasive predators and global biodiversity loss. *Proceedings of the National Academy of Sciences* 113(40): 11261-11265.
- Donald PF, Fishpool LDC, Ajagbe A, Bennun LA, Bunting G, Burfield IJ, Butchart SHM, Capellan S, Crosby MJ, Dias MP, Diaz D, Evans MI, Grimmett R, Heath M, Jones VR, Lascelles BG, Merriman JC, O'Brien M, Ramírez I, Waliczky Z & Wege DC (2019). Important Bird and Biodiversity Areas (IBAs): The development and characteristics of a global inventory of key sites for biodiversity. *Bird Conservation International* 29(2): 177–198.
- dos Santos I, Gonçalves AMM, Carreiro AR, Martins B, Rocha CP, Vieira C, Matos DM, Gutiérrez IB, Rodrigues I, Almeida N, Ramos JA, Paiva VH & Araújo PM (2023). Similar breeding performance despite inter-annual differences in diet composition of seabirds inhabiting a tropical environment. *Marine Ecology Progress Series* 725: 95–119.
- dos Santos I, Paiva VH, Norte AC, Churlaud C, Ceia FR, Pais de Faria J, Pereira JM, Cerveira LR, Laranjeiro MI, Veríssimo SN, Ramos JA & Bustamante P (2024). Assessing the impacts of trace element contamination on the physiology and health of seabirds breeding along the western and southern coasts of Portugal. *Environmental Pollution* 358: 124528.
- dos Santos I, Ramos JA, Ceia FR, Rodrigues I, Almeida N, Antunes S, Carreiro AR, Matos DM, Lopes RJ, Gerales P & Paiva VH (2022). Sexual segregation in the foraging distribution, behaviour, and trophic niche of the endemic Boyd's shearwater (*Puffinus lherminieri boydi*). *Marine Biology* 169: 144.
- Drewitt AL & Langston RH (2006). Assessing the impacts of wind farms on birds. *Ibis* 148: 29-42.
- Dunn EK & Steel C (2001). *The impact of long-line fishing on seabirds in the North east Atlantic: recommendations for reducing mortality*. RSPB/JNCC, Sandy, England.
- Durant J, Anker-Nilssen T & Stenseth NC (2003). Trophic interactions under climate fluctuations: the Atlantic puffin as an example. *Proceedings of the Royal Society of London Series B* 270: 1461-1466.
- eBird (2026). *eBird: An online database of bird distribution and abundance (web application)*. eBird, Cornell Lab of Ornithology, Ithaca, New York. Downloaded from <http://www.ebird.org> on 02.02.2026.
- Egevang C, Stenhouse IJ, Phillips RA, Petersen A, Fox JW & Silk JRD (2010). Tracking of Arctic terns *Sterna paradisaea* reveals longest animal migration. *Proceedings of the National Academy of Sciences* 107(5): 2078–2081.
- Elias G & Leitão D (1992). A nidificação da Andorinha-do-mar-comum *Sterna hirundo* em Portugal Continental. *Airo* 3 (3): 86-88.
- Elias G, Reino LM, Silva T, Tomé R & Gerales P (coords.) (1998). *Atlas das aves invernantes do Baixo Alentejo*. Sociedade Portuguesa para o Estudo das Aves, Lisboa.
- Elmberg J, Hirschfeld E, Cardoso H & Hessel R (2020). Seabird migration at Cabo Carvoeiro (Peniche, Portugal) in autumn 2015. *Marine Ornithology* 48: 231-244.
- Equipa Atlas (2018). *Atlas das Aves Nidificantes em Portugal (1999-2005)*. Instituto da Conservação da Natureza e da Biodiversidade, Sociedade Portuguesa para o Estudo das Aves, Parque Natural da Madeira e Secretaria Regional do Ambiente e do Mar. Assírio & Alvim, Lisboa.
- Equipa Atlas (2018). *Atlas das Aves Invernantes e Migradoras de Portugal 2011-2013*. Sociedade Portuguesa para o Estudo das Aves, LabOr-Laboratório de Ornitologia – ICAAM - Universidade de Évora, Instituto da Conservação da Natureza e das Florestas, Instituto das Florestas e Conservação da Natureza (Madeira), Secretaria Regional da Energia, Ambiente e Turismo (Açores) e Associação Portuguesa de Anilhadores de Aves. Lisboa.
- Equipa Atlas (2022). *III Atlas das Aves Nidificantes de Portugal (2016-2021)*. SPEA, ICNF, LabOr/UE, IFCN. Portugal.
- Ercal N, Gurer-Orhan H & Aykin-Burns N (2001). Toxic metals and oxidative stress part I: mechanisms involved in metal-induced oxidative damage. *Current topics in medicinal chemistry* 6: 529-539.
- Erwin CA & Congdon BC (2007). Day-to-day variation in sea-surface temperature reduces sooty tern *Sterna fuscata* foraging success on the Great Barrier Reef, Australia. *Marine Ecology Progress Series* 331: 255-266.
- European Environment Agency (2025). *Oil spills in Europe's seas (Signal)*. Downloaded from <https://www.eea.europa.eu/en/european-zero-pollution-dashboards/indicators/oil-spills-in-europes-seas> on 30.11.2025.
- European Food Safety Authority (2024). Avian influenza overview June–September 2024. *EFSA Journal* 22(10): e9057.
- Exo K, Hüppop O & Garthe S (2003). Birds and offshore wind farms: a hot topic in marine ecology. *Wader Study Group Bulletin* 100: 50-53.
- Fagundes AI & Cattry P (2022). Projeto Arenaria, 2009–2022. In Alonso H, Andrade J, Teodósio J & Lopes A (coords.). *O estado das aves em Portugal, 2022* (2nd ed.). Sociedade Portuguesa para o Estudo das Aves.
- Fagundes AI, Godinho C, Ramos JA, Oliveira N, Andrade J, Alonso H, Silva E, Ferreira A, Meirinho A, Santos A, Santos C, Cardoso H, Rocha L, Mendes M, Barros N, Ramalho P, Caldeira T & Paiva VH (2024). Temporal Changes in Migratory Seabird Abundance on the Portuguese Coast Revealed by a Citizen Science Project. *Ardeola* 71(1): 119-143.
- Fagundes AI, Ramos JA, Ramos U, Medeiros R & Paiva VH (2016). Breeding biology of a winter-breeding procellariiform in the North Atlantic, the Macaronesian shearwater *Puffinus lherminieri baroli*. *Zoology* 119: 421–429.
- Falcão M & Vale C (2003). Nutrient dynamics in a coastal lagoon (Ria Formosa, Portugal): The importance of lagoon-sea water exchanges on the biological productivity. *Ciencias marinhas* 29(4): 425-433.
- Falk K, Jensen JK & Kampp K (1992). Winter diet of Atlantic Puffins (*Fratercula arctica*) in the northeast Atlantic. *Colonial Waterbirds* 15: 230–235.
- Farinha JC & Costa H (1999). Aves aquáticas de Portugal. Instituto de Conservação da Natureza, Lisboa
- Fayet al, Freeman R, Anker-Nilssen T, Diamond A, Erikstad KE, Fifield D, Fitzsimmons MG, Hansen ES, Harris MP, Jessopp M, Kouwenberg AL, Kress S, Mowat S, Perrins CM, Petersen A, Petersen IK, Reiertsen TK, Robertson GJ, Shannon P, Sigurðsson IA, Shoji A, Wanless S & Guilford T (2017). Ocean-wide drivers of migration strategies

- and their influence on population breeding performance in a declining seabird. *Current Biology* 27: 3871–3878.e3.
- Fayet *al*, Freeman R, Shoji A, Boyle D, Kirk H, Dean BJ, Perrins CM & Guilford T (2016). Drivers and fitness consequences of dispersive migration in a pelagic seabird. *Behavioral Ecology* 27(4): 1061–1072.
- Fernandes RR, Ramos JA, de Faria JP, Matos DM, dos Santos I, Oliveira N, Rodrigues P & Paiva VH (2025). Year-round colony-level differences in foraging behaviour and diel activity of yellow-legged gulls from natural and urban colonies. *Journal of Zoology* 328: 256–270.
- Ferreira S, Sousa M, Picado A, Vaz N & Dias JM (2022). New insights about upwelling trends off the Portuguese coast: An ERA5 dataset analysis. *Journal of Marine Science and Engineering* 10(12): 1849.
- Fijn RC (2024). *Tracking terns: Year-round movement ecology of sandwich terns in a changing marine environment*. PhD thesis, University of Amsterdam, the Netherlands.
- Fijn RC, Hiemstra D, Phillips RA & van der Winden J (2013). Arctic Terns *Sterna paradisaea* from The Netherlands migrate record distances across three oceans to Wilkes Land, East Antarctica. *Ardea* 101: 3–12.
- Finlayson JC (1992). *Birds of the Strait of Gibraltar*. T & AD Poyser, London, UK.
- Fletcher (2022). *Exploring the migration and reproduction of Common Ringed Plovers (Charadrius hiaticula) breeding in Iceland*. Master thesis. University of Akureyri and University Centre of the Westfjords. Master of Resource Management: Coastal and Marine Management.
- Fliessbach KL, Borkenhagen K, Guse N, Markones N, Schwemmer P & Garthe S (2019). A ship traffic disturbance vulnerability index for Northwest European seabirds as a tool for marine spatial planning. *Frontiers in Marine Science* 6: 192.
- Flood B & Fisher A (2011). Multimedia Identification Guide to North Atlantic Seabirds: Storm-petrels and Bulwer's Petrel. Pelagic Birds & Birding Multimedia Guides.
- Flood B, Romano H & Correia-Fagundes C (2013). The first confirmed South Polar Skua for Madeira. *Birding World* 26(6): 248–252.
- Flood RL (2009). "All dark" *Oceanodroma* storm petrels in the Atlantic and neighbouring seas. *British Birds* 102: 365–385.
- Flood RL, López-Velasco D, Sutherland K & Newell D (2024). Identification of Great Skua and South Polar Skua in north-eastern Atlantic Ocean in autumn. *Dutch Birding* 46: 217–244.
- Fontaine R, Gimenez O & Bried J (2011). The impact of introduced predators, light-induced mortality of fledglings and poaching on the dynamics of the Cory's shearwater (*Calonectris diomedea*) population from the Azores, northeastern subtropical Atlantic. *Biological Conservation* 144: 1998–2011.
- Fort J, Pettex E, Tremblay Y, Lorentsen SH, Garthe S, Votier S, Pons JB, Siorat F, Furness RW, Grecian WJ, Bearhop S, Montevecchi WA & Grémillet D (2012). Meta-population evidence of oriented chain migration in northern gannets (*Morus bassanus*). *Frontiers in Ecology and the Environment* 10(5): 237–242.
- Frade M, Carvalho F, Samel V, Oliveira N, Almeida A, Andrade J, Gonçalves JMS & Marçalo A (2025). Mitigation measures to reduce seabird's interactions with bottom-set nets in southern Iberia. *Ocean & Coastal Management* 268: 107767.
- Frederiksen M, Descamps S, Erikstad KE, Gaston AJ, Gilchrist HG, Grémillet D, Johansen KL, Kolbeinsson Y, Linnebjerg JF, Mallory ML, McFarlane Tranquilla LA, Merkel FR, Montevecchi WA, Mosbech A, Reiertsen TK, Robertson GJ, Steen H, Strøm H & Thórarinnsson TL (2016). Migration and wintering of a declining seabird, the thick-billed murre *Uria lomvia*, on an ocean basin scale: Conservation implications. *Biological Conservation* 200: 26–35.
- Frederiksen M, Dierschke V, Marra S, Parsons M, French G, Fusi M, Schekkerman H, Anker-Nilssen T & Mitchell I (2022). Marine Bird Breeding Productivity. In OSPAR (2023). *The 2023 Quality Status Report for the North-East Atlantic*. OSPAR Commission, London.
- Frederiksen M, Moe B, Daunt F Phillips RA, Barrett RT, Bogdanova MI, Boulinier T, Chardine JW, Chastel O, Chivers LS, Christensen-Dalsgaard S, Clément-Chastel C, Colhoun K, Freeman R, Gaston AJ, González-Solis J, Goutte A, Grémillet D, Guilford T, Jensen, GH, Krasnov Y, Lorentsen SH, Mallory ML, Newell M, Olsen B, Shaw D, Steen H, Strøm H, Systad GH, Thórarinnsson TL & Anker-Nilssen T (2012). Multicolony tracking reveals the winter distribution of a pelagic seabird on an ocean basin scale. *Diversity and Distributions* 18: 530–542.
- Frederiksen M, Wanless S, Harris MP, Rothery P & Wilson LJ (2004). The role of industrial fisheries and oceanographic change in the decline of North Sea black-legged kittiwakes. *Journal of Applied Ecology* 41: 1129–1139.
- Furness RW (2003). Impacts of fisheries on seabird communities. *Scientia Marina* 67(S2): 33–45.
- Furness RW & Camphuysen CJ (1997). Seabirds as monitors of the marine environment. *ICES Cooperative Research Report* 225: 1–252.
- Furness RW, Crane JE, Bearhop S, Garthe S, Käckelä A, Käckelä R, Kelly A, Kubetzki U, Votier SC & Waldron S (2006). Techniques to link migration patterns of seabirds with diet specialization, condition and breeding performance. *Ardea* 94: 631–638
- Furness RW, Wade HM & Masden EA (2013). Assessing vulnerability of marine bird populations to offshore wind farms. *Journal of environmental management* 119: 56–66.
- Furness RW, Wade HM, Robbins AM & Masden EA (2012). Assessing the sensitivity of seabird populations to adverse effects from tidal stream turbines and wave energy devices. *ICES Journal of Marine Science* 69(8): 1466–1479.
- Furtado R, Granadeiro JP, Gatt MC, Rounds R, Horikohi K, Paiva VH, Menezes D, Pereira E & Cattray P (2021). Monitoring of mercury in the mesopelagic domain of the Pacific and Atlantic oceans using body feathers of Bulwer's petrels as bioindicators. *Science of the Total Environment* 775: 145796.
- Furtado R, Menezes D, Santos CJ & Cattray P (2016). White-faced storm-petrels *Pelagodroma marina* preyed by gulls as biological monitors of plastic pollution in the pelagic subtropical Northeast Atlantic. *Marine Pollution Bulletin* 112: 117–122.
- García L, Viada C, Moreno-Opo R, Carboneras C, Alcalde A & González F (2003). *Impacto de la marea negra del "Prestige" sobre las aves marinas*. Madrid: SEO/BirdLife.
- García-Barcelona S, Ortiz de Urbina JM, de la Serna JM, Alot E & Macías D (2010). Seabird by-catch in Spanish Mediterranean large pelagic logline fisheries, 1998–2008. *Aquatic Living Resources* 23: 363–371.
- Garthe S, Peschko V, Fiefield DA, Borkenhagen K, Nyegaard T & Dierschke J (2024). Migratory pathways and winter destinations of Northern Gannets breeding at Helgoland (North Sea): known patterns and increasing importance of the Baltic Sea. *Journal of Ornithology* 165: 869–880.
- Garthe S, Schwemmer H, Peschko V, Markones N, Müller S, Schwemmer P & Mercker M (2023). Large-scale effects of offshore wind farms on seabirds of high conservation concern. *Scientific Reports* 13(1): 4779.
- Gaston KJ, Davies TW, Nedelec SL, & Holt LA (2017). Impacts of artificial light at night on biological timings. *Annual Review of Ecology, Evolution, and Systematics* 48(1): 49–68.
- Genovart M, Arcos JM, Álvarez D, McMin M, Meier R, Wynn RB, Guilford T & Oro D (2016). Demography of the critically endangered Balearic shearwater: the impact of fisheries and time to extinction. *Journal of Applied Ecology* 53(4): 1158–1168.
- Genovart M, García D, Louzao M & Arcos JM (2019). *First conservation diagnosis of the Balearic Shearwater Puffinus mauretanicus in Ibiza*. Final report for ACAP. SEO/BirdLife, CSIC y IRBI.
- Genovart M, Sanz-Aguilar A, Fernández-Chacón A, Igual JM, Pradel R, Forero MG & Oro D (2013). Contrasting effects of climatic variability on the demography of a trans-equatorial migratory seabird. *Journal of Animal Ecology* 82: 121–130.
- Geraldes P (2002). *Plano de Acção para a Freira do Bugio*, Pterodroma feae: *Revisão e Actualização*. Relatório de Estágio. Faculdade de Ciências da Universidade de Lisboa, Lisboa.
- Gibble CM & Hoover BA (2018). Interactions between seabirds and harmful algal blooms. *Harmful algal blooms: A compendium desk reference*, 223–242.
- Gilg O, Moe B, Hanssen SA, Schmidt NM, Sittler B, Hansen J, Reneerkens J, Sabard B, Chastel O, Moreau J, Phillips RA, Oudman T, Biersma EM, Fenstad AA, Lang J & Bollache L (2013). Trans-equatorial migration routes, staging sites and wintering areas of a High-Arctic avian predator: The Long-tailed Skua (*Stercorarius longicaudus*). *PLoS ONE* 8(5): e64614.
- Gill F & Donsker D (eds.) (2019). *Loons, penguins, petrels*. IOC World Bird List v 9.1.
- Glass JP & Ryan PG (2013). Reduced seabird night strikes and mortality in the Tristan rock lobster fishery. *African Journal of Marine Science* 35(4): 589–592.

- Gomes FCB (2015). *Dieta da torda-mergulheira*, Alca torda, *capturada acidentalmente em Portugal Continental*. Dissertação de Mestrado em Ecologia. Universidade do Minho.
- González-Solís J, Felicísimo A, Fox JW, Afanasyev V, Kolbeinsson Y & Muñoz J (2009). Influence of sea surface winds on shearwater migration detours. *Marine Ecology Progress Series* 391: 221–230.
- Goutte A, Barbraud C, Meillère A, Carravieri A, Bustamante P, Labadie P, Budzinski H, Delord K, Cherel Y, Weimerskirch H & Chastel O (2014). Demographic consequences of heavy metals and persistent organic pollutants in a vulnerable long-lived bird, the wandering albatross. *Proceedings of the Royal Society B: Biological Sciences* 281(1787): 20133313.
- Gouveia CS (2022). Light Pollution as a Seabirds' Conservation Threat. In Ramos JA & Pereira L (eds.). *Seabird Biodiversity and Human Activities*. CRC Press: 211–222.
- Graham NAJ, Wilson SK, Carr P, Hoey AS, Jennings S & MacNeil MA (2018). Seabirds enhance coral reef productivity and functioning in the absence of invasive rats. *Nature* 559(7713): 250–253.
- Granadeiro JP (1991). The breeding biology of Cory's shearwater *Calonectris diomedea borealis* on Berlenga Island, Portugal. *Seabird* 13: 30–39
- Granadeiro JP, Andrade J & Palmeirim JM (2004). Modeling the distribution of shorebirds in estuarine areas using generalised additive models. *Journal of Sea Research* 52: 227–240.
- Granadeiro JP, Catry T, Catry P, Pereira S & Campos A (2013). *Distribuição e impacto do corvo-marinho-de-faces-brancas sobre as comunidades ictiológicas do estuário do Sado*. Relatório para o ICNF/Tróia-Natura, Lisboa.
- Granadeiro JP, Dias M, Rebelo R, Santos C & Catry P (2006). Numbers and population trends of Cory's shearwater *Calonectris diomedea* at Selvagem Grande, Northeast Atlantic. *Waterbirds* 29: 56–60.
- Granadeiro JP, Grade N, Lecoq M, Morais L, Santos C & Silva MC (1998). Breeding Madeiran Storm-petrels *Oceanodroma castro* on the Farilhões islands, Portugal. *Proceedings of the IV Mediterranean Seabird Symposium: Seabird Ecology and Coastal Zone Management in the Mediterranean*.
- Granadeiro JP, Monteiro LR, Silva MC & Furness RW (2002). Diet of common terns in the Azores, Northeast Atlantic. *Waterbirds* 25: 149–155.
- Granadeiro JP, Silva MA, Fernandes C & Reis A (1997). Beach bird surveys in Portugal 1990–1996. *Ardeola* 44(1): 9–17.
- Grecian WJ, Williams HJ, Votier SC, Bearhop S, Cleasby IR, Grémillet D, Hamer KC, Le Nuz M, Lescroët A, Newton J, Patrick SC, Phillips RA, Wakefield ED & Bodey TW (2019). Individual Spatial Consistency and Dietary Flexibility in the Migratory Behavior of Northern Gannets Wintering in the Northeast Atlantic. *Frontiers in Ecology and Evolution* 7: 214.
- Grémillet D & Boulinier T (2009). Spatial ecology and conservation of seabirds facing global climate change: a review. *Marine Ecology Progress Series* 391: 121–137.
- Grémillet D, Ponchon A, Paleczny M, Palomares ML, Karpouzi V & Pauly D (2018). Persisting worldwide seabird-fishery competition despite seabird community decline. *Current Biology* 28(24): 4009–4013.
- Grimaldi W, Jabour J & Woehler EJ (2011). Considerations for minimising the spread of infectious disease in Antarctic seabirds and seals. *Polar Record* 47(1): 56–66.
- Guilford T, Freeman R, Boyle D, Dean B, Kirk H, Phillips R & Perrins C (2011). A Dispersive Migration in the Atlantic Puffin and its Implications for Migratory Navigation. *PLoS ONE* 6(7): e21336
- Guilford T, Meade J, Willis J, Phillips RA, Roberts S, Collett T, Freeman R & Perrins CM (2009). Migration and stopover in a small pelagic seabird, the Manx Shearwater *Puffinus puffinus*: insights from machine learning. *Proceedings of the Royal Society B* 276: 1215–1223.
- Guilford T, Wynn R, McMinn M, Rodríguez A, Fayet A, Maurice L, Jones A & Meier R (2012). Geolocators reveal migration and pre-breeding behaviour of the critically endangered Balearic shearwater *Puffinus mauretanicus*. *PLoS One* 7(3): e33753.
- Guilherme JL, Morais B, Alonso H, Andrade J, Almeida A, Barros N & Dias MP (2023). *Mapping seabird and marine biodiversity sensitivity to marine wind farm expansion in Portugal | Mapeamento da sensibilidade das aves marinhas à energia eólica no mar em Portugal* (Versão 1). Sociedade Portuguesa para o Estudo das Aves (SPEA).
- Gutiérrez-Arnal J & Marin C (2024). The latent threat in wild birds: *Clostridium botulinum*. *Veterinary Sciences* 11(1): 36.
- Häkkinen H, Petrovan SO, Taylor NG, Sutherland WJ & Pettorelli N (2023). *Seabirds in the North-East Atlantic: Climate change vulnerability and potential conservation actions*. Open Book Publishers.
- Hario M, Himberg K, Hollmén T & Rudbäck E (2000). Polychlorinated biphenyls in diseased lesser black-backed gull (*Larus fuscus fuscus*) chicks from the Gulf of Finland. *Environmental Pollution* 107(1): 53–60.
- Harris MP (1962). Recoveries of ringed Great Black-backed Gull as shown in ringing data. *Bird Study* 17: 174–182.
- Harris MP, Daunt F, Newell M, Phillips RA & Wanless S (2010). Wintering areas of adult Atlantic puffins *Fratercula arctica* from a North Sea colony as revealed by geolocation technology. *Marine Biology* 157(4): 827–836.
- Hartert E & Ogilvie-Grant WR (1905). On the birds of the Azores. *Novitates Zoologicae* XII: 80–128.
- Harwood AJ & King S (2022). Seabirds and marine renewable energy sources. In Ramos JA & Pereira L (eds.). *Seabird Biodiversity and Human Activities*. CRC Press: 105–124.
- Hatch JM, Wiley D, Murray KT & Welch L (2016). Integrating satellite-tagged seabird and fishery-dependent data: A case study of Great Shearwaters (*Puffinus gravis*) and the U.S. New England sink gillnet fishery. *Conservation Letters* 9: 43–50.
- Hays H, Neves V & Lima P (2002). Banded Roseate Terns from different continents trapped in the Azores. *Journal of Field Ornithology* 73: 180–184.
- Hedd A & Montevecchi WA (2006). Diet and trophic position of Leach's storm-petrel *Oceanodroma leucorhoa* during breeding and moult, inferred from stable isotope analysis of feathers. *Marine Ecology Progress Series* 322: 291–301.
- Hedd A, Montevecchi W, Otley H, Phillips R & Field D (2012). Trans-equatorial migration and habitat use by sooty shearwaters *Puffinus griseus* from the South Atlantic during the nonbreeding season. *Marine Ecology Progress Series* 449: 277–290.
- Henriques AC (2010). *Impacto dos predadores introduzidos na Ilha do Corvo no sucesso reprodutor das populações de Cagarro* (*Calonectris diomedea borealis*). Dissertação para obtenção do Grau de Mestre em Gestão e Conservação dos Recursos Naturais, Instituto Superior de Agronomia, Universidade Técnica de Lisboa e Universidade de Évora.
- Hermida M & Delgado J (2016). High trophic level and low diversity: Would Madeira benefit from fishing down? *Marine Policy* 73: 130–137.
- Hervías S, Henriques A, Oliveira N, Pipa T, Cowen H, Ramos J A, Nogales M, Gerales P, Silva C, Ybáñez R R & Oppel S (2013). Studying the effects of multiple invasive mammals on Cory's shearwater nest survival. *Biological Invasions* 15: 143–155.
- Higgins PJ & Davies SJJF (1996). *Handbook of Australian, New Zealand and Antarctic Birds*. Vol. 3: Snipe to Pigeons. Oxford University Press, Oxford.
- Hölker F, Moss T, Griefahn B, Kloas W, Voigt CC, Henckel D, Hänel A, Kappeler P, Völker S, Schwoppe A, Franke S, Uhrlandt D, Fischer J, Klenke R, Wolter C & Tockner K (2010). The dark side of light: a transdisciplinary research agenda for light pollution policy. *Ecology and society* 15(4).
- Hoogendoorn W, Adriaens P, Cederroth C, Smet G & Lindholm A (2003). Interesting gull records at Porto, Portugal, in March–April 2001. *Dutch Birding* 25(4): 235–246.
- Huettmann F, Diamond AW, Dalzell B & Macintosh K (2005). Winter distribution, ecology and movements of razorbills *Alca torda* and other auks in the outer Bay of Fundy, Atlantic Canada. *Marine Ornithology* 33: 161–171.
- Hulme PE (2007). Biological invasions in Europe: drivers, pressures, states, impacts and responses. In Hester RE, Harrison RM, Harrison R & Hester R (eds.). *Biodiversity Under Threat*. The Royal Society of Chemistry, Cambridge: 56–80.
- Hurling S, Hedd A, Hansen SH & Studholme K (2024). Year-round distribution and foraging behaviour of Icelandic Leach's and European Storm-petrel populations revealed. *Conference: 16th International Seabird Conference*. Coimbra, Portugal.
- Hutchinson CD & Neath B (1978). Little Gulls in Britain and Ireland. *British Birds* 71: 563–582.
- Hyrenbach KD & Veit RR (2003). Ocean warming and seabird communities of the southern Californian current system (1987–98): response at multiple temporal scales. *Deep-sea Research. Part II, Topical Studies in Oceanography* 50: 2537–2565.

- ICES (2023). Joint OSPAR/HELCOM/ICES Working Group on Seabirds (JWGBIRD; outputs from 2021 meeting). *ICES Scientific Reports* 5(19): 60 pp.
- ICES (2024). Working Group on Southern Horse Mackerel, Anchovy and Sardine (WGHANSA). *ICES Scientific Reports* 6(46): 761pp.
- Inch T, Nicoll MA, Feare CJ & Horswill C (2024). Population viability analysis predicts long-term impacts of commercial Sooty Tern egg harvesting to a large breeding colony on a small oceanic island. *Ibis* 166(4): 1296-1310.
- Irons DB, Anker-Nilssen T, Gaston AJ, Byrd GV, Falk K, Gilchrist HG, Hario M, Hjernerquist M, Krasnov YV, Mosbech A, Olsen B, Petersen A, Reid JB, Robertson GJ, Strom H & Wohl KD (2008). Fluctuations in circumpolar seabird populations linked to climate oscillations. *Global Change Biology* 14: 1455-1463.
- IUCN (2012). *IUCN Red List Categories and Criteria: Version 3.1*. Second edition. Gland, Switzerland and Cambridge, UK. IUCN. 32pp.
- IWC (2026). *Censo internacional de aves aquáticas*. Downloaded from <https://iwc.wetlands.org/index.php/nattotals> on 02.04.2026.
- Jagiello Z, Dylewski Ł, Tobolka M & Aguirre JI (2019). Life in a polluted world: a global review of anthropogenic materials in bird nests. *Environmental Pollution* 251: 717-722.
- James PC & Robertson HA (1985). First record of Swinhoe's storm petrel *Oceanodroma monorhis* in the Atlantic Ocean. *Ardea* 73: 105-106
- Jean-Michel L, Eric G, Romain B-B, Gilles G, Angélique M, Marie D, Clément B, Mathieu H, Olivier LG, Charly R, Tony C, Charles-Emmanuel T, Florent G, Giovanni R, Mounir B, Yann D & Pierre-Yves LT (2021). The Copernicus Global 1/12° Oceanic and Sea Ice GLORYS12 Reanalysis. *Frontiers in Earth Science* 9: 698876.
- Jenssen BM (1994). Effects of oil pollution, chemically treated oil, and cleaning on thermal balance of birds. *Environmental Pollution* 86(2): 207-215.
- Jesus AGC (2018). *Contribuição para a monitorização da negrola (Melanitta nigra) nas ZPEs Ria de Aveiro e Aveiro-Nazaré*. Tese de mestrado em Ecologia Aplicada. Universidade de Aveiro. 52pp.
- Johnston EM, Mittelhauser GH, Foster JT, Mau RL, Gibson AA, Gillece JD, Klemmer AJ & Olsen BJ (2025). Barnacles dominate the winter diet of *Calidris maritima* (Purple Sandpiper) in Maine: A bona fide dietary shift or molecular techniques revealing an unknown diet composition? *Ornithology* 142(3): 1-13.
- Jones HP, Tereshy BR, Zavaleta ES, Croll DA, Keitt BS, Finkelstein ME & Howald GR (2008). Severity of the effects of invasive rats on seabirds: a global review. *Conservation biology* 22(1): 16-26.
- Jones IL (2013). Evolutionary lag of predator avoidance by island seabirds, and what happens when naturally occurring colonists become 'invasive'. *Ibis* 155: 1-3
- Karris G, Fric J, Kitsou Z, Kalfopoulou J, Giokas S, Sfenthourakis S & Poirazidis K (2013). Does by-catch pose a threat for the conservation of seabird populations in the southern Ionian Sea (eastern Mediterranean)? A questionnaire-based survey of local fisheries. *Mediterranean Marine Science* 14: 19-25.
- Karris G, Ketsilis-Rinis V, Kalogeropoulou A, Xirouchakis S, Machias A, Maina I & Kavadas S (2018). The use of demersal trawling discards as a food source for two scavenging seabird species: a case study of an eastern Mediterranean oligotrophic marine ecosystem. *Avian Research* 9: 26.
- Karris G, Xirouchakis S, Poirazidis K, Voulgaris M-D, Tsouroupi A, Sfenthourakis S & Giokas S (2024). Aspects of breeding performance of Scopoli's Shearwater (*Calonectris diomedea*): The case of the largest colony in Greece. *Diversity* 16: 150.
- Keller V, Herrando S, Voříšek P, Franch M, Kipson M, Milanese P, Martí D, Anton M, Klvaňová A, Kalyakin MV *et al.* (2020). *European Breeding Bird Atlas 2: Distribution, Abundance and Change*. European Bird Census Council & Lynx Edicions: Barcelona, Spain.
- Knief U, Bregnballe T, Alfawi I, Ballmann MZ, Brenninkmeijer A, Bzoma S, Chabrolle A, Dimmlich J, Engel E & Fijn R (2024). Highly pathogenic avian influenza causes mass mortality in Sandwich Tern *Thalasseus sandvicensis* breeding colonies across north-western Europe. *Bird Conservation International* 34: e6.
- Koivula MJ & Eeva T (2010). Metal-related oxidative stress in birds. *Environmental pollution* 158(7): 2359-2370.
- Kolzsch A, Lohr A, Partecke J, Quetting M, Safi K, Scharf A, Schneider G, Lang I, Schaeuffelhut F, Landwehr M, Storhas M, van Schalkwyk L, Vinciguerra C, Weinzierl R & Wikelski M (2022). The Movebank system for studying global animal movement and demography. *Methods in Ecology and Evolution* 13(2): 419-431.
- Kopp M, Peter H-U, Mustafa O, Lisovski S, Ritz MS, Phillips RA & Hahn S (2011). South Polar Skuas from a single breeding population overwinter in different oceans though show similar migration patterns. *Marine Ecology Progress Series* 435: 263-267.
- Krüger L (2018). Population estimates of Trindade Petrel (*Pterodroma arminjoniana*) by ensemble nesting habitat modelling. *International Journal of Environmental Sciences & Natural Resources* 10(4): 145-157.
- Krüger L, Paiva VH, Colabundo FI, Petry MV, Montone RC, Ramos JA (2016). Year-round spatial movements and trophic ecology of Trindade Petrels (*Pterodroma arminjoniana*). *Journal of Field Ornithology* 87: 404-416.
- Kühn S & Van Franeker JA (2020). Quantitative overview of marine debris ingested by marine megafauna. *Marine pollution bulletin* 151: 110858.
- Lamelas-López L, Pietrzak M, Ferreira M & Neves VC (2021). Threats and conservation status of common and roseate terns *Sterna hirundo*/S. *dougallii* in the Azores: a case study for Terceira Island. *Marine Ornithology* 49: 301-309.
- Lane JV, Jeglinski JWE, Avery-Gomm S, Ballstaedt E, Banyard AC, Barychka T, Brown IH, Brugger B, Burt TV, Careen N, Castenschield JHF, Christensen-Dalsgaard S, Clifford S, Collins SM, Cunningham E, Danielsen J, Daunt F, D'Entremont KJN, Doiron P, Duffy S, English MD, Falchieri M, Giacinti J, Gjerret B, Granstad S, Grémillet D, Guillemette M, Hallgrímsson GT, Hamer KC, Hammer S, Harrison K, Hart JD, Hatsell C, Humpidge R, James J, Jenkinson A, Jessopp M, Jones MEB, Lair S, Lewis T, Malinowska AA, McCluskie A, McPhail G, Moe B, Montevecchi WA, Morgan G, Nichol C, Nisbet C, Olsen B, Provencher J, Provost P, Purdie A, Rail JF, Robertson G, Seyer Y, Sheddan M, Soos C, Stephens N, Strøm H, Svansson V, Tierney TD, Tyler G, Wade T, Wanless S, Ward CRE, Wilhelm SL, Wischniewski S, Wright LJ, Zonfrillo B, Matthiopoulos J & Votier SC (2024). High pathogenicity avian influenza (H5N1) in Northern Gannets (*Morus bassanus*): Global spread, clinical signs and demographic consequences. *Ibis* 166: 633-650.
- Langlois Lopez S, Snell K, van Bemmelen R, Pokrovskiy I, O'Hanlon N, Boertmann D, Gilg O, Green M, Hanssen SA, Harrison A-L, Moe B, Santos I, Smith PA, Systad GH & Humphreys EM (2026). Global population status of the migratory Holarctic species Arctic skua *Stercorarius parasiticus*. *Bird Conservation International* 36: e1.
- Lavers JL, Bond AL & Hutton I (2014). Plastic ingestion by Flesh-footed Shearwaters (*Puffinus carneipes*): Implications for fledgling body condition and the accumulation of plastic-derived chemicals. *Environmental Pollution* 187: 124-129.
- Leal A & Lecoq M (2006). *Plano de Acção para a Conservação da Gaivota de Audouin em Portugal*. Sociedade Portuguesa para o Estudo das Aves, Lisboa
- Leal GR, Furness RW, McGill RAR, Santos RA & Bugoni L (2017). Feeding and foraging ecology of Trindade petrels *Pterodroma arminjoniana* during the breeding period in the South Atlantic Ocean. *Marine Biology* 164: 211.
- Léandri-Breton DJ, Lamarre JF & Bêty J (2019). Seasonal variation in migration strategies used to cross ecological barriers in a nearctic migrant wintering in Africa. *Journal of Avian Biology* 50(6).
- Lecoq M (2003). *Censo das Populações de Aves Marinhas Nidificantes no Arquipélago da Berlenga em 2002*: Calonectris diomedea, Phalacrocorax aristotelis e Uria aalge. Relatório II (Final): Censo da População em 2002. SPEA, Lisboa.
- Lecoq M, Catry P & Granadeiro JP (2010). Population trends of Cory's Shearwaters *Calonectris diomedea borealis* breeding at Berlengas Islands, Portugal. *Airo* 20: 36-41
- Lecoq M, Lourenço PM, Catry P, Andrade J & Granadeiro JP (2013). Wintering waders on the Portuguese mainland non-estuarine coast: results of the 2009-2011 survey. *Wader Study Group Bulletin* 120: 66-70.
- Lecoq M, Ramirez I, Gerales P & Andrade J (2011). First complete census of Cory's shearwaters *Calonectris diomedea borealis* breeding at Berlengas Islands (Portugal), including the small islets of the archipelago. *Airo* 21: 31-34.
- Leitão AH, Canário F, Pires N & Tomé R (2014). A importância do Cabo de S. Vicente (Sagres, Sudoeste de Portugal) como corredor migratório para aves marinhas. In SPEA (ed.). *Livro de resumos do VIII congresso de ornitologia da SPEA (1.ª edição)*. Sociedade Portuguesa para o Estudo das Aves, Lisboa.
- Leitão D, Catry P, Costa H, Elias G & Reino LM (1998). *As aves do estuário do Tejo*. ICN, Lisboa.
- Leitão D, Encarnação V & Sampaio H (2013). *Censo nacional de corvos marinhos invernantes – Janeiro 2013*. Relatório não publicado.

- Sociedade Portuguesa para o Estudo das Aves / Instituto da Conservação da Natureza e das Florestas. Lisboa
- Leitão D, Rufino R & Tomé R (1997). Primeiro registo de nidificação de Guincho-comum *Larus ridibundus* em Portugal Continental. *Airo* 8: 33-34.
- León F, Ulloa-Contreras C, Pizarro EJ, Castillo-Torres PN, Díaz-Morales KB, Franco AC, Timm FCB, Corrêa ML, Krüger L, Poulin E, Pardo-Roa C & Vianna JA (2025). Skuas mortalities linked to positives HPAIV A/H5 beyond Polar Antarctic Circle. bioRxiv, preprint.
- Lislevand T, Briedis M, Heggøy O & Hahn S (2017). Seasonal migration strategies of common ringed plovers *Charadrius hiaticula*. *Ibis* 159(1): 225-229.
- Lockley RM (1952). Notes on the birds of the islands of the Berlengas (Portugal), the Desertas and Baixo (Madeira) and the Salvages. *Ibis* 94(1): 144-157.
- Lopes AF (2024). *Influência da pressão antropogénica na distribuição e ecologia alimentar de aves limícolas em contexto urbano*. Tese de Mestrado. Faculdade de Ciências da Universidade de Lisboa.
- Lopes CS, Laranjeiro MI, Lavers JL, Finger A & Provencher J (2022). Seabirds as indicators of metal and plastic pollution. In Ramos JA & Pereira L (eds.). *Seabird Biodiversity and Human Activities*. CRC Press: 168-187.
- Lopes CS, Paiva VH, Vaz PT, Pais de Faria J, Calado JG, Pereira JM & Ramos JA (2021). Ingestion of anthropogenic materials by yellow-legged gulls (*Larus michahellis*) in natural, urban, and landfill sites along Portugal in relation to diet composition. *Environmental Science and Pollution Research* 28: 19046–19063.
- Lopes CS, Ramos JA & Paiva VH (2015). Changes in vegetation cover explain shifts of colony sites by Little Terns (*Sternula albifrons*) in coastal Portugal. *Waterbirds* 38(3): 260-268.
- Lopes R, Moniz F & Encarnação V (2022). Programa Nacional de Monitorização de Aves Aquáticas Invernantes – PNMAAI, 1976-2022. In Alonso H, Andrade J, Teodósio J & Lopes A (coord.). *O estado das aves em Portugal, 2022*. 2ª edição. Sociedade Portuguesa para o Estudo das Aves, Lisboa.
- Lopes RJ, Cabral JA, Múrias T & Marques JC (1998). Contribuição para o conhecimento da dieta de Pilrito-comum *Calidris alpina* e da Tarambola-cinzenta *Pluvialis squatarola* no estuário do Mondego. *Airo* 9: 27–32.
- Lopes RJ, Marques JC & Wennerberg L (2006). Migratory connectivity and temporal segregation of dunlin (*Calidris alpina*) in Portugal: evidence from morphology, ringing recoveries and mtDNA. *Journal of Ornithology*, 147(2), 385-394.
- Loring SA (2023). *Disentangling the main causes and potential origin of an unusual razorbill (Alca torda) die-off in the Mediterranean Sea: an interdisciplinary approach*. Universitat Autònoma de Barcelona.
- Lourenço PM (2019). Internet photography forums as sources of avian dietary data: bird diets in Continental Portugal. *Airo* 26:3-26.
- Lourenço PM, Alonso H, Alves JA, Carvalho AT, Catry T, Costa H, Costa JS, Dias MP, Encarnação V, Fernandes P, Leal AI, Martins RC, Moniz F, Pardal S, Rocha A & Santos CD (2018). Monitoring waterbird populations in the Tejo estuary, Portugal: report for the decade 2007-2016. *Airo* 25: 3-3.
- Lourenço PM, Alves JA, Catry T & Granadeiro JP (2015). Foraging ecology of sanderlings (*Calidris alba*) wintering in estuarine and non-estuarine intertidal areas. *Journal of Sea Research* 104: 33–40.
- Lourenço PM, Catry P, Lecoq M, Ramírez I & Granadeiro JP (2013). Role of disturbance, geology and other environmental factors in determining abundance and diversity in coastal avian communities during winter. *Marine Ecology Progress Series* 479: 223-234.
- Lourenço PM, Serra-Gonçalves C, Ferreira JL, Catry T & Granadeiro JP (2017). Plastic and other microfibers in sediments, macroinvertebrates and shorebirds from three intertidal wetlands of southern Europe and West Africa. *Environmental Pollution* 231: 123–133.
- Luminaves (2020). *Light pollution and conservation in Macaronesian archipelagos: reducing light pollution effects in seabirds' populations: 2017–2020*. Technical report. Canary Island, Spain. INTERREG MAC.
- Madeiros J, Carlile N & Priddel D (2012). Breeding biology and population increase of the endangered Bermuda petrel *Pterodroma cahow*. *Bird Conservation International* 22: 35–45.
- Madeiros J, Flood B & Zufelt K (2014). Conservation and at-sea range of Bermuda Petrel (*Pterodroma cahow*). *North American Birds* 67(4): 547-557.
- Madeiros JN (2024). Results of the 2024 Cahow breeding season. Latest updates on Bermuda's endangered national bird. In Audubon. *Audubon Newsletter*. The Bermuda Audubon Society, Bermudas.
- Magnusdottir E, Leat EH K, Bourgeon S, Strøm H, Petersen A, Phillips R, Hanssen SA, Bustnes JO, Hersteinsson P & Furness RW (2012). Wintering areas of Great Skuas *Stercorarius skua* breeding in Scotland, Iceland and Norway. *Bird Study* 59 (1): 1-9.
- Martin-Vélez V, Navarro J, Vazquez M, Navarro-Ramos MJ, Bonnedahl J, van Toor ML, Bustamante J & Green AJ (2024). Dirty habits: potential for spread of antibiotic-resistance by black-headed gulls from wastewater treatment plants. *Environmental Science and Pollution Research* 31(58): 66079-66089.
- Martinez-Abrain A, Oro D, Conesa D & Jimenez J (2008). Compromise between seabird enjoyment and disturbance: the role of observed and observers. *Environmental Conservation* 35(2): 104-108.
- Martínez-Abrain A, Tomillo PS, Mourriño J, Rodríguez-Silvar J & Bermejo A (2023). Predator-prey collapses at the edge of predator distribution: the case of clupeids and common guillemots (*Uria aalge*) in NW Iberia. *Scientia Marina* 87(1): e053-e053.
- Martínez-Abrain A, Velando A, Oro D, Genovart M, Gerique C, Bartolomé MA, Villuendas E & Sarzo B (2006). Sex-specific mortality of European shags after the Prestige oil spill: demographic implications for the recovery of colonies. *Marine Ecology Progress Series* 318: 271-276.
- Marzano M, Carss D & Cheyne I (2013). Managing European cormorant-fisheries conflicts: Problems, practicalities and policy. *Fisheries Management and Ecology* 20: 401-413.
- Matias R & Catry P (2010). The diet of Atlantic yellow-legged gulls (*Larus michahellis atlantis*) at an oceanic seabird colony: estimating predatory impact upon breeding petrels. *European Journal of Wildlife Research* 56: 861-869
- Matos DM, Ramos JA, Calado JG, Ceia FR, Hey J & Paiva VH (2018). How fishing intensity affects the spatial and trophic ecology of two Gull species breeding in sympatry. *ICES Journal of Marine Science* 75(6): 1949-1964.
- Mazzochi MS, Nightingale J & Pereira MJR (2021). Trophic interactions of shorebirds in a wintering area of southern Brazil: Foraging strategies and habitat preferences. *Waterbirds* 44(4): 492–498.
- Medeiros R, Ramos JA, Paiva VH, Almeida A, Pedro P & Antunes S (2007) Signage reduces the impact of disturbance in Little Tern nesting success in Portugal. *Biological Conservation* 135: 99-106.
- Medina FM, Bonnaud E, Vidal E, Tershy BR, Zavaleta ES, Josh Donlan C, Keitt BS, Le Corre M, Horwath SV & Nogales M (2011). A global review of the impacts of invasive cats on island endangered vertebrates. *Global change biology* 17(11): 3503-3510.
- Medrano F, Repullés K, Militão T, Leal A & González-Solís J (2023). Migratory movements and activity patterns of White-faced Storm-petrels *Pelagodroma marina* Breeding in Cabo Verde. *Ardeola* 71(1): 101-118.
- Meirinho A, Barros N, Oliveira N, Catry P, Lecoq M, Paiva V, Gerales P, Granadeiro JP, Ramírez I & Andrade J (2014). *Atlas das Aves Marinhas de Portugal*. Sociedade Portuguesa para o Estudo das Aves.
- Meirinho A, Pitta Groz M & Silva AG (2003a). *Proposta de Plano de Gestão da Zona de Protecção Especial Ilhéu da Praia*. Departamento de Oceanografia e Pescas da Universidade dos Açores, Horta.
- Meirinho A, Pitta Groz M, Silva AG & Bolton M (2003b). *Proposta de Plano de Gestão da Zona de Protecção Especial Ilhéu da Vila*. Departamento de Oceanografia e Pescas da Universidade dos Açores, Horta.
- Mendes RF, Ramos JA, Paiva VH, Calado JG, Matos DM & Ceia FR (2018). Foraging strategies of a generalist seabird species, the yellow-legged gull, from GPS tracking and stable isotope analyses. *Marine Biology* 165(10): 168.
- Menezes D, Oliveira P & Ramírez I (2010a). *Pterodromas do arquipélago da Madeira. Duas espécies em recuperação*. Serviço do Parque Natural da Madeira, Funchal.
- Menezes D, Oliveira P & Ramírez I (2010b). *Medidas urgentes para a Recuperação da Freira do Bugio Pterodroma feae e do seu Habitat. Segundo Relatório de Progresso*. Serviço do Parque Natural da Madeira/ Sociedade Portuguesa para o Estudo das Aves
- Menezes D, Oliveira P & Ramírez I (2011). *Medidas Urgentes para a Recuperação da Freira do Bugio Pterodroma feae e do seu Habitat. Relatório Final*. Serviço do Parque Natural da Madeira/ Sociedade Portuguesa para o Estudo das Aves

- Menezes GM, Sigler MF, Silva HM & Pinho MR (2006). Structure and zonation of demersal fish assemblages off the Azores Archipelago (mid-Atlantic). *Marine Ecology Progress Series* 324: 241-260.
- Mercker M, Markones N, Borkenhagen K, Schwemmer H, Wahl & J Garthe S (2021). An integrated framework to estimate seabird population numbers and trends. *Journal of Wildlife Management* 85: 751-771.
- Michel G, Nightingale J, Beal M, Bernard A, Dias MP & Alves JA (2026). Global review of shorebird tracking data to identify research gaps and conservation priorities. *Conservation Biology* 40: e70211.
- Michel L, Zhang J, Asimakopoulos A, Austad M, Bustamante P, Cecere JG, Cianchetti-Benedetti M, Colominas-Ciuró R, Dell'Omo G, De Pascalis F, Jaspers VLB & Quillfeldt P (2025). Assessing perfluoroalkyl substance pollution in Central Mediterranean breeding shearwaters. *Environmental Toxicology and Chemistry* 44:420-431.
- Militao T, Bourgeois K, Roscales JL & González-Solís J (2013). Individual migratory patterns of two threatened seabirds revealed using stable isotope and geolocation analyses. *Diversity and Distributions* 19: 317-329.
- Militão T, Dinis HA, Zango L, Calabuig P, Stefan LM & González-Solís J (2017). Population size, breeding biology and on-land threats of Cape Verde Petrel (*Pterodroma feae*) in Fogo Island, Cape Verde. *PLoS ONE* 12(4): e0174803.
- Møller AP, Flensted-Jensen E & Mardal W (2006). Dispersal and climate change: a case study of the Arctic tern *Sterna paradisaea*. *Global Change Biology* 12: 2005–2013.
- Moniz F (2015). *Ecologia Alimentar da Gaivota-de-audouin* (Larus audouinii) e da Gaivota-de-patas-amarelas (Larus michahellis) no Sul de Portugal. Tese de Mestrado. Universidade de Évora.
- Moniz P, Monteiro L & Oliveira P (1997). The Little shearwater. In Hegemeijer W & Blair M (eds.). *The EBCC atlas of european breeding birds. Their distribution and abundance*. T & Ad Poyser, London.
- Monteiro LR, Granadeiro JP & Furness RW (1998). Relationship between mercury levels and diet in Azores seabirds. *Marine Ecology Progress Series* 166: 259-265.
- Monteiro LR, Ramos JA, Furness RW & Del Nevo A J (1996b). Movements, morphology, breeding, molt, diet and feeding of seabirds in the Azores. *Colonial Waterbirds* 19(1): 82-97.
- Monteiro LR, Ramos JA, Pereira JC, Monteiro PR, Feio RS, Thompson DR, Bearshop S, Furness RW, Laranjo M, Hilton G, Neves VC, Groz MP & Thompson KR (1999). Status and distribution of Fea's Petrel, Bulwer's Petrel, Manx Shearwater, Little Shearwater and Band-rumped Storm-Petrel in the Azores Archipelago. *Waterbirds* 22(3): 358-366.
- Monteiro LR & Furness RW (1995). Seabirds as monitors of mercury in the marine environment. *Water, Air, and Soil Pollution* 80(1): 851-870.
- Monteiro LR, Ramos JA, Furness RW (1996a). Past and present status and conservation of the seabirds breeding in the Azores Archipelago. *Biological Conservation* 78: 319–328.
- Montevocchi WA (2001). Interactions between fisheries and seabirds. In Schreiber EA & Burger J (eds.). *Biology of Marine Birds*. CRC Press: 527-558.
- Monticelli D, Ramos JA & Pereira J (2006). Habitat use and foraging success of roseate and common terns in flocks in the Azores. *Ardeola* 53(2): 293-306.
- Moore CC (1992). The Mediterranean Gull *Larus melanocephalus* in the Tagus estuary: numbers, ages classes and possible origins. *Airo* 3: 83-86.
- Moore CC (2000). Movimentações invulgares de aves marinhas junto ao cabo Carvoeiro. *Pardela* 13: 7-10.
- Morato T, Dominguez-Carrió C, Mohn C, Ocaña-Vicente O, Ramos M, Rodrigues L, Sampaio Í, Taranto GH, Fauconnet L, Tojeira I, Gonçalves EJ & Carreiro-Silva M (2021). Dense cold-water coral garden of Paragorgia johnsoni suggests the importance of the Mid-Atlantic Ridge for deep-sea biodiversity. *Ecology and Evolution* 11: 16426–16433.
- Morato T, Guénette S & Pitcher TJ (2002). Fisheries of the Azores (Portugal), 1982–1999. In Zeller D, Watson R, Pitcher TJ & Pauly D (eds.). Fisheries impacts on North Atlantic ecosystems: Catch, effort and national/regional data sets. *Fisheries Centre Research Reports*: 9(3): 214–220.
- Moreira F (1993). Macrohabitat selection by waders in the Tagus estuary (Portugal). *Portugaliae Zoologica* 2: 1-15
- Moreira F (1994). Diet and feeding rates of knots *Calidris canutus* in the Tagus estuary (Portugal). *Ardea* 82: 133-136.
- Moreira F (1996). Diet and feeding behaviour of grey plovers *Pluvialis squatarola* and redshanks *Tringa totanus* in a southern European estuary. *Ardeola* 43: 145–156.
- Morera-Pujol V, Cattray P, Magalhães M, Péron C, Reyes-González JM, Granadeiro JP, Militão T, Dias MP, Oro D, Igual JM, Dell'Omo G, Müller M, Paiva VH, Metzger B, Neves V, Navarro J, Karris G, Xirouchakis S, Cecere JG, Zamora-Marín JM, Forero MG, Afán I, Ouni R, Romdhane MS, De Felipe F, Zajková Z, Cruz-Flores M, Grémillet D, González-Solís J & Ramos R (2025) Migratory connectivity and non-breeding habitat segregation across biogeographical scales in closely related seabird taxa. *Diversity and Distributions* 31(3): e70013.
- Munilla I, Arcos JM, Oro D, Álvarez D, Leyenda PM & Velando A (2011). Mass mortality of seabirds in the aftermath of the Prestige oil spill. *Ecosphere* 2(7): 1-14.
- Munilla I, Díez C & Velando A (2007). Are edge bird populations doomed to extinction? A retrospective analysis of the common guillemot collapse in Iberia. *Biological Conservation* 137: 359-371.
- Nascimento T, Oliveira N & Andrade J (2023a). *Monitoring the control of invasive mammals on Barreta Island. Action D2 of the project Ilhas Barreira*. Lisboa: Sociedade Portuguesa para o Estudo das Aves.
- Nascimento T, Oliveira N & Luís A (2021). Hey, that's my fish – Overlap in prey composition between European Shag and local fisheries in Portugal. *Ardea* 109(1): 77-90.
- Nascimento T, Oliveira N & Luís A (2023b). Spatial overlap between the European Shag and commercial fisheries in a special protected area: implications for conservation. *Fisheries Research* 263: 106689.
- Nascimento T, Oliveira N, Werling E, Rossi M, Welzel S & Andrade J (2025). *Monitoring human disturbance on breeding seabirds on Barreta island. Report of the Action D3 of the project Ilhas Barreira*. Sociedade Portuguesa para o Estudo das Aves, Lisboa.
- Navarro J, Grémillet D, Afán I, Miranda F, Bouten W, Forero MG & Figuerola J (2019). Pathogen transmission risk by opportunistic gulls moving across human landscapes. *Scientific reports* 1: 10659.
- Navarro J, Louzao M, Igual JM, Oro D, Delgado A, Arcos JM, Genovart M, Hobson KA & Forero MG (2009). Seasonal changes in the diet of a critically endangered seabird and the importance of trawling discards. *Marine Biology* 156(12): 2571-2578.
- Navarro-Herrero L, March D, Militão T, Saldanha S, Medrano F, Vicente-Sastre D, Ouled-Cheikh J, Ramos R, Matos D, Rodrigues I, Paiva VH, Granadeiro JP, Cattray P, Leal A, Dinis HA & González-Solís J (2025). Seabird-vessel interactions in industrial fisheries of Northwest Africa: Implications for international bycatch management. *Journal of Applied Ecology* 62: 2814–2831.
- Naves LC & Rothe TC (2023). Managing harvests of seabirds and their eggs. In Young L, VanderWerf E (eds.). *Conservation of marine birds*. Academic Press: 345-367.
- Neves VC, Bremer RE & Hays H (2002). Recovery in Punta Rasa, Argentina of Common Terns banded in the Azores Archipelago, North Atlantic. *Waterbirds* 25: 459–461.
- Neves VC, Bried J, González-Solís J, Roscales JL & Clarke MR (2012). Feeding ecology and movements of the Barolo shearwater *Puffinus baroli baroli* in the Azores, NE Atlantic. *Marine Ecology Progress Series* 452: 269-285.
- Neves VC, Nava C, Monteiro EV, Monteiro PR & Bried J (2017). Depredation of Monteiro's Storm-petrel (*Hydrobates monteiri*) chicks by Madeiran wall lizards (*Lacerta dugesii*). *Waterbirds* 40(1): 82-86.
- Neves VC, Nava CP, Cormons M, Bremer E, Castresana G, Lima P, Junior SMA, Phillips RA, Magalhães MC & Santos RS (2015). Migration routes and non-breeding areas of Common Terns (*Sterna hirundo*) from the Azores. *Emu* 115: 158–167.
- Neves VC, Nolf D & Clarke MR (2011a). Diet of Bulwer's Petrel (*Bulweria bulwerii*) in the Azores, NE Atlantic. *Waterbirds* 34 (3): 357-362.
- Neves VC, Panagiotakopoulos S & Ratcliffe N (2011b). Predation on roseate tern eggs by European starlings in the Azores. *Arquipelago - Life and Marine Sciences* 28: 15-23.
- Nevitt GA (2008). Sensory ecology on the high seas: the odor world of the procellariiform seabirds. *Journal of Experimental Biology* 211(11): 1706-1713.
- Newton I (2007). *The Migration Ecology of Birds*. Academic Press, London.
- Nikolaeva NG, Spiridonov VA & Krasnov YV (2006). Existing and proposed marine protected areas and their relevance for seabird conservation: a case study in the Barents Sea region. In Boere G, Galbraith C & Stroud D (eds.). *Waterbirds around the world*. The Stationery Office, Edinburgh, UK: 743-749.
- Norte AC & Ramos JA (2004). Nest-site selection and breeding biology of Kentish plover *Charadrius alexandrinus* on sandy beaches of the Portuguese west coast. *Ardeola* 51: 255-268.

- Nunes J, Nunes M, Fagundes AI & Valkenburg T (2010). Contributo para a conservação do Fura-bucho-do-Atlântico *Puffinus puffinus*, uma espécie ameaçada na ilha da Madeira. *Airo* 20: 12-21.
- Nunes M (2000). Madeiran Storm-petrel in the Desertas Islands (Madeira Archipelago): a new case of two distinct populations breeding annually? *Arquipélago. Life and Marine Sciences Supplement 2* (Part A): 175-180.
- Nunes M & Hazevoet C (2001). Cape Verde's seabirds in trouble. *World Birdwatch* 23(2): 24-26.
- O'Hanlon NJ, James NA, Masden EA & Bond AL (2017). Seabirds and marine plastic debris in the northeastern Atlantic: A synthesis and recommendations for monitoring and research. *Environmental Pollution* 231: 1291-1301.
- Observations published in Ornithological Reports, see Book Atlas of Seabirds of Portugal – pp. 207.
- O'Hanlon NJ, van Bemmelen RS, Snell KR, Conway GJ, Thaxter CB, Aiton H, Aiton D, Balmer DE, Hanssen SA, Calladine JR, Hammer S, Harris SJ, Moe B, Schekkerman H, Tulp I & Humphreys EM (2024). Atlantic populations of a declining oceanic seabird have complex migrations and weak migratory connectivity to staging areas. *Marine Ecology Progress Series*: 730: 113-129.
- Okes N, Hockey P, Pichegru L, Lingen C, Crawford, RJM & Grémillet, D (2009). Competition for shifting resources in the southern Benguela upwelling: Seabirds versus purse-seine fisheries. *Biological Conservation* 142: 2361–2368.
- Oliveira N (compiler) (2018). *International Single Species Action Plan for the conservation of Monteiro's Storm Petrel* *Hydrobates monteiroi* (2018 to 2028). European Commission Technical Report, May-2018.
- Oliveira N, Abreu P, Alonso H, Fagundes AI, Macq A, Gerales PL & Andrade J (2023a). The Effect of Environmental Conditions on Captures, Survival and Breeding Success of a Winter-Breeding Seabird. *Ardea* 111(2): 487-500.
- Oliveira N, Abreu P, Bores J, Fagundes A, Alonso H & Andrade J (2020). Evaluating the potential of artificial nests as a conservation measure for Cory's Shearwaters *Calonectris borealis* breeding in Berlengas Archipelago, Portugal. *Airo* 27: 3–19.
- Oliveira N, Almeida A, Alonso H, Bouça A, Costa M, Crisóstomo P, Leandro S, Mendes RN, Morais L, Mouga T, Mourato E, Nascimento T, Paiva VH, Silva CP & Andrade J (2025a). *5-years after-Life Berlengas: Conservation efforts and monitoring in Berlengas Archipelago (2019-2024). Project LIFE Berlengas*. Sociedade Portuguesa para o Estudo das Aves, Lisboa.
- Oliveira N, Almeida A, Alonso H, Constantino E, Ferreira A, Gutierrez I, Santos AL, Silva E & Andrade J (2021). A contribution to reducing bycatch in a high priority area for seabird conservation in Portugal. *Bird Conservation International* 31(4): 553-572.
- Oliveira N, Alonso H, Encarnação V, Menezes D, Magalhães M, Carreira G, Heber S, Pimentel R, Medeiros V, Bairos J, Raposo P, Coelho R, Rufino R, Neves R, Nascimento T, Silva E & Andrade J (2023b). Changes in numbers and distribution of Yellow-legged Gull *Larus michahellis* nesting in Portugal during the last two decades. *Airo* 31: 20–37.
- Oliveira N, Henriques A, Miodonski J, Pereira J, Marujo D, Almeida A, Barros N, Andrade J, Marçalo A, Santos J, Oliveira IB, Ferreira M, Araújo H, Monteiro S, Vingada J, Ramírez I (2015). Seabird bycatch in Portuguese mainland coastal fisheries: An assessment through on-board observations and fishermen interviews. *Global Ecology and Conservation* 3: 51-61.
- Oliveira N, Nascimento T & Vulcano A (comp.) (2025b). *International Single Species Action Plan for the conservation of the Audouin's Gull* *Larus audouinii* (2025 to 2035). Project LIFE Ilhas Barreira. SPEA - Portuguese Society for the Study of Birds, European Commission Technical Report, Lisbon.
- Oliveira N, Ramos JA, Calado J & Arcos J (2022a). Seabird and fishery interactions. In Ramos JA & Pereira L (eds.). *Seabird Biodiversity and Human Activities*. CRC Press: 75-88.
- Oliveira N, Varanda IC, Harris MP, Almeida A, Alonso H, Bouça A, Ferreira M, Georg M, Lopes J, Sequeira M, Hilário F & Andrade J (2023c). *Caracterização do arrojamento massivo de papagaio-do-mar no inverno de 2022-23 em Portugal Continental*. Sociedade Portuguesa para o Estudo das Aves, Lisboa (unpublished report).
- Oliveira P (1999). *A conservação e gestão das aves do arquipélago da Madeira*. Parque Natural da Madeira
- Oliveira P & Menezes D (2004). *A gestão e conservação das Aves do Arquipélago da Madeira*. Parque Natural da Madeira/Arquipélago Verde. Funchal.
- Oliveira P & Moniz P (1995). Population size, breeding chronology, annual cycle and effects of inter-specific competition on the reproductive success of little shearwater *Puffinus assimilis baroli* in Selvagem. In Tasker ML (ed.) *Threats to seabirds: Proceedings of the 5th International Seabird Group conference*. Seabird Group, Sandy: 35.
- Oliveira P, Medina FM, Nogales M & Gerales PL (2022b). Eradication and control of invasive mammal species as a seabird conservation tool. In Ramos JA & Pereira L (eds.). *Seabird Biodiversity and Human Activities*. CRC Press: 223-241.
- Olsen KM & Larsson H (2004). *Gulls of Europe, Asia and North America*. Christopher Helm, London.
- Oppel S, Hervás S, Oliveira N, Pipa T, Silva C, Gerales P, Goh M, Immler E & McKown M (2014). Estimating population size of a nocturnal burrow-nesting seabird using acoustic monitoring and habitat mapping. *Nature Conservation* 7: 1-13
- Oppel S, Raine AF, Borg JJ, Raine H, Bonnaud E, Bourgeois K & Breton AR (2011). Is the Yelkouan shearwater *Puffinus yelkouan* threatened by low adult survival probabilities? *Biological Conservation* 144(9): 2255-2263.
- Oro D, Cam E, Pradel R & Martínez-Abraín A (2004). Influence of food availability on demography and local population dynamics in a long-lived seabird. *Proceedings of the Royal Society of London. Series B: Biological Sciences* 271(1537): 387-396.
- orten JM, Carneiro APB, Beal M, Bonnet-Lebrun A-S, Dias MP, Rouyer M-M, Harrison A-L, González-Solís J, Jones VR, Garcia Alonso VA, Antolos M, Arata JA, Barbraud C, Bell EA, Bell M, Bose S, Broni S, de L Brooke M, Butchart SHM, Carlile N, Catry P, Catry T, Charteris M, Cherel Y, Clark BL, Clay TA, Cole NC, Conners MG, Debski I, Delord K, Egevang C, Elliot G, Esefeld J, Facer C, Fayet al, Fijn RC, Fischer JH, Franklin KA, Gilg O, Gill JA, Granadeiro JP, Guilford T, Handley JM, Hanssen SA, Hawkes LA, Hedd A, Jaeger A, Jones CG, Jones CW, Kopp M, Krietsch J, Landers TJ, Lang J, Le Corre M, Mallory ML, Masello JF, Maxwell SM, Medrano F, Militão T, Millar CD, Moe B, Montevecchi WA, Navarro-Herrero L, Neves VC, Nicholls DG, Nicoll MAC, Norris K, O'Dwyer TW, Parker GC, Peter H-U, Phillips RA, Quillfeldt P, Ramos JA, Ramos R, Rayner MJ, Rexer-Huber K, Ronconi RA, Ruhomaun K, Ryan PG, Sagar PM, Saldanha S, Schmidt NM, Schultz H, Shaffer SA, Stenhouse IJ, Takahashi A, Tatayah V, Taylor GA, Thompson DR, Thompson T, van Bemmelen R, Vicente-Sastre D, Vigfúsdóttir F, Walker KJ, Watts J, Weimerskirch H, Yamamoto T & Davies TE (2025). Global Marine Flyways Identified for Long-Distance Migrating Seabirds From Tracking Data. *Global Ecology and Biogeography* 34(2): e70004.
- OSPAR (2017). *Marine Bird Abundance. Intermediate Assessment 2017*. OSPAR Commission, London.
- OSPAR (2023). *The 2023 Quality Status Report for the North-East Atlantic*. OSPAR Commission, London.
- Otero XL, De La Peña-Lastra S, Pérez-Alberti A, Ferreira TO & Huerta-Díaz MA (2018). Seabird colonies as important global drivers in the nitrogen and phosphorus cycles. *Nature Communications* 9(1): 1–8.
- Oudi A, Chokri MA, Hammouda A, Chaabane R, Badraoui R, Besnard A & Santos R (2019). Physiological impacts of pollution exposure in seabird's progeny nesting in a Mediterranean contaminated area. *Marine pollution bulletin* 142: 196-205.
- Pacoureau N, Delord K, Jenouvrier S & Barbraud C (2019). Demographic and population responses of an apex predator to climate and its prey: a long-term study of South Polar Skuas. *Ecological Monographs* 89(4): e01388.
- Paiva VH , Gerales P, Marques V, Rodríguez R, Garthe S & Ramos JA (2013a). Effects of environmental variability on different trophic levels of the North Atlantic food web. *Marine Ecology Progress Series* 477: 15-28
- Paiva VH , Ramos JA, Martins J, Almeida A & Carvalho A (2008). Feeding habitat selection of Little Terns *Sterna albifrons* in an estuarine lagoon system of southern Portugal. *Ibis* 150: 18-31.
- Paiva VH, Fagundes AI, Romão V, Gouveia C & Ramos JA (2016). Population-scale foraging segregation in an apex predator of the North Atlantic. *PLoS ONE* 11(3): e0151340.
- Paiva VH, Gerales P, Ramirez I, Meirinho A, Garthe S & Ramos JA (2010a). Oceanographic characteristics of areas used by Cory's shearwaters during short and long foraging trips in the North Atlantic. *Marine Biology* 157(6): 1385-1399.

- Paiva VH, Ramos JA, Nava C, Neves V, Bried J & Magalhães MC (2018). Inter-sexual habitat and isotopic niche segregation of the endangered Monteiro's storm-petrel during breeding. *Zoology* 126: 29–35.
- Paiva VH, Xavier J, Gerales P, Ramirez I, Meirinho A, Ramos JA & Garthe S (2010b). Foraging ecology of Cory's shearwaters in different ecological environments of the North Atlantic. *Marine Ecology Progress Series* 410: 257–268
- Paredes R, Orben RA, Suryan RM, Irons DB, Roby DD, Harding AM, Young RC, Benoit-Bird K, Ladd C, Renner H & Heppell S (2014). Foraging responses of Black-legged Kittiwakes to prolonged food-shortages around colonies on the Bering Sea Shelf. *PLoS one* 9(3): e92520.
- Parsons M, Mitchell I, Butler A, Ratcliffe N, Frederiksen M, Foster S & Reid JB (2008). Seabirds as indicators of the marine environment. *ICES Journal of Marine Science* 65(8): 1520–1526.
- Paulino J, Granadeiro JP, Matos P & Catry T (2024). Rice fields play a complementary role within the landscape mosaic supporting structurally and functionally distinct waterbird communities. *Hydrobiologia* 852: 3503–3522.
- Paz JA, Pon JPS, Favero M, Blanco G & Copello S (2018). Seabird interactions and by-catch in the anchovy pelagic trawl fishery operating in northern Argentina. *Aquatic Conservation Marine and Freshwater Ecosystems* 28: 850–860.
- Pedro P & Ramos J (2009). Diet and prey selection of shorebirds on salt pans in the Mondego estuary, western Portugal. *Ardeola* 56(1): 1–11.
- Pereira JM, Krüger L, Oliveira N, Meirinho A, Silva A, Ramos JA, Paiva VH (2018). Using a multi-model ensemble forecasting approach to identify key marine protected areas for seabirds in the Portuguese coast. *Ocean Coastal Management* 153: 98–107
- Pereira JM, Ramos JA, Almeida A, Marçalo A, Carvalho F, Fagundes, I, Gonçalves JMS, Frade M, Oliveira N, Nascimento T & Paiva VH (2025a). Seasonal variation in seabird abundance and bycatch at artisanal bottom-set net fisheries in the southern Iberian Atlantic coast. *Ocean & Coastal Management* 267: 107660.
- Pereira JM, Ramos JA, Domingues A, Almeida A, Marçalo A, Cascão C, Silva C, Rey D, Ceia FR, Carvalho F, Santos ID, Gonçalves JMS, Cerveira LR, Frade M, Laranjeiro MI, Oliveira N, Nascimento T, Paiva VH & Norte AC (2025b). Experimental anthropogenic food restrictions drive short-term foraging and immuno-haematological changes in sympatric breeding gulls. *Science of the Total Environment* 1003: 180672.
- Perez JAA & Wahrlich R (2005). A bycatch assessment of the gillnet monkfish *Lophius gastrophysus* fishery off southern Brazil. *Fisheries Research* 72: 81–95.
- Péron C, Grémillet D, Prudor A, Pettex E, Sarau C, Soriano-Redondo A & Fort J (2013). Importance of coastal Marine Protected Areas for the conservation of pelagic seabirds: The case of Vulnerable yellow shearwaters in the Mediterranean Sea. *Biological conservation* 168: 210–221.
- Perrow MR, Gilroy JJ, Skeate ER & Tomlinson ML (2011). Effects of the construction of Scroby Sands offshore wind farm on the prey base of Little tern *Sternula albifrons* at its most important UK colony. *Marine pollution bulletin* 62(8): 1661–1670.
- Petronilho JM, Vingada JV, Ferreira M, Paulino NAC, Eira C, Costa RA & Tenreiro PJQ (2004). Seabird census along the Figueira da Foz-Aveiro coastline (Portugal) during August/September 2002. *Airo* 14: 94–100
- Phillips RA, Fort J & Dias MP (2023). Conservation status and overview of threats to seabirds. In Young L, VanderWerf E (eds.). *Conservation of marine birds*. Academic Press: 33–56.
- Phillips RA, Gales R, Baker GB, Double MC, Favero M, Quintana F, Tasker ML, Weimerskirch H, Uhart M & Wolfaardt A (2016). The conservation status and priorities for albatrosses and large petrels. *Biological Conservation* 201: 169–183.
- Philpot SM, Lavers JL, Nugegoda D, Gilmour ME, Hutton I & Bond AL (2019). Trace element concentrations in feathers of seven petrels (*Pterodroma* spp.). *Environmental Science and Pollution Research* 26(10): 9640–9648.
- Pichegru L, Grémillet D, Crawford RJ & Ryan PG (2010). Marine no-take zone rapidly benefits endangered penguin. *Biology letters* 6(4): 498–501.
- Piec D & Dunn EK (2021). *International (East Atlantic) Species Action Plan for the Conservation of the roseate tern Sterna dougallii (2021–2030)*. Developed under the framework of the Roseate Tern LIFE Project (LIFE14 NAT/UK/000394). European Commission 2021.
- Pierce KE, Harris RJ, Larned LS & Pokras MA (2004). Obstruction and starvation associated with plastic ingestion in a Northern Gannet *Morus bassanus* and a Greater Shearwater *Puffinus gravis*. *Marine Ornithology* 32: 187–189.
- Pinho D, Bertocci I, Arenas F, Franco JN, Jacinto D, Castro JJ, Vieira R, Sousa-Pinto I, Wernberg T, Tuya F (2015). Spatial and temporal variation of kelp forests and associated macroalgal assemblages along the Portuguese coast. *Marine & Freshwater Research* 67: 113–122.
- Pipa T & Silva C (2021) *Projeto LuMinAves (2017–2020): Reduzir o impacto da luz artificial nas aves marinhas*. Lisboa (unpublished report).
- Pipa T, Martins B, Magalhães M, Codina J, Lourenço J, Aguiar L, Cunha B, Raposo P, Carreira G, Pereira D & De La Cruz A (2026). *Monitorização de aves marinhas Procellariiformes 2023–2025. Relatório da Ação D3*. Projeto LIFE NATURA@NIGHT (unpublished report).
- Pipa T, Martins B, Silva C, Heber S, Magalhães M, Carriço R, Câmara R, Lourenço J, Aguiar L, Cunha B, Raposo P, Raposo A, Coelho R, Huamán M, Pinto F, Sequeira R, Carreira G, Pereira D & De la Cruz A (2024). *Monitorização de aves marinhas Procellariiformes 2020–2023: Relatório da Ação D5.1*. Projeto LIFE IP AZORES NATURA - LIFE17 IPE/PT/00010. Unpublished report.
- Pipa T, Silva C, Atchoi E, Hervias-Parejo S, Oliveira N, Ramirez J & Martín A (2023). Estimativa populacional bioacústica de roque-de-castro *Hydrobates castro* e painho-de-monteiro *Hydrobates montei* nos Açores. XI Congresso SPEA II Jornadas da Macaronésia. São Miguel, Açores, 22–26 Novembro 2023.
- Pollet IL, Lenske AK, Aulsems ANMA, Barbraud C, Bedolla-Guzmán Y, Bicknell AWJ, Bolton M, Bond AL, Delord K, Diamond AW, Fifield DA, Gjerdrum C, Halpin LR, Hansen ES, Hedd A, Hoeg R, Major HL, Mauck RA, McClelland G, McFarlane Tranquilla L, Montevocchi WA, Parker M, Pratte I, Rail J-F, Robertson GJ, Rock JC, Ronconi RA, Shutler D, Stenhouse IJ, Takahashi A, Watanuki Y, Welch LJ, Wilhelm SI, Wong SNP & Mallory ML (2023). Experts' opinions on threats to Leach's Storm-Petrels (*Hydrobates leucorhous*) across their global range. *Avian Conservation and Ecology* 18(1): art11.
- Poot M (2003). Offshore foraging of Mediterranean Gulls *Larus melanocephalus* in Portugal during the winter. *Atlantic Seabirds* 5(1): 1–12.
- Poot M (2008). Nocturnal and diurnal nearshore foraging of European Storm Petrels *Hydrobates* sp. along the Lisbon coast, Portugal. *Airo* 18: 13–21.
- Poot MJM & Flamant R (2006). Numbers, behaviour and origin of Mediterranean Gulls (*Larus Melanocephalus*) wintering along the west coast of southern Portugal. *Airo* 16: 13–22.
- Portuguese Rarities Committee Reports, see Book *Atlas of Seabirds of Portugal* – pp 207
- Pott C & Wiedenfeld DA (2017). Information gaps limit our understanding of seabird bycatch in global fisheries. *Biological Conservation* 210: 192–204.
- Projeto Arenaria (2025). *Monitorização da distribuição e abundância de aves nas praias e costas de Portugal*. Downloaded from sites. google.com/site/projectoarenaria/Home on 21.12.2025.
- Projeto Freira da Madeira (2010). *Relatório intercalar do impacto do incêndio na zona de nidificação da Freira da Madeira (secção Oeste do Maciço Montanhoso Central)*.
- Provencher JF, Bond AL, Avery-Gomm S, Borrelle SB, Bravo Rebolledo EL, Hammer S, Kühn S, Lavers JL, Mallory ML, Trevaíl A & van Franeker JA (2019). Recommended best practices for plastic and litter ingestion studies in marine birds: Collection, processing and reporting. *FACETS* 4(1): 111–130.
- Provencher JF, Bond AL, Avery-Gomm S, Borrelle SB, Bravo Rebolledo EL, Lavers JL, Mallory ML, Trevaíl A, van Franeker JA, Hammer S & Kühn S (2017). Quantifying ingested debris in marine megafauna: A review and recommendations for standardization. *Analytical Methods* 9(9): 1454–1469.
- Provencher JF, Forbes MR, Hennin HL, Love OP, Braune BM, Mallory ML & Gilchrist HG (2016). Implications of mercury and lead concentrations on breeding physiology and phenology in an Arctic bird. *Environmental Pollution* 218: 1014–1022.
- Pyle P, Welch AJ & Fleischer RC (2011). A new species of shearwater (*Puffinus*) recorded from Midway Atoll, Northwestern Hawaiian Islands. *The Condor: Ornithological Applications* 113(3): 518–527.
- Raine AF, Boone M, McKown M & Holmes N (2017). The breeding phenology and distribution of the band-rumped storm-petrel (*Oceanodroma castro*) on Kaua'i and Lehua Islet, Hawaiian Islands. *Marine Ornithology* 45: 73–82.

- Raine AF, Borg JJ, Raine H & Phillips RA (2013). Migration strategies of the Yelkouan Shearwater *Puffinus yelkouan*. *Journal of Ornithology* 154(2): 411-422.
- Raine AF, Gjerdrum C, Pratte I, Madeiros J, Felis JJ & Adams J (2021). Marine distribution and foraging habitat highlight potential threats at sea for the endangered Bermuda petrel *Pterodroma Cahow*. *Endangered Species Research* 45: 337–356.
- Ramírez I, Geraldes P, Meirinho A, Amorim P & Paiva V (2008). Áreas Importantes para as Aves Marinhas em Portugal. Projecto LIFE04NAT/PT/000213 – Sociedade Portuguesa para o Estudo das Aves. Lisboa.
- Ramírez I, Mitchell D, Vulcano A, Rouxel Y, Marchowski D, Almeida A, Arcos JM, Cortes V, Lange G, Morkūnas J, Oliveira N & Paiva VH (2024). Seabird bycatch in European waters. *Animal Conservation* 27(6): 737-752.
- Ramírez I, Paiva VH, Menezes D, Silva I, Phillips RA, Ramos JA & Garthe S (2013). Year-round distribution and habitat preferences of the Bugio petrel. *Marine Ecology Progress Series* 476: 269–284.
- Ramírez I, Paiva VH, Fagundes I, Menezes D, Silva I, Ceia F, Phillips RA, Ramos JA & Garthe S (2016). Conservation implications of consistent foraging and trophic ecology in a rare petrel species. *Animal Conservation* 19: 139–152.
- Ramírez I, Tarzia M, Dias MP, Burfield IJ, Ramos JA, Garthe S & Paiva VH (2017). How well is the EU protecting its seabirds? Progress in implementing the Birds Directive at sea. *Marine Policy* 81: 179-184.
- Ramos JA, Fagundes AI, Xavier J C, Fidalgo V, Ceia FR, Medeiros R & Paiva V H (2015a). A switch in the Atlantic Oscillation correlates with inter-annual changes in foraging location and food habits of Macaronesian shearwaters (*Puffinus baroli*) nesting on two islands of the sub-tropical Atlantic Ocean. *Deep-Sea Research I* 104: 60–71.
- Ramos JA, Monteiro LR, Sola E & Moniz Z (1997). Characteristics and competition for nest cavities in burrowing Procelariiformes. *The Condor* 99: 634-641.
- Ramos JA, Pedro P, Matos A & Paiva VH (2013a). Relation between climatic factors, diet and reproductive parameters of Little Terns over a decade. *Acta Oecologica* 53: 56-52.
- Ramos JA, Solá E, Monteiro LR & Ratcliffe N (1998). Prey delivered to roseate tern chicks in the Azores. *Journal of Field Ornithology* 69: 419-429.
- Ramos R, Carlile N, Madeiros J, Ramírez I, Paiva VH, Dinis HA, Zino F, Biscoito M, Leal GR, Bugoni L, Jodice PGR, Ryan PG & González-Solís J (2017). It is the time for oceanic seabirds: tracking year-round distribution of gadfly petrels across the Atlantic Ocean. *Diversity and Distributions* 23: 794–805.
- Ramos R, Granadeiro JP, Nevoux M, Mougín J-L, Dias MP & Catty P (2012). Combined Spatio-Temporal Impacts of Climate and Longline Fisheries on the Survival of a Trans-Equatorial Marine Migrant. *PLoS ONE* 7(7): e40822.
- Ramos R, Granadeiro JP, Rodríguez B, Navarro J, Paiva VH, Bécares J, Reyes-González JM, Fagundes I, Ruiz A, Arcos JM, González-Solís J & Catty P (2013b). Meta-population feeding grounds of Cory's shearwater in the subtropical Atlantic Ocean: implications for the definition of Marine Protected Areas based on tracking studies. *Diversity and Distributions* 19(10): 1284-1298.
- Ramos R, Paiva VH, Zajková Z, Precheur C, Fagundes AI, Jodice PGR, Mackin W, Zino F, Bretagnolle V & González-Solís J (2020). Spatial ecology of closely related taxa: the case of the little shearwater complex in the North Atlantic Ocean. *Zoological Journal of the Linnean Society* XX: 1–21.
- Ramos R, Ramírez, Paiva VH, Militão T, Biscoito M, Menezes D, Phillips RA, Zino F & González-Solís J (2016). Global spatial ecology of three closely-related gadfly petrels. *Scientific Reports* 6: 23447.
- Ramos R, Sanz V, Militão T, Bried J, Neves VC, Biscoito M, Phillips RA, Zino F & González-Solís J (2015b). Leapfrog migration and habitat preferences of a small oceanic seabird, Bulwer's Petrel (*Bulweria bulwerii*). *Journal of Biogeography*, 42: 1651-1664.
- Rando JC, Pieper H, Pereira F, Torres-Roig E & Alcover JA (2024). Petrel extinction in Macaronesia (North-East Atlantic Ocean): the case of the genus *Pterodroma* (Aves: Procellariiformes: Procellariidae). *Zoological Journal of the Linnean Society* 202(2): zlae123.
- Ratcliffe N, Zino FJ, Oliveira P, Vasconcelos A, Hazevoet CJ, Neves HC, Monteiro LR & Zino EA (2000). The status and distribution of Fea's Petrel *Pterodroma feae* in the Cape Verde Islands. *Atlantic Seabirds* 2(2): 73-86.
- Rayner MJ, Gaskin CP, Fitzgerald NB, Baird KA, Berg M, Boyle D, Joyce L, Landers TJ, Loh G, Maturin S, Perrimen L, Scofield RP, Simm J, Southey I, Tennyson AJD, Robertson BC, Young M, Walle R & Ismar SMH (2015). Miniaturised radio telemetry to discover endangered seabird breeding grounds: a case study of the New Zealand storm petrel *Fregetta maoriana*. *Ibis* 157: 754-766.
- Rehfish MM, Austin GE, Freeman SN, Armitage MJS & Burton NHK (2004). The possible impact of climate change on the future distributions and numbers of waders on Britain's non-estuarine coast. *Ibis* 146: 70–81.
- Reneerkens J, Benhoussa A, Boland H, Collier M, Grond K, Guenther K, Hallgrimsson GT, Hansen J, Meissner W, de Meulenaer B, Ntiama-Baidu Y, Piersma T, Poot M, van Roomen M, Summers RW, Tomkovich PS & Underhill LG (2009). Sanderlings using African–Eurasian flyways: A review of current knowledge. *Wader Study Group Bulletin* 116: 2–20.
- Reyes-González JM (2022). *Pardela cenicienta atlántica* Calonectris borealis. In Molina B, Nebreda A, Muñoz AR, Seoane J, Real R, Bustamante J & del Moral JC. *III Atlas de las aves en época de reproducción en España*. SEO/BirdLife. Madrid.
- Richards C, Cooke RS & Bates AE (2021). Biological traits of seabirds predict extinction risk and vulnerability to anthropogenic threats. *Global Ecology and Biogeography* 30(5): 973-986.
- Robb M, Alfrey P, Alves P, Cardoso H, Crochet PA, Fagerström V, Fernandes P, Nicolau P, Ramalho P & Valkenburg T (2025). Aves de ocorrência rara ou acidental em Portugal. Relatório do Comité Português de Raridades referente ao ano de 2023. *Anuário Ornitológico* 17: 3-37.
- Rocha AD (2022). Censo Nacional do Borrelho-de-coleira-interrompida, 2021. In Alonso H, Andrade J, Teodósio J & Lopes A (coord.). *O estado das aves em Portugal, 2022*. 2ª edição. Sociedade Portuguesa para o Estudo das Aves, Lisboa.
- Rocha AD, Fonseca D, Masero JA & Ramos JA (2016). Coastal salt pans are a good alternative breeding habitat for Kentish plover *Charadrius alexandrinus* when umbrella species are present. *Journal of Avian Biology* 47: 824-833.
- Rocha AR, Ramos JA, Paredes T & Masero JA (2017). Coastal salt pans as foraging grounds for migrating shorebirds: an experimentally drained fish pond in Portugal. *Hydrobiologia* 790(1): 141-155.
- Rodríguez A & Rodríguez B (2009). Attraction of petrels to artificial lights in the Canary Islands: effects of the moon phase and age class: Petrel attraction to lights. *Ibis* 151: 299-310.
- Rodríguez A, Holmes ND, Ryan PG, Wilson KJ, Faulquier L, Murillo Y, Raine AF, Penniman JF, Neves V, Rodríguez B, Negro JJ, Chiaradia A, Dann P, Anderson T, Metzger B, Shirai M, Deppe L, Wheeler J, Hodum P, Gouveia C, Carmo V, Carreira GP, Delgado-Alburquerque L, Guerra-Correa C, Couzi FX, Travers M & Corre ML (2017). Seabird mortality induced by land-based artificial lights. *Conservation Biology* 31(5): 986-1001.
- Rodríguez A, Rodríguez B & Lucas M P (2012). Trends in numbers of petrels attracted to artificial lights suggest population declines in Tenerife, Canary Islands. *Ibis* 154: 167-172.
- Rodríguez Y, Rodríguez A, van Loon WM, Pereira JM, Frias J, Duncan EM, Garcia S, Herrera L, Marqués C, Neves V, Domínguez-Hernández C, Hernández-Borges J, Rodríguez B & Pham CK (2024). Cory's shearwater as a key bioindicator for monitoring floating plastics. *Environment International journal* 108595.
- Romero J, Alonso H, Freitas L & Granadeiro JP (2024). Food web of the oceanic region of the archipelago of Madeira: The role of marine megafauna in the subtropical northeast Atlantic ecosystem. *Marine Environmental Research* 195: 106382.
- Romero J, Catty P, Alonso H & Granadeiro JP (2021). Seabird diet analysis suggests sudden shift in the pelagic communities of the subtropical Northeast Atlantic. *Marine Environmental Research* 165: 105232.
- Romero J, Catty P, Menezes D, Coelho N, Silva JP & Granadeiro JP (2019). A gull that scarcely ventures on the ocean: Yellow-Legged Gulls *Larus michahellis atlantis* on the oceanic island of Madeira. *Ardeola* 66(1): 101-112.
- Ronconi RA, Allard KA & Taylor PD (2015). Bird interactions with offshore oil and gas platforms: Review of impacts and monitoring techniques. *Journal of Environmental Management* 147: 34-45.
- Roux F (1983). Présence et reproduction de Laridés nouveaux aux îles Salvages. *L'Oiseau et la R.F.O.* 53: 291-292.
- Rueda-Urbe C, Lötberg U, Ericsson M, Tesson SV & Åkesson S (2021). First tracking of declining Caspian terns *Hydroprogne caspia* breeding in the Baltic Sea reveals high migratory dispersion and disjunct annual ranges as obstacles to effective conservation. *Journal of Avian Biology* 52.

- Ruffino L, Bourgeois K, Vidal E, Duhem C, Paracuellos M, Escribano F, Sposimo P, Baccetti, N, Pascal M & Oro D (2009). Invasive rats and seabirds: a review after 2,000 years of an unwanted coexistence on Mediterranean islands. *Biological Invasions* 11: 1631-1651.
- Rufino R & Neves R (1990). Invernada de pato-negro *Melanitta nigra* na costa de Aveiro: Janeiro de 1990. *Airo* 2: 1-2
- Rufino R & Neves R (2004). *Wintering common scoter Melanitta nigra in Portugal: results of aerial surveys - 1991-1999*. Regional Status Reports (unpublished report).
- Ruiz A & Martí R (2004). *La Pareda Balear*. SEO/BirdLife-Conselleria de Medi Ambient del Govern de les Illes Balears, Madrid.
- Ryan PG (2018). Entanglement of birds in plastics and other synthetic materials. *Marine Pollution Bulletin* 135: 159-164.
- Sandvik H, Erikstad KE, Barrett RT & Yoccoz NG (2005). The effect of climate on adult survival in five species of North Atlantic seabirds. *Journal of Animal Ecology* 74(5): 817-831.
- Saraux C, Sydeman WJ, Piatt JF, Anker-Nilssen T, Hentati-Sundberg J, Bertrand S, Curry PM, Furness RW, Mills JA, Österblom H, Passuni G, Roux J-P, Shannon LJ & Crawford RJ (2021). Seabird-induced natural mortality of forage fish varies with fish abundance: Evidence from five ecosystems. *Fish and Fisheries* 22(2): 262-279.
- Schekkerman H, Fall KG, Nagy S & van Roomen M (2018). Patterns in trends of waterbird populations using the coastal East Atlantic Flyway, update 2017. In van Roomen M, Nagy S, Citegetse G & Schekkerman H (eds.), *East Atlantic Flyway Assessment 2017: the status of coastal waterbird populations and their sites*. Wadden Sea Flyway Initiative p/a CWSS, Wilhelmshaven, Germany, Wetlands International, Wageningen, The Netherlands, BirdLife International, Cambridge, United Kingdom.
- Schreiber EA & Burger J (eds.) (2002). *Biology of Marine Birds*. CRC Press, Boca Raton.
- Sebastiano M, Costantini D, Eens M, Pineau K, Bustamante P & Chastel O (2022). Possible interaction between exposure to environmental contaminants and nutritional stress in promoting disease occurrence in seabirds from French Guiana: a review. *Regional environmental change* 22(2): 63.
- Semedo G, Paiva VH, Militão T, Rodrigues IB, Dinis HA, Pereira J, Matos DM, Ceia FR, Almeida N, Geraides P, Saldanha S, Barbosa N, Hernández-Montero M, Fernandes C, González-Solís J & Ramos JA (2021). Distribution, abundance, and on-land threats to Cabo Verde seabirds. *Bird Conservation International* 31(1): 53-76.
- Shaffer SA, Tremblay Y, Weimerskirch H, Scott DP, Thompson DR, Sagar PM, Moller H, Taylor GA, Foley DG, Block BA & Costa DP (2006). Migratory shearwaters integrate oceanic resources across the Pacific Ocean in an endless summer. *Proceedings of the National Academy of Sciences* 103(34): 12799-12802.
- Shamoun-Baranes J, Burant JB, Van Loon EE, Bouten W & Camphuysen CJ (2017). Short distance migrants travel as far as long distance migrants in lesser black-backed gulls *Larus fuscus*. *Journal of Avian Biology* 48(1): 49-57.
- Shuford WD & Craig DP (2002). *Status assessment and conservation recommendations for the Caspian Tern (Sterna caspia) in North America*. U.S. Department of the Interior, Fish and Wildlife Service, Portland, OR.
- Shumway SE, Allen SM & Boersma PD (2003). Marine birds and harmful algal blooms: sporadic victims or under-reported events? *Harmful Algae* 2(1): 1-17.
- Silva MA & Canto e Castro MF (1992). Recuperação de anilhas entre 1989 e 1991. *Airo* 3 (3): 90-120.
- Silva MA, Prieto R, Cascão I, Seabra MI, Machete M, Baumgartner MF & Santos RS (2014). Spatial and temporal distribution of cetaceans in the mid-Atlantic waters around the Azores. *Marine Biology Research* 10(2): 123-137.
- Silva MC, Catry P, Newton J, Nunes VL & Wakefield ED (2024). Diet of non-breeding leach's storm-petrels (*Hydrobates leucorhous*) in the sub-polar frontal zone of the North Atlantic. *Marine Biology* 171(8): 148.
- Sittler B, Aebischer A & Gilg O (2011). Post-breeding migration of four Long-tailed Skuas (*Stercorarius longicaudus*) from North and East Greenland to West Africa. *Journal of Ornithology* 152: 375-381.
- Snow DW & Perrins CM (1998). *The Birds of the Western Palearctic vol. 1: Non-Passerines*. Oxford University Press, Oxford.
- Sobrinho-Monteliu M, Navarro A, Rodríguez B, Tejera G, Herrera A & Rodríguez A (2025). Seabird biomonitoring indicates similar plastic pollution throughout the Canary Current. *Marine Pollution Bulletin* 211: 117424.
- SPEA (2023). *Monitorização de arrojamentos. Resultados da monitorização 2011-2022 e de um evento extraordinário em 2023*. Infografia. Sociedade Portuguesa para o Estudo das Aves.
- Stenhouse I, Egevang C & Phillips RA (2011). Trans-equatorial migration, staging sites and wintering area of Sabine's Gulls *Larus sabini* in the Atlantic Ocean. *Ibis* 154: 42-51.
- Sultana J, Borg JJ, Gauci C & Falzon V (2011). *The Breeding Birds of Malta*. BirdLife Malta, Malta.
- Suryan R, Santora J & Sydeman W (2012). New approach for using remotely sensed chlorophyll *a* to identify seabird hotspots. *Marine Ecology Progress Series* 451: 213-225.
- Svensson L, Mullaney K & Zetterström D (2022). *Guia de Aves - O Guia de Campo Mais Completo das Aves de Portugal e da Europa. 4ª edição*. Assirio & Alvim, Lisboa.
- Taylor M & Tipling D (2014). *RSPB Seabirds*. Bloombury Publishing, London.
- Taylor RC (1980). Migration of the Ringed Plover *Charadrius hiaticula*. *Ornis Scandinavica* 11: 30-42.
- Teboul E, Orihel DM, Provencher JF, Drever MC, Wilson L & Harrison AL (2021). Chemical identification of microplastics ingested by Red Phalaropes (*Phalaropus fulicarius*) using Fourier Transform Infrared spectroscopy. *Marine Pollution Bulletin* 171: 1-7.
- Teixeira AM (1983). Seabirds breeding at the Berlengas, forty-two years after Lockley's visit. *Ibis* 125: 417-420.
- Teixeira AM (1984). Aves Marinhas nidificantes no litoral português. Actas do Colóquio Nacional para a Conservação das Zonas Ribeirinhas. *Boletim da Liga para a Protecção da Natureza* 18(3): 105-115.
- Telfer TC, Sincok JL, Byrd GV & Reed JR (1987). Attraction of Hawaiian seabirds to lights: conservation efforts and effects of moon phase. *Wildlife Society Bulletin* 15(3): 406-413.
- Theron AJ, Tintinger GR & Anderson R (2012). Harmful interactions of non-essential heavy metals with cells of the innate immune system. *Journal of Clinical Toxicology* s3: 005.
- Thorisson B, Eyjólfsson V, Gardarsson A, Albertsdóttir HB & Gunnarsson TG (2012). The non-breeding distribution of Icelandic Common Ringed Plovers. *Wader Study Group Bulletin* 119(2): 97-101.
- Tipper R, Alfrey P, Alves P, Cardoso H, Crochet P-A, Leitão AH, Ramalho P, Robb M & Valkenburg T (2022). Aves de ocorrência rara ou acidental em Portugal. Relatório do Comité Português de Raridades referentes ao ano de 2020. *Anuário Ornitológico* 14: 3-51.
- Tremlett CJ, Cleasby IR, Bolton M & Wilson LJ (2024). Declines in UK breeding populations of seabird species of conservation concern following the outbreak of high pathogenicity avian influenza (HPAI) in 2021-2022. *Bird Study* 71(4): 293-31.
- Trigo S (2007). *Ecologia alimentar e de reprodução de Borrelho-de-coleira-interrompida*, Charadrius alexandrinus, na faixa costeira da Ria de Aveiro. Tese de Mestrado em Ecologia. Universidade de Coimbra.
- Troisi G, Barton S & Bexton S (2016). Impacts of oil spills on seabirds: Unsustainable impacts of non-renewable energy. *International Journal of Hydrogen Energy* 41(37): 16549-16555.
- Uhart MM, Gallo L & Quintana F (2018). Review of diseases (pathogen isolation, direct recovery and antibodies) in albatrosses and large petrels worldwide. *Bird Conservation International* 28(2): 169-196.
- Uhlmann S (2003). *Fisheries bycatch mortalities of sooty shearwaters (Puffinus griseus) and short-tailed shearwaters (P. tenuirostris)*. DOC Science Internal Series 92, Department of Conservation, New Zealand.
- Valeiras J (2003). Attendance of scavenging seabirds at trawler discards off Galicia, Spain. *Scientia Marina* 67(Suppl. 2): 77-82.
- van Bemmelen RS, Leemans JJ, Collier MP, Green RM, Middelveld RP, Thaxter CB & Fijn RC (2024a). Avoidance of offshore wind farms by Sandwich Terns increases with turbine density. *Ornithological Applications* 126(1): duad0055.
- van Bemmelen RSA, Moe B, Schekkerman H, Hansen SA, Snell KRS, Humphreys EM, Mäntylä E, Hallgrímsson GT, Gilg O, Ehrich D, Calladine J, Hammer S, Harris S, Lang J, Vignisson SR, Kolbeinsson Y, Nuotio K, Sillanpää M, Sittler B, Sokolov A, Klaassen RHG, Phillips RA & Tulp I (2024b). Synchronous timing of return to breeding sites in a long-distance migratory seabird with ocean-scale variation in migration schedules. *Movement Ecology* 12: 22.
- van Franeker JA, Blaize C, Danielsen J, Fairclough K, Gollan J, Guse N, Hansen PL, Heubeck M, Jensen JK, Le Guillou G, Olsen B, Olsen KO, Pedersen J, Stienen EWM & Turner DM (2011). Monitoring plastic

- ingestion by the northern fulmar *Fulmarus glacialis* in the North Sea. *Environmental Pollution* 159: 2609–2615.
- van Franeker JA, Jensen J-K, Simonsen PJ, Bravo Rebolledo EL & Kühn S (2022). Plastics in stomachs of northern fulmars *Fulmarus glacialis* collected at sea off east Greenland: Latitude, age, sex and season. *Marine Biology* 169(4): 47.
- van Franeker JA, Soldaat E, Bried J, González-Solís J, Zino F, Biscoito M, Borg JJ, Tossani F, Parolini M & Kühn S (2026) Plastic ingestion by Cory's and Scopoli's shearwaters (*Calonectris* spp.) from the north-eastern Atlantic Ocean and Mediterranean Sea. *Marine Pollution Bulletin* 223: 119008.
- Veiga-Malta T, Szalaj D, Angélico MM, Azevedo M, Farias I, Garrido S, Lourenço S, Marçalo A, Marques V, Moreno A, Oliveira PB, Paiva VH, Prista N, Silva C, Sobrinho-Gonçalves L, Vingada J & Silva A (2019). First representation of the trophic structure and functioning of the Portuguese continental shelf ecosystem: insights into the role of sardine. *Marine Ecology Progress Series* 617-618: 323-340.
- Velando A & Munilla I (2011). Disturbance to a foraging seabird by sea-based tourism: Implications for reserve management in marine protected areas. *Biological Conservation* 144(3): 1167-1174.
- Velando A, Munilla I & Leyenda PM (2005). Short-term indirect effects of the 'Prestige' oil spill on European Shags: changes in availability of prey. *Marine Ecology Progress Series* 302: 263-274.
- Velde PMV (2025). *Analysis of population trends of overwintering coastal birds in continental Portugal in relation to habitat type*. Tese de Mestrado em Biologia Marinha. Faculdade de Ciências e Tecnologia. Universidade do Algarve.
- Ventura F, Catry P, Dias MP, Breed G, Folch A, Granadeiro JP (2022). A central place foraging seabird flies at right angles to the wind to jointly optimize locomotor and olfactory search efficiency. *Proceedings of the Royal Society B* 289: 20220895.
- Ventura F, Granadeiro J, Catry P, Gjerdrum C, De Pascalis F, Viveiros F, Silva I, Menezes D, Paiva VH & Silva MC (2024). Allochrony is shaped by foraging niche segregation rather than adaptation to the windscape in long-ranging seabirds. *Movement Ecology* 12: 27.
- Ventura F, Granadeiro JP, Padgett O & Catry P (2020). Gadfly petrels use knowledge of the windscape, not memorized foraging patches, to optimize foraging trips on ocean-wide scales. *Proceedings of the Royal Society B: Biological Sciences* 287(1918): 20191775.
- Veríssimo SN, Paiva VH, Cunha SC, Brandão ALC, Coentro J, Fernandes JO, Pereira JM, Batista de Carvalho LAE, Cerveira LR, Marques MPM, Silva V, Norte AC & Ramos JA (2025). From mudflats and salt pans to open sea: Plastic ingestion and PBDE/MeO-BDE accumulation in waterbirds from southern Portugal. *Marine Pollution Bulletin* 214.
- Vieite B, Braga HO, Costa Neto EM & Azeiteiro UM (2022). Fishermen's knowledge and conservation attitudes: focus on the great cormorant *Phalacrocorax carbo* (Linnaeus, 1758) in the Minho River, Portugal. *Aquatic Ecology* 56(3): 667–684.
- Votier SC, Archibald K, Morgan G & Morgan L (2011). The use of plastic debris as nesting material by a colonial seabird and associated entanglement mortality. *Marine Pollution Bulletin* 62(1): 168-172.
- Votier SC, Bearhop S, Witt MJ, Inger R, Thompson D & Newton J (2010). Individual responses of seabirds to commercial fisheries revealed using GPS tracking, stable isotopes and vessel monitoring systems. *Journal of applied ecology* 47(2): 487-497.
- Voulgaris M-D, Karris G, Xirouchakis S, Pedro PZ, Asimakopoulos AG, Grivas K & Bebianno MJ (2019). Trace metal blood concentrations in Scopoli's shearwaters (*Calonectris diomedea*) during 2007–2014: A systematic analysis of the largest species colony in Greece, Greece. *Science of the Total Environment* 691: 187-194.
- Vulcano A, Rutherford CA, Mitchell D, Dias M, Pymartin A & Staneva A (2024). *Seabirds of Europe: current status, main threats and way forward*. BirdLife Europe and Central Asia Summary Report.
- Waap S, Symondson WOC, Granadeiro JP, Alonso H, Serra-Gonçalves C, Dias MP & Catry P (2017). The diet of a nocturnal pelagic predator, the Bulwer's petrel, across the lunar cycle. *Scientific Reports* 7: 1384.
- Ward EJ, Holmes EE, Thorson JT & Collen B (2014). Complexity is costly: a meta-analysis of parametric and non-parametric methods for short-term population forecasting. *Oikos* 123(6): 652-661.
- Weimerskirch H (2002). Seabird demography and its relationship with the marine environment. In Schreiber EA & Burger J (eds.). *Biology of Marine Birds*. CRC Press, Boca Raton: 115-136.
- Wetlands International (2025). *Waterbird Population Estimates*. Downloaded from <http://wpe.wetlands.org> on 30.11.2025.
- Whitney K (2022). *History of Wildlife Tracking Technologies*. Oxford Research Encyclopedia of Environmental Science. Downloaded from <https://oxfordre.com/environmentalscience/view/10.1093/acrefore/9780199389414.001.0001/acrefore-9780199389414-e-725> on 30.11.2025.
- Wilcox C, van Seville E & Hardesty BD (2015). Threat of plastic pollution to seabirds is global, pervasive, and increasing. *Proceedings of the National Academy of Sciences* 112(38): 11899–11904.
- Woods R, Jones HI, Watts J, Miller GD & Shellam GR (2009). Diseases of Antarctic seabirds. In Kerry KR & Riddle MJ (eds.). *Health of Antarctic wildlife: a challenge for science and policy*. Springer, Berlin/Heidelberg: 35-55.
- Xavier JC, Magalhães MC, Mendonça AS, Antunes M, Carvalho N, Machete M, Santos RS, Paiva V & Hamer KC (2011). Changes in diet of Cory's shearwaters *Calonectris diomedea* breeding in the Azores. *Marine Ornithology* 39: 129-134.
- Xavier JC, Magalhães MC, Mendonça AS, Antunes M, Carvalho N, Machete M, Santos RS, Paiva V & Hamer KC (2011). Changes in diet of Cory's shearwaters *Calonectris diomedea* breeding in the Azores. *Marine Ornithology* 39: 129-134.
- Zajková Z, Militão T & González-Solís J (2017). Year-round movements of a small seabird and oceanic isotopic gradient in the tropical Atlantic. *Marine Ecology Progress Series* 579: 169-183.
- Zino F, Biscoito MJ & Zino PA (1995a). Birds of the archipelago of Madeira and the Selvagens. New records and checklist. *Boletim do Museu Municipal do Funchal* 47(262): 61-100.
- Zino F, Heredia B & Biscoito M (1995b). Action plan for Zino's petrel *Pterodroma madeira*. In Heredia B, Rose L & Painter M (eds.). *Globally threatened birds in Europe: action plans*. Council of Europe and BirdLife International, Strasbourg: 25-31.
- Zino F, Heredia B & Biscoito MJ (1996). Action plan for Fea's Petrel (*Pterodroma feae*). In Heredia B, Rose L & Painter M (eds.). *Globally threatened birds in Europe: action plans*. Council of Europe and BirdLife International, Strasbourg: 25-31.
- Zino F, Oliveira P, King S, Buckle A, Biscoito M, Neves H & Vasconcelos A (2001). Conservation of Zino's petrel *Pterodroma madeira* in the archipelago of Madeira. *Oryx* 35: 128–136.
- Zino F, Phillips R & Biscoito M (2012). Bulwer's Petrel movements at sea – a preliminary analysis of datalogger results from Selvagem Grande. *Birding World* 26(2): 79-81.
- Zino F, Phillips R & Biscoito M (2011). Zino's Petrel movements at sea - a preliminary analysis of datalogger results. *Birding World* 24: 216–219.
- Zino PA (1985). Pequeno apontamento histórico sobre a caça das cagaras na Selvagem Grande e desenvolvimentos recentes nesta ilha. *Bocagiana* 84: 1-14.
- Zonfrillo B (1986). Diet of Bulwer's petrel *Bulweria bulwerii* in the Madeiran archipelago. *Ibis* 128: 570-572.
- Žydelis R, Small C & French G (2013). The incidental catch of seabirds in gillnet fisheries: a global review. *Biological Conservation* 162: 76-88.

18. Tracking data source references

- Åkesson S, Lötberg U & Rueda-Urbe C (2022). Data from: Study "Tracking of Caspian Terns (*Hydroprogne caspia*) in the Swedish Baltic Sea 2017–2020". Movebank Data Repository.
- Alerstam T, Bäckman J, Grönroos J, Olofsson P, Strandberg R & Sjöberg S (2025). Migration of black terns *Chlidonias niger* and common terns *Sterna hirundo* between south Sweden and the Atlantic coast of Africa. *Journal of Avian Biology* 2025: e03348.
- Araújo A & Rufino R (1981). *Populações de aves marinhas na costa sul e sudoeste de Portugal*. Secretaria de Estado do Ordenamento e Ambiente, CEMPA, Lisboa.
- Arcos JM (2006). Dataset 672: Cory's Shearwater, *Calonectris borealis*, PTT, Agranza, Canarias, Spain, 2006. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/672/> on 30.11.2025.
- Arcos JM (2007). Dataset 674: Scopoli's Shearwater, *Calonectris diomedea*, PTT, Chafarinas, Chafarinas, Spain, 2007. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/674/> on 30.11.2025.
- Arcos JM (2010a). Dataset 862: Cory's Shearwater, *Calonectris borealis*, GPS, Agranza, Canarias, Spain, 2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/862/> on 30.11.2025.
- Arcos JM (2010b). Dataset 859: Bulwer's Petrel, *Bulweria bulwerii*, PTT, Agranza, Canarias, Spain, 2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/859/> on 30.11.2025.
- Arcos JM (2011). Dataset 860: Scopoli's Shearwater, *Calonectris diomedea*, GPS, Chafarinas, Chafarinas, Spain, 2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/860/> on 30.11.2025.
- Arcos JM & Ruiz A (2000a). Dataset 828: Balearic Shearwater, *Puffinus mauretanicus*, PTT, Formentera, Balearic Archipelago, Spain, 2000. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/828/> on 30.11.2025.
- Arcos JM & Ruiz A (2000b). Dataset 829: Balearic Shearwater, *Puffinus mauretanicus*, PTT, Ibiza, Balearic Archipelago, Spain, 2000. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/829/> on 30.11.2025.
- Atchoi E (2021). Relatório Final LuMinAves – FRCT. Okeanos-UAç, Horta, Azores.
- Burnham KK, Burnham JL, Johnson JA & Huffman A (2021). Data from: Migratory movements of Atlantic puffins *Fratercula arctica naumanni* from High Arctic Greenland. *Movebank Data Repository*. Downloaded from <https://www.doi.org/10.5441/001/1.nr8qv005>.
- Byholm P, Beal M, Lötberg U & Åkesson S (2022). Data from: Paternal transmission of migration knowledge in a long-distance bird migrant. *Movebank Data Repository*. Downloaded from <https://www.doi.org/10.5441/001/1.352qf1cv>.
- Calado M (1996). Little Tern (*Sterna albigifrons*) status and conservation at Ria Formosa Natural Park, Algarve, Portugal. *Colonial Waterbirds* 19 (Special Publication): 78–80.
- Campioni L, Catry P, Granadeiro JP & Dias MA (2016). Dataset 1459: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Selvagens, Madeira, Portugal, 2012–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1459/> on 30.11.2025.
- Catry I (2002). *Distribuição e efectivo das populações reprodutoras de Gaivota-de-patas-amarelas (Larus cachinnans) e Corvo-marinho-de-crista (Phalacrocorax aristotelis) na costa rochosa continental*. Instituto de Conservação da Natureza.
- Catry P & Granadeiro JP (2009). Dataset 1343: Cory's Shearwater, *Calonectris borealis*, GPS, Selvagens, Madeira, Portugal, 2009. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1343/> on 30.11.2025.
- Catry P & Granadeiro JP (2010). Dataset 1344: Cory's Shearwater, *Calonectris borealis*, GPS, Selvagens, Madeira, Portugal, 2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1344/> on 30.11.2025.
- Catry P & Granadeiro JP (2011). Dataset 1345: Cory's Shearwater, *Calonectris borealis*, GPS, Selvagens, Madeira, Portugal, 2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1345/> on 30.11.2025.
- Catry P & Granadeiro JP (2012). Dataset 1346: Cory's Shearwater, *Calonectris borealis*, GPS, Selvagens, Madeira, Portugal, 2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1346/> on 30.11.2025.
- Catry P & Granadeiro JP (2013). Dataset 1347: Cory's Shearwater, *Calonectris borealis*, GPS, Selvagens, Madeira, Portugal, 2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1347/> on 30.11.2025.
- Catry P & Granadeiro JP (2017). Dataset 1463: Desertas Petrel, *Pterodroma deserta*, GPS, Bugio, Madeira, Portugal, 2015–2017. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1463/> on 30.11.2025.
- Catry P, Costa H, Elias G & Matias R (2010). *Aves de Portugal, Ornitologia do Território Continental*. Lisboa.
- Catry P, Dias M, Catry T, Pedro P, Tenreiro P & Menezes D (2015). Bulwer's petrels breeding numbers on the Desertas Islands (Madeira): improved estimates indicate the NE Atlantic population to be much larger than previously thought. *Airo* 23: 10–14.
- Catry P, Dias M, Menezes D, Oliveira P, Lopes D, Alho M, Campioni L, Catry T, Gatt MC, Ventura F, Romero J & Granadeiro JP (2025). Fixed-plot monitoring as a tool to assess population trends of underground nesting seabirds: an example with Cory's Shearwater at its world's largest colony. *Bird Conservation International* 35 (e3): 1–8.
- Catry P, Galdes P, Pio JP & Almeida A (2010). Aves marinhas da Selvagem Pequena e do Ilhéu de Fora: censos e notas, com destaque para a dieta da gaivota-de-patas-amarelas. *Airo* 20: 29–35.
- Catry P, Granadeiro JP & Alho MS (2019a). Dataset 1665: White-faced Storm-petrel, *Pelagodroma marina*, GPS, Selvagens, Madeira, Portugal, 2018–2019. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1665/> on 30.11.2025.
- Catry P, Granadeiro JP & Silva MC (2019b). Dataset 1663: Zino's Petrel, *Pterodroma madeira*, GPS, Pico do Areeiro, Madeira, Portugal, 2018–2019. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1663/> on 30.11.2025.
- Catry P, Oliveira P, Menezes D & Granadeiro JP (2023). Nesting terns and gulls (Laridae) on the Selvagens Islands in 2023 and a brief review of past occurrence. *Airo* 31: 38–42.
- Catry T, Ramos JA, Catry I, Allen-Revez M & Grade N (2004). Are salinas a suitable alternative breeding habitat for Little Terns *Sterna albigifrons*? *Ibis* 146: 247–257.
- Cecere JG, Campioni L, De Pascalis F & Ruibolini D (2019). Dataset 1621: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Spargiotto-Barettini, La Maddalena Archipelago, Italy, 2018–2019. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1621/> on 30.11.2025.
- Cecere JG, Dell'Omo G & Campioni L (2013). Dataset 1682: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Capraia, Tremiti, Italy, 2011–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1682/> on 30.11.2025.
- Corman A-M, Mendel B, Voigt CC & Garthe S (2016). Varying foraging patterns in response to competition? A multicolony approach in a generalist seabird. *Ecology and Evolution* 6: 974–986.
- Costa LT, Nunes M, Galdes P & Costa H (2003). *Zonas importantes para as aves em Portugal*. Sociedade Portuguesa para o Estudo das Aves, Lisboa.
- Daunt F (2008). Dataset 1102: Black-legged Kittiwake, *Rissa tridactyla*, Geolocator (GLS), Isle of May, North Sea, United Kingdom, 2007–2008. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1102/> on 30.11.2025.
- Daunt F (2010). Dataset 1037: Black-legged Kittiwake, *Rissa tridactyla*, Geolocator (GLS), Isle of May, North Sea, United Kingdom, 2009–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1037/> on 30.11.2025.

- Davis SE, Maftei M & Mallory ML (2016). Migratory connectivity at high latitudes: Sabine's gulls (*Xema sabini*) from a colony in the Canadian high Arctic migrate to different oceans. *PLOS ONE* 11(12): e0166043.
- del Moral JC & Oliveira N (2019). *El cormorán moñudo en la península Ibérica. Población reproductora en 2017 y método de censo*. SEO/BirdLife, Madrid.
- Dias MA & Catry P (2010). Dataset 607: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Selvagens, Madeira, Portugal, 2008–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/607/> on 30.11.2025.
- Dias MA & Granadeiro JP (2008). Dataset 610: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Selvagens, Madeira, Portugal, 2006–2008. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/610/> on 30.11.2025.
- Dias MA, Catry P & Granadeiro JP (2011). Dataset 736: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Selvagens, Madeira, Portugal, 2010–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/736/> on 30.11.2025.
- DQEM (2020). *Relatório do 2.º ciclo. Estratégia Marinha. Parte B – Atividades, Pressões e Impactes. Subdivisão da Madeira*. Diretiva Quadro Estratégia Marinha. Governo dos Açores / Governo Regional da Região Autónoma da Madeira.
- DQEM (2024). *Relatório de avaliação das águas marinhas e metas ambientais do 3.º ciclo. Estratégia Marinha. Parte III – Subdivisão Madeira*. Estado Ambiental. Diretiva Quadro Estratégia Marinha. Secretaria Regional de Agricultura, Pescas e Ambiente. Governo Regional da Região Autónoma da Madeira.
- eBird (2026). eBird: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Downloaded from <http://www.ebird.org>.
- Egevang C (2008). Dataset 739: Arctic Tern, *Sterna paradisaea*, Geolocator (GLS), Sand Island, Young Sound, Greenland, 2007–2008. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/739/> on 30.11.2025.
- Encarnação V (2014). *Relatório do Projeto de Monitorização das espécies de aves aquáticas coloniais – 2014*. Instituto da Conservação da Natureza e das Florestas I.P., Lisboa.
- Equipa Atlas (2008). *Atlas das Aves Nidificantes em Portugal (1999–2005)*. ICNB, SPEA, Parque Natural da Madeira e Secretaria Regional do Ambiente e do Mar. Assírio & Alvim, Lisboa.
- Equipa Atlas (2022). *III Atlas das Aves Nidificantes de Portugal (2016–2021)*. SPEA, ICNF, LabOr/UE, IFCN.
- Fagundes I, Nunes J, Carvalho S, Menezes D & Delliger T (2002). Gaivotas nos aeroportos do Arquipélago da Madeira. Funchal.
- Fayet A & Guilford T (2014). Dataset 1124: Atlantic Puffin, *Fratercula arctica*, Geolocator (GLS), Skomer, Wales, United Kingdom, 2007–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1124/> on 30.11.2025.
- Fayet *al*, Freeman R, Anker-Nilssen T, Diamond A, Erikstad KE, Fifield D, Fitzsimmons MG, Hansen ES, Harris MP, Jessopp M, Kouwenberg AL, Kress S, Mowat S, Perrins CM, Petersen A, Petersen IK, Reiertsen TK, Robertson GJ, Shannon P, Sigurðsson IA, Shoji A, Wanless S & Guilford T (2017). Ocean-wide drivers of migration strategies and their influence on population breeding performance in a declining seabird. *Current Biology* 27(24): 3871–3878.
- Fijn RC, Hiemstra D, Phillips R & van der Winden J (2013). Arctic Terns I from the Netherlands Migrate Record Distances Across Three Oceans to Wilkes Land, East Antarctica. *Ardea* 101(1): 3–12.
- Fontaine R, Gimenez O & Bried J (2011). The impact of introduced predators, light-induced mortality of fledglings and poaching on the dynamics of the Cory's shearwater (*Calonectris diomedea*) population from the Azores, northeastern subtropical Atlantic. *Biological Conservation* 144: 1998–2011.
- Frederiksen M (2013). Dataset 1065: Thick-billed Murre, *Uria lomvia*, Geolocator (GLS), Kippaku, Greenland, Greenland, 2008–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1065/> on 30.11.2025.
- Furness R, Petersen A & Magnusdottir E (2009a). Dataset 1100: Great Skua, *Catharacta skua*, Geolocator (GLS), Breidamerkursundur, Iceland, Iceland, 2008–2009. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1100/> on 30.11.2025.
- Furness R, Petersen A & Magnusdottir E (2009b). Dataset 1101: Great Skua, *Catharacta skua*, Geolocator (GLS), Foula, Shetland, United Kingdom, 2008–2009. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1101/> on 30.11.2025.
- Furness R, Petersen A & Magnusdottir E (2010). Dataset 1099: Great Skua, *Catharacta skua*, Geolocator (GLS), Bear Island, Norway, Norway, 2008–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1099/> on 30.11.2025.
- Gagliardo A, Bried J, Lambardi P, Luschi P, Wikelski M & Bonadonna F (2013). Data from: Oceanic navigation in Cory's shearwaters. *Movebank Data Repository*. Downloaded from <https://www.doi.org/10.5441/001/1.nf80477p>.
- Geraldes P (2000). *Censos de Procelariformes na Ilha da Madeira. Época de nidificação 2000*. Relatório final do projeto Novos Atlas das Aves Nidificantes em Portugal. SPNM e ICN.
- Gonzalez-Solis J (2001). Dataset 508: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Chafarinas, Chafarinas, Spain, 2000–2001. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/508/> on 30.11.2025.
- Gonzalez-Solis J (2003a). Dataset 506: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Chafarinas, Chafarinas, Spain, 2002–2003. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/506/> on 30.11.2025.
- Gonzalez-Solis J (2003b). Dataset 507: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Pantaleu, Balearic Archipelago, Spain, 2002–2003. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/507/> on 30.11.2025.
- Gonzalez-Solis J (2003c). Dataset 1714: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Pantaleu, Balearic Archipelago, Spain, 2002–2003. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1714/> on 30.11.2025.
- Gonzalez-Solis J (2005). Dataset 509: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Veneguera, Canarias, Spain, 2002–2005. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/509/> on 30.11.2025.
- Gonzalez-Solis J (2009a). Dataset 984: Red-billed Tropicbird, *Phaethon aethereus*, Geolocator (GLS), Raso, Raso Islet, Cape Verde, 2008–2009. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/984/> on 30.11.2025.
- Gonzalez-Solis J (2009b). Dataset 981: Boyd's Shearwater, *Puffinus boydi*, Geolocator (GLS), Raso, Raso Islet, Cape Verde, 2007–2009. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/981/> on 30.11.2025.
- Gonzalez-Solis J (2010a). Dataset 972: Bulwer's Petrel, *Bulweria bulwerii*, Geolocator (GLS), Raso, Raso Islet, Cape Verde, 2007–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/972/> on 30.11.2025.
- Gonzalez-Solis J (2010b). Dataset 977: Cape Verde Shearwater, *Calonectris edwardsii*, Geolocator (GLS), Curral Velho, Boa Vista, Cape Verde, 2006–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/977/> on 30.11.2025.
- Gonzalez-Solis J (2010c). Dataset 978: Cape Verde Shearwater, *Calonectris edwardsii*, Geolocator (GLS), Raso, Raso Islet, Cape Verde, 2006–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/978/> on 30.11.2025.
- Gonzalez-Solis J (2010d). Dataset 979: Cape Verde Petrel, *Pterodroma feae*, Geolocator (GLS), Fogo, Fogo, Cape Verde, 2007–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/979/> on 30.11.2025.
- Gonzalez-Solis J (2010e). Dataset 693: Yelkouan Shearwater, *Puffinus yelkouan*, Geolocator (GLS), Iles Hyeres, Iles Hyeres, France, 2006–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/693/> on 30.11.2025.
- Gonzalez-Solis J (2012a). Dataset 970: Bulwer's Petrel, *Bulweria bulwerii*, Geolocator (GLS), Ilhéu de Cima, Ilhéus do Rombo, Cape Verde, 2010–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/970/> on 30.11.2025.
- Gonzalez-Solis J (2012b). Dataset 983: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), M Clara, Canarias, Spain, 2011–2012.

- BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/983/> on 30.11.2025.
- Gonzalez-Solis J (2012c). Dataset 1716: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Pantaleu, Balearic Archipelago, Spain, 2009–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1716/> on 30.11.2025.
- Gonzalez-Solis J (2013a). Dataset 971: Bulwer's Petrel, *Bulweria bulwerii*, Geolocator (GLS), M Clara, Canarias, Spain, 2010–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/971/> on 30.11.2025.
- Gonzalez-Solis J (2013b). Dataset 973: Bulwer's Petrel, *Bulweria bulwerii*, Geolocator (GLS), Vila, Azores, Portugal, 2007–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/973/> on 30.11.2025.
- Gonzalez-Solis J (2013c). Dataset 1691: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Chafarinas, Chafarinas, Spain, 2008–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1691/> on 30.11.2025.
- Gonzalez-Solis J (2013d). Dataset 974: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Veneguera, Canarias, Spain, 2002–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/974/> on 30.11.2025.
- Gonzalez-Solis J (2013e). Dataset 975: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Vila, Azores, Portugal, 2002–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/975/> on 30.11.2025.
- Gonzalez-Solis J (2013f). Dataset 1690: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Chafarinas, Chafarinas, Spain, 2008–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1690/> on 30.11.2025.
- Gonzalez-Solis J (2013g). Dataset 1715: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Pantaleu, Balearic Archipelago, Spain, 2012–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1715/> on 30.11.2025.
- Gonzalez-Solis J (2014a). Dataset 980: Boyd's Shearwater, *Puffinus boydi*, Geolocator (GLS), Ilhéu de Cima, Ilhéus do Rombo, Cape Verde, 2009–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/980/> on 30.11.2025.
- Gonzalez-Solis J (2014b). Dataset 1083: Manx Shearwater, *Puffinus puffinus*, Geolocator (GLS), Heimaey, Iceland, Iceland, 2006–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1083/> on 30.11.2025.
- Gonzalez-Solis J (2015a). Dataset 1710: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), M Clara, Canarias, Spain, 2012–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1710/> on 30.11.2025.
- Gonzalez-Solis J (2015b). Dataset 1669: Cory's Shearwater, *Calonectris borealis*, GPS, M Clara, Canarias, Spain, 2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1669/> on 30.11.2025.
- Gonzalez-Solis J (2015c). Dataset 1713: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Pantaleu, Balearic Archipelago, Spain, 2012–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1713/> on 30.11.2025.
- Gonzalez-Solis J (2015d). Dataset 1717: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Pantaleu, Balearic Archipelago, Spain, 2013–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1717/> on 30.11.2025.
- Gonzalez-Solis J (2015e). Dataset 1603: Cape Verde Shearwater, *Calonectris edwardsii*, Geolocator (GLS), Curral Velho, Boa Vista, Cape Verde, 2010–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1603/> on 30.11.2025.
- Gonzalez-Solis J (2016a). Dataset 1711: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Veneguera, Canarias, Spain, 2014–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1711/> on 30.11.2025.
- Gonzalez-Solis J (2016b). Dataset 1712: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Vila, Azores, Portugal, 2014–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1712/> on 30.11.2025.
- Gonzalez-Solis J (2016c). Dataset 1697: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Sisargas, Sisargas, Spain, 2015–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1697/> on 30.11.2025.
- Gonzalez-Solis J (2016d). Dataset 1696: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Terreros, Terreros, Spain, 2014–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1696/> on 30.11.2025.
- Gonzalez-Solis J (2016e). Dataset 1698: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Lanzarote/Timanfaya, Canarias, Spain, 2015–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1698/> on 30.11.2025.
- Gonzalez-Solis J (2016f). Dataset 1692: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Menorca/Cala Morell, Balearic Archipelago, Spain, 2014–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1692/> on 30.11.2025.
- Gonzalez-Solis J (2016g). Dataset 1693: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Na Pobra, Balearic Archipelago, Spain, 2015–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1693/> on 30.11.2025.
- Gonzalez-Solis J (2016h). Dataset 1694: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Na Foradada, Balearic Archipelago, Spain, 2015–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1694/> on 30.11.2025.
- Gonzalez-Solis J (2016i). Dataset 1695: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Palomas, Palomas, Spain, 2014–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1695/> on 30.11.2025.
- Gonzalez-Solis J (2016j). Dataset 1030: Audouin's Gull, *Larus audouinii*, GPS, Ebro Delta, Ebro Delta, Spain, 2015–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1030/> on 30.11.2025.
- Gonzalez-Solis J (2020a). Dataset 1639: Bulwer's Petrel, *Bulweria bulwerii*, GPS, M Clara, Canarias, Spain, 2020. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1639/> on 30.11.2025.
- Gonzalez-Solis J (2020b). Dataset 1640: Cory's Shearwater, *Calonectris borealis*, GPS, M Clara, Canarias, Spain, 2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1640/> on 30.11.2025.
- Gonzalez-Solis J (2021a). Dataset 2157: White-faced Storm-petrel, *Pelagodroma marina*, Geolocator (GLS), Pássaros, Boa Vista, Cape Verde, 2019–2021. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/2157/> on 30.11.2025.
- Gonzalez-Solis J (2021b). Dataset 1807: Bulwer's Petrel, *Bulweria bulwerii*, GPS, M Clara, Canarias, Spain, 2020. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1807/> on 30.11.2025.
- Gonzalez-Solis J (2021c). Dataset 1770: Cory's Shearwater, *Calonectris borealis*, GPS, M Clara, Canarias, Spain, 2021. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1770/> on 30.11.2025.
- Gonzalez-Solis J & Becker PH (2011). Dataset 985: Common Tern, *Sterna hirundo*, Geolocator (GLS), Lake Bant, Wilhelmshaven, Germany, 2009–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/985/> on 30.11.2025.
- Gonzalez-Solis J & Oro D (2012). Dataset 976: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Pantaleu, Balearic Archipelago, Spain, 2009–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/976/> on 30.11.2025.
- Gonzalez-Solis J & Ryan P (2014). Dataset 982: Great Shearwater, *Ardenna gravis*, Geolocator (GLS), Gough Island, Gough, Saint Helena, Ascension and Tristan da Cunha, 2008–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/982/> on 30.11.2025.

- Granadeiro JP & Catry P (2015). Dataset 1869: Bulwer's Petrel, *Bulweria bulwerii*, GPS, Deserta Grande, Madeira, Portugal, 2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1869/> on 30.11.2025.
- Granadeiro JP & Catry P (2021a). Dataset 1870: Bulwer's Petrel, *Bulweria bulwerii*, GPS, Selvagens, Madeira, Portugal, 2016–2021. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1870/> on 30.11.2025.
- Granadeiro JP & Catry P (2021b). Dataset 1868: Bulwer's Petrel, *Bulweria bulwerii*, GPS, Selvagens, Madeira, Portugal, 2016–2021. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1868/> on 30.11.2025.
- Granadeiro JP, Catry P & Dias MA (2012). Dataset 1470: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Selvagens, Madeira, Portugal, 2007–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1470/> on 30.11.2025.
- Granadeiro JP, Dias MP, Rebelo R, Santos CD & Catry P (2006). Numbers and population trends of Cory's shearwaters *Calonectris diomedea* at Selvagem Grande, Northeast Atlantic. *Waterbirds* 29: 56–60.
- Gremillet D & Dossa J (2011). Dataset 1023: Northern Gannet, *Morus bassanus*, Geolocator (GLS), Ile Rouzic, Brittany, France, 2010–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1023/> on 30.11.2025.
- Gremillet D & Péron C (2012a). Dataset 1748: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Porquerolles, Iles Hyeres, France, 2011–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1748/> on 30.11.2025.
- Gremillet D & Péron C (2012b). Dataset 1749: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Frioul, Frioul, France, 2011–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1749/> on 30.11.2025.
- Gremillet D & Péron C (2012c). Dataset 1750: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Giraglia, Giraglia, France, 2011–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1750/> on 30.11.2025.
- Gremillet D & Péron C (2012d). Dataset 1751: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Giraglia, Giraglia, France, 2011–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1751/> on 30.11.2025.
- Gremillet D & Péron C (2012e). Dataset 1752: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Riou, Riou, France, 2011–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1752/> on 30.11.2025.
- Hamer K & Lane J (2019). Dataset 1815: Northern Gannet, *Morus bassanus*, GPS, Bass Rock, East Lothian, United Kingdom, 2018–2019. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1815/> on 30.11.2025.
- Hansen ES & Thorarinsson TL (2014a). Dataset 1073: Atlantic Puffin, *Fratercula arctica*, Geolocator (GLS), Grimsey, Iceland, Iceland, 2013–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1073/> on 30.11.2025.
- Hansen ES & Thorarinsson TL (2014b). Dataset 1074: Atlantic Puffin, *Fratercula arctica*, Geolocator (GLS), Heimaey, Iceland, Iceland, 2013–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1074/> on 30.11.2025.
- Hansen ES & Thorarinsson TL (2014c). Dataset 1072: Atlantic Puffin, *Fratercula arctica*, Geolocator (GLS), Papey, Iceland, Iceland, 2013–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1072/> on 30.11.2025.
- Heath MF & Evans MI (eds.) (2000). *Important Bird Areas in Europe: Priority sites for conservation*. Vol. 2: Southern Europe. BirdLife International, Cambridge.
- Henriques ACM (2010). *Impacto dos predadores introduzidos na ilha do Corvo no sucesso reprodutor das populações de cagarro* (*Calonectris diomedea borealis*). Tese de Mestrado, Universidade Técnica de Lisboa.
- Hereward HFR, Porter B & Neves V (2020). Dataset 1630: Monteiro's Storm-petrel, *Hydrobates monteiroi*, GPS, Country Island, Country Island, Canada, 2020. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1630/> on 30.11.2025.
- IFCN (2020). *LIFE RECOVER NATURA (LIFE12 NAT/PT/000195)*. Final Report (01/10/2013–31/03/2019).
- Jessopp M (2013). Dataset 1048: Atlantic Puffin, *Fratercula arctica*, Geolocator (GLS), Skellig Michael, Kerry, Ireland, 2010–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1048/> on 30.11.2025.
- Jessopp M (2021). Dataset 1926: Atlantic Puffin, *Fratercula arctica*, Geolocator (GLS), Skellig Michael, Kerry, Ireland, 2010–2021. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1926/> on 30.11.2025.
- Jesus AGC (2018). *Contribuição para a monitorização da negrola* (*Melanitta nigra*) nas ZPEs Ria de Aveiro e Aveiro-Nazaré. Tese de Mestrado em Ecologia Aplicada, Universidade de Aveiro, 52 p.
- Karris G (2014). Dataset 1677: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Stamfani Island, Strofades Island Group, Greece, 2009–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1677/> on 30.11.2025.
- Kopp M, Esefeld J, Krietsch J & Peter H-U (2010). Dataset 1116: South Polar Skua, *Catharacta maccormicki*, Geolocator (GLS), King George Island, South Shetland Islands, Antarctica, 2007–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1116/> on 30.11.2025.
- Krüger L (2014). Dataset 1282: Trindade Petrel, *Pterodroma arminjoniana*, Geolocator (GLS), Praia das Tartarugas, Trindade Island, Brazil, 2013–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1282/> on 30.11.2025.
- Lago P, Metzger B & BirdLife Malta (2017). Dataset 1443: European Storm-petrel, *Hydrobates pelagicus*, Geolocator (GLS), Filfla, Filfla, Malta, 2016–2017. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1443/> on 30.11.2025.
- Lamelas-Lopez L, Ferrante M, Borges PA, do Rosário IA & Neves V (2023). Nest predation of Cory's shearwater *Calonectris borealis* by introduced mammals on Terceira Island, Azores. *Biodiversity Data Journal* 11: e112871.
- Lang J (2013). Dataset 1098: Long-tailed Jaeger, *Stercorarius longicaudus*, Geolocator (GLS), Karupelv, Greenland, Greenland, 2010–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1098/> on 30.11.2025.
- Lecoq M (2003). *Censo das populações de aves marinhas nidificantes no arquipélago da Berlenga em 2002*: *Calonectris diomedea*, *Phalacrocorax aristotelis* e *Uria aalge*. Relatório Final. Sociedade Portuguesa para o Estudo das Aves, Lisboa.
- Lecoq M (2010). *Censo da população reprodutora da Cagarra na Ilha da Berlenga em 2010*. Projecto FAME. Sociedade Portuguesa para o Estudo das Aves, Lisboa (relatório não publicado).
- Lecoq M, Catry P & Granadeiro JP (2010). Population trends of Cory's Shearwaters *Calonectris diomedea borealis* breeding at Berlengas Islands, Portugal. *Airo* 20: 36–41.
- Lecoq M, Ramirez I, Gerales P & Andrade J (2011). First complete census of Cory's Shearwaters *Calonectris diomedea borealis* breeding at Berlengas Islands (Portugal). *Airo* 21: 31–34.
- Linnebjerg JF & Frederiksen M (2011). Dataset 1066: Thick-billed Murre, *Uria lomvia*, Geolocator (GLS), Kitsissut Aavaaliit, Greenland, Greenland, 2009–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1066/> on 30.11.2025.
- Lockley RM (1952). Notes on the birds of the islands of Berlengas (Portugal), the Desertas and Baixo (Madeira) and the Salvages. *Ibis* 94: 144–157.
- Magalhães M (2005). Dataset 686: Cory's Shearwater, *Calonectris borealis*, PTT, Vila, Azores, Portugal, 2005. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/686/> on 30.11.2025.
- Magalhães M (2011a). Dataset 1722: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Corvo, Azores, Portugal, 2008–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1722/> on 30.11.2025.
- Magalhães M (2011b). Dataset 1837: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Capelo – Faial, Azores, Portugal, 2008–

2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1837/> on 30.11.2025.
- Magalhães M (2011c). Dataset 1838: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Praia, Azores, Portugal, 2008–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1838/> on 30.11.2025.
- Magalhães M (2011d). Dataset 1839: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Vila, Azores, Portugal, 2008–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1839/> on 30.11.2025.
- Magalhães M (2011e). Dataset 1840: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Monte Pico Island, Azores, Portugal, 2010–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1840/> on 30.11.2025.
- Mallory M (2010). Dataset 1739: Arctic Herring Gull, *Larus smithsonianus*, Geolocator (GLS), East Bay, East Bay, Canada, 2007–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1739/> on 30.11.2025.
- Mallory M (2012). Dataset 1742: Sabine's Gull, *Xema sabini*, Geolocator (GLS), Nasaruvaalik Island, Nasaruvaalik Island, Canada, 2008–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1742/> on 30.11.2025.
- Menezes D, Oliveira P & Ramírez I (2010). *Pterodromas do arquipélago da Madeira: duas espécies em recuperação*. Serviço do Parque Natural da Madeira, Funchal.
- Merkel F (2012). Dataset 1068: Thick-billed Murre, *Uria lomvia*, Geolocator (GLS), Innaq, Greenland, Greenland, 2011–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1068/> on 30.11.2025.
- Metzger B & BirdLife Malta (2011). Dataset 962: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Ghar Lapsi, Malta, Malta, 2010–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/962/> on 30.11.2025.
- Metzger B & BirdLife Malta (2014a). Dataset 959: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Hal Far, Malta, Malta, 2013–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/959/> on 30.11.2025.
- Metzger B & BirdLife Malta (2014b). Dataset 960: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Filfla, Filfla, Malta, 2012–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/960/> on 30.11.2025.
- Metzger B & BirdLife Malta (2014c). Dataset 961: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Gharb, Gozo, Malta, 2010–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/961/> on 30.11.2025.
- Metzger B & BirdLife Malta (2016). Dataset 1084: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Hal Far, Malta, Malta, 2015–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1084/> on 30.11.2025.
- Monteiro LR, Ramos JA & Furness RW (1996). Past and present status and conservation of the seabirds breeding in the Azores archipelago. *Biological Conservation* 78: 319–328.
- Monteiro LR, Ramos JA, Pereira JRC, Monteiro PR, Feio RS, Thompson DR, Bearhop S, Furness RW, Laranjo M, Hilton G, Neves VC, Groz MP & Thompson KR (1999). Status and distribution of Fea's petrel, Bulwer's petrel, Manx shearwater, Little shearwater and Band-rumped storm-petrel in the Azores archipelago. *Waterbirds* 22(3): 358–366.
- Morten J, Hawkes L & Maxwell S (2018). Dataset 1905: Arctic Tern, *Sterna paradisaea*, GPS, Sandgerdi, Iceland, Iceland, 2018. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1905/> on 30.11.2025.
- Mougin JL & Mougin MC (2000). L'évolution des effectifs des Puffins cendrés *Calonectris diomedea borealis* de l'île Selvagem Grande de 1995 à 1998. *Boletim do Museu Municipal do Funchal* 52: 45–50.
- Mougin JL & Stahl JC (1982). Essai de dénombrement des Puffins cendrés *Calonectris diomedea borealis* de l'île Selvagem Grande en 1980. *Bocagiana* 63: 17 p.
- Mougin JL, Granadeiro JP & Oliveira P (1996). L'évolution des effectifs des reproducteurs chez le Puffin cendré *Calonectris diomedea borealis* de Selvagem Grande de 1992 à 1995. *Boletim do Museu Municipal do Funchal* 48(269): 171–178.
- Mougin JL, Granadeiro JP & Roux F (1994). L'évolution des effectifs des Puffins cendrés *Calonectris diomedea borealis* de l'île Selvagem Grande de 1989 à 1992. *Boletim do Museu Municipal do Funchal* 46: 77–84.
- Mougin JL, Jouanin C & Roux F (2000). Démographie du Puffin cendré de l'île Selvagem Grande. *Revue d'Écologie* 55: 275–299.
- Mougin JL, Roux F, Stahl JC & Jouanin C (1984). L'évolution des effectifs des Puffins cendrés *Calonectris diomedea borealis* de l'île Selvagem Grande de 1980 à 1983. *Bocagiana* 75: 8 p.
- Neves V (2005). *Towards a Conservation Strategy of the Roseate Tern Sterna dougallii in the Azores Archipelago*. PhD Thesis, University of Glasgow, 222 p.
- Neves V & Gonzalez-Solis J (2008). Dataset 684: Barolo Shearwater, *Puffinus baroli*, Geolocator (GLS), Vila, Azores, Portugal, 2007–2008. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/684/> on 30.11.2025.
- Neves V, Nava C, Cormons M, Bremen E, Castresana G, Lima P, Junior S, Phillips R, Magalhaes M & Santos RS (2015). Migration routes and non-breeding areas of Common Terns (*Sterna hirundo*) from the Azores. *Emu* 115:158–67.
- Neves V, Quillfeldt P & Schäfer W (2021). Dataset 1549: Monteiro's Storm-petrel, *Hydrobates monteiroi*, GPS, Country Island, Country Island, Canada, 2018–2021. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1549/> on 30.11.2025.
- Neves VC, Murdoch N & Furness RW (2006). Population status and diet of the Yellow-legged Gull in the Azores. *Arquipélago – Life and Marine Sciences* 23A: 59–73.
- Oliveira N, Abreu P, Bores J, Fagundes A, Alonso H & Andrade J (2020). Evaluating the potential of artificial nests as a conservation measure for Cory's Shearwaters *Calonectris borealis* breeding in Berlengas Archipelago, Portugal. *Airo* 27: 3–19.
- Oliveira N, Almeida A, Alonso H, Bouça A, Costa M, Crisóstomo P, Leandro S, Mendes RN, Morais L, Mouga T, Mourato E, Nascimento T, Paiva VH, Silva CP & Andrade J (2025). *5-years after LIFE Berlengas: Conservation efforts and monitoring in Berlengas Archipelago (2019–2024)*. Project LIFE Berlengas. SPEA, Lisboa (relatório não publicado).
- Oliveira N, Alonso H, Encarnação V, Menezes D, Magalhães M, Carreira G, Heber S, Pimentel R, Medeiros V, Bairos J, Raposo P, Coelho R, Rufino R, Neves R, Nascimento T, Silva E & Andrade J (2023). Changes in numbers and distribution of Yellow-legged Gull *Larus michahellis* nesting in Portugal during the last two decades. *Airo* 31: 20–37.
- Oliveira N, Pipa T, Silva C, Teodósio J & Andrade J (2016). *Final Report of the Monteiro's Storm-petrel Project (phase 1)*. Sociedade Portuguesa para o Estudo das Aves, Lisboa (relatório não publicado).
- OSPAR (2009). *Background document for Little Shearwater Puffinus assimilis baroli*. OSPAR Commission, London, 13 p.
- Paiva V (2008). Dataset 571: Cory's Shearwater, *Calonectris borealis*, GPS, Selvagens, Madeira, Portugal, 2008. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/571/> on 30.11.2025.
- Paiva V (2013). Dataset 1029: Barolo Shearwater, *Puffinus baroli*, Geolocator (GLS), Selvagens, Madeira, Portugal, 2010–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1029/> on 30.11.2025.
- Paiva V (2014). Dataset 1028: Barolo Shearwater, *Puffinus baroli*, Geolocator (GLS), Cima Islet, Madeira, Portugal, 2011–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1028/> on 30.11.2025.
- Paiva V & Ramírez I (2007a). Dataset 511: Cory's Shearwater, *Calonectris borealis*, GPS, Corvo, Azores, Portugal, 2007. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/511/> on 30.11.2025.
- Paiva V & Ramírez I (2007b). Dataset 510: Cory's Shearwater, *Calonectris borealis*, GPS, Berlengas, Azores, Portugal, 2007. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/510/> on 30.11.2025.
- Paiva V & Ramírez I (2013). Dataset 1031: Desertas Petrel, *Pterodroma deserta*, Geolocator (GLS), Bugio, Madeira, Portugal, 2008–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1031/> on 30.11.2025.
- Paiva V & Ramos JA (2014a). Dataset 1057: Cory's Shearwater, *Calonectris borealis*, GPS, Berlengas, Portugal, Portugal, 2013–2014. *BirdLife*

- International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1057/> on 30.11.2025.
- Paiva V & Ramos JA (2014b). Dataset 1055: Cory's Shearwater, *Calonectris borealis*, GPS, Berlengas, Portugal, Portugal, 2010–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1055/> on 30.11.2025.
- Paiva V & Ramos JA (2015a). Dataset 1033: Cory's Shearwater, *Calonectris borealis*, GPS, Cima Islet, Madeira, Portugal, 2011–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1033/> on 30.11.2025.
- Paiva V & Ramos JA (2015b). Dataset 1060: Cory's Shearwater, *Calonectris borealis*, GPS, Corvo, Azores, Portugal, 2010–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1060/> on 30.11.2025.
- Paiva V & Ramos JA (2015c). Dataset 1061: Cory's Shearwater, *Calonectris borealis*, GPS, Corvo, Azores, Portugal, 2010–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1061/> on 30.11.2025.
- Paiva V & Ramos JA (2015d). Dataset 1058: Cory's Shearwater, *Calonectris borealis*, GPS, Berlengas, Portugal, Portugal, 2010–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1058/> on 30.11.2025.
- Paiva V & Ramos JA (2016). Dataset 1032: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Berlengas, Portugal, Portugal, 2011–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1032/> on 30.11.2025.
- Piec D & Dunn EK (2021). *International (East Atlantic) Species Action Plan for the Conservation of the Roseate Tern Sterna dougallii (2021–2030)*. European Commission.
- Pipa T & Silva C (2021). *Projeto LuMinAves (2017–2020): Reduzir o impacto da luz artificial nas aves marinhas*. Lisboa (relatório não publicado).
- Pipa T, Lanchas N, Silva C, Martins B, Atchoi E, Coelho R, Mendonça A, Bairós J, Moura N, Câmara R, Raposo P, Aguiar L, Picanço M, Sequeira R, Mendes F, Pinto F, Teixeira C, Estácio C, Dutra S & De la Cruz, A (2021). *Seabird Macaronesian Sound (SMS) Report - Azores*. Relatório não publicado.
- Pipa T, Martins B, Silva C, Heber S, Magalhães M, Carriço R, Câmara R, Lourenço J, Aguiar L, Cunha B, Raposo P, Raposo A, Coelho R, Huamán M, Pinto F, Sequeira R, Carreira G, Pereira D & De la Cruz A (2024). *Monitorização de aves marinhas Procellariiformes 2020–2023: Relatório da Ação D5.1*. Projeto LIFE IP AZORES NATURA – LIFE17 IPE/PT/00010 (relatório não publicado).
- Pollet IL (2012a). Dataset 1706: Leach's Storm-petrel, *Hydrobates leucorhous*, Geolocator (GLS), Bon Portage, Bon Portage, Canada, 2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1706/> on 30.11.2025.
- Pollet IL (2012b). Dataset 1707: Leach's Storm-petrel, *Hydrobates leucorhous*, Geolocator (GLS), Country Island, Country Island, Canada, 2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1707/> on 30.11.2025.
- Porter B, Hereward HFR & Neves V (2019). Dataset 1550: Band-rumped Storm-petrel, *Hydrobates castro*, GPS, Praia Islet, Azores, Portugal, 2019. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1550/> on 30.11.2025.
- Porter B, Hereward HFR & Neves V (2020). Dataset 1551: Band-rumped Storm-petrel, *Hydrobates castro*, GPS, Praia Islet, Azores, Portugal, 2019–2020. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1551/> on 30.11.2025.
- Ramos JA, Monteiro LR, Solá E & Moniz Z (1997). Characteristics and competition for nest cavities in burrowing Procellariiformes. *The Condor* 99(3): 634–641.
- Ramos R (2016a). Dataset 1704: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Zembra, Zembra, Tunisia, 2014–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1704/> on 30.11.2025.
- Ramos R (2016b). Dataset 1705: Scopoli's Shearwater, *Calonectris diomedea*, Geolocator (GLS), Paximada, Crete, Greece, 2014–2016. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1705/> on 30.11.2025.
- Ramos R (2020a). Dataset 1848: European Storm-petrel, *Hydrobates pelagicus*, Geolocator (GLS), Benidorm, Benidorm Island, Spain, 2019–2020. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1848/> on 30.11.2025.
- Ramos R (2020b). Dataset 1831: Yellow-legged Gull, *Larus michahellis*, GPS, Ebro Delta, Ebro Delta, Spain, 2019–2020. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1831/> on 30.11.2025.
- Ramos R (2021a). Dataset 1757: Audouin's Gull, *Larus audouinii*, GPS, San Pedro, San Pedro, Spain, 2020–2021. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1757/> on 30.11.2025.
- Ramos R (2021b). Dataset 1835: Yellow-legged Gull, *Larus michahellis*, GPS, San Pedro, San Pedro, Spain, 2020–2021. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1835/> on 30.11.2025.
- Ramos R (2022). Dataset 1836: Yellow-legged Gull, *Larus michahellis*, GPS, San Pedro, San Pedro, Spain, 2021–2022. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1836/> on 30.11.2025.
- Redfern C (2018a). Dataset 1627: Roseate Tern, *Sterna dougallii*, Geolocator (GLS), Rockabill, Rockabill, Ireland, 2017–2018. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1627/> on 30.11.2025.
- Redfern C (2018b). Dataset 1659: Arctic Tern, *Sterna paradisaea*, Geolocator (GLS), Farne Islands, Farne Islands, United Kingdom, 2017–2018. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1659/> on 30.11.2025.
- Redfern C (2018c). Dataset 1658: Arctic Tern, *Sterna paradisaea*, Geolocator (GLS), Farne Islands, Farne Islands, United Kingdom, 2017–2018. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1658/> on 30.11.2025.
- Redfern C (2019). Dataset 1626: Roseate Tern, *Sterna dougallii*, Geolocator (GLS), Coquet, England, United Kingdom, 2018–2019. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1626/> on 30.11.2025.
- Rodrigues P, Micael J, Rodrigo RK & Cunha RT (2009). A conservational approach on the seabird populations of Vila Franca do Campo islet, Azores, Portugal. *Açoreana* 6: 217–225.
- Ronconi P & Westgate A (2009). Dataset 656: Sooty Shearwater, *Ardeanna grisea*, PTT, At-Sea, Gough, At-Sea, High Seas, 2007–2009. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/656/> on 30.11.2025.
- Ronconi R & Ryan P (2010). Dataset 665: Great Shearwater, *Ardeanna gravis*, PTT, At-Sea, At-Sea, High Seas, 2013–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/665/> on 30.11.2025.
- Rufino R & Neves R (1999). *Wintering Common Scoter Melanitta nigra in Portugal: results of aerial surveys (1991–1999)*. Regional Status Reports (relatório não publicado).
- Saavedra C, Santos MB, Valcarce P, Freitas L, Silva M, Pipa T, Bécaries J, Gil-Velasco M, Vandeperre F, Gouveia C, Lopes V, Teixeira A, Simão AP, Otero Matias J, Miodonski JV, Carreira GP, Henriques F, Pérez S, Esteban R, Verborgh P, Cañadas A, Varo N, Lagoa J, Dellinger T, Atchoi E, Silva C, Pérez M, Servidio A, Martín V, Carrillo M, Urquiola E & Monzón C (2018). *Macaronesian Roof Report*. Technical Report. Project MISTIC-SEAS II, 114 p.
- Sittler B, Aebischer A & Gilg O (2011). Post-breeding migration of four Long-tailed Skuas (*Stercorarius longicaudus*) from North and East Greenland to West Africa. *Journal of Ornithology* 152: 375–381.
- SPNM (2015). *Planos de Ação para as 14 espécies alvo do projeto LIFE ILHÉUS DO PORTO SANTO (LIFE09 NAT/PT/000041)*.
- Stenhouse I & Egevang C (2008). Dataset 1110: Sabine's Gull, *Xema sabini*, Geolocator (GLS), Sand Island, Young Sound, Greenland, 2007–2008. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1110/> on 30.11.2025.
- Stienen EWM, Buijs R-J, de Visser J, Fijn R, Govaert S, Lilipaly S, Platteeuw M & Desmet P (2023). DELTATRACK - Herring gulls (*Larus argentatus*, Laridae) and lesser black-backed gulls (*Larus fuscus*, Laridae) breeding at Neeltje Jans (Netherlands). Dataset. <https://doi.org/10.5281/zenodo.10209520>
- Stienen EWM, Desmet P, Govaert S, Milotic T, Spanoghe G & Janssens K (2022). MEDGULL_ANTWERPEN - Mediterranean gulls (*Ichthyaeetus melanocephalus*, Laridae) breeding near Antwerp (Belgium). Dataset. <https://doi.org/10.5281/zenodo.6599272>
- Stienen EWM, Desmet P, Milotic T, Hernandez F, Deneudt K, Bouten W, Müller W, Matheve H & Lens L (2019). LBBG_ZEEBRUGGE - Lesser

- black-backed gulls (*Larus fuscus*, Laridae) breeding at the southern North Sea coast (Belgium and the Netherlands). Dataset. <https://doi.org/10.5281/zenodo.3540799>
- Stienen EWM, Müller W, Lens L, Govaert S, Milotic T & Desmet P (2021). LBBG_JUVENILE - Juvenile lesser black-backed gulls (*Larus fuscus*, Laridae) and herring gulls (*Larus argentatus*, Laridae) hatched in Zeebrugge (Belgium). Dataset. <https://doi.org/10.5281/zenodo.5075868>
- Teixeira AM (1984). Aves marinhas nidificantes no litoral português. Actas do Colóquio Nacional para a Conservação das Zonas Ribeirinhas. *Boletim da Liga para a Protecção da Natureza* 18 (3.ª série, 1.º vol.): 105–115.
- Thompson P (2013). Dataset 1048: Northern Fulmar, *Fulmarus glacialis*, Geolocator (GLS), Eynehalow, Orkney, United Kingdom, 2006–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1048/> on 30.11.2025.
- Thorarinsson TL (2011). Dataset 1036: Black-legged Kittiwake, *Rissa tridactyla*, Geolocator (GLS), Hafnarholmi, Iceland Shelf, Iceland, 2009–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1036/> on 30.11.2025.
- Thorarinsson TL & Kolbeinnsson Y (2014a). Dataset 1075: Razorbill, *Alca torda*, Geolocator (GLS), Langanes, Iceland, Iceland, 2013–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1075/> on 30.11.2025.
- Thorarinsson TL & Kolbeinnsson Y (2014c). Dataset 1071: Common Murre, *Uria aalge*, Geolocator (GLS), Latrabjarg, Iceland, Iceland, 2013–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1071/> on 30.11.2025.
- Thorarinsson TL & Kolbeinnsson Y (2014d). Dataset 1078: Thick-billed Murre, *Uria lomvia*, Geolocator (GLS), Langanes, Iceland, Iceland, 2013–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1078/> on 30.11.2025.
- Thorarinsson TL & Kolbeinnsson Y (2014e). Dataset 1079: Thick-billed Murre, *Uria lomvia*, Geolocator (GLS), Grimsey, Iceland, Iceland, 2013–2014. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1079/> on 30.11.2025.
- Thorarinsson TL & Kolbeinnsson Y (2015a). Dataset 1076: Razorbill, *Alca torda*, Geolocator (GLS), Grimsey, Iceland, Iceland, 2013–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1076/> on 30.11.2025.
- Thorarinsson TL & Kolbeinnsson Y (2015b). Dataset 1077: Razorbill, *Alca torda*, Geolocator (GLS), Latrabjarg, Iceland, Iceland, 2013–2015. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1077/> on 30.11.2025.
- Tranquilla LM, Mallory M, Montevecchi W & Gilchrist HG (2010). Dataset 1109: Thick-billed Murre, *Uria lomvia*, Geolocator (GLS), Prince Leopold Island, Arctic Canada, Canada, 2009–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1109/> on 30.11.2025.
- Tranquilla LM, Montevecchi W, Gilchrist HG & Mallory M (2008). Dataset 1114: Thick-billed Murre, *Uria lomvia*, Geolocator (GLS), Minarets, Canada, 2007–2008. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1114/> on 30.11.2025.
- Tranquilla LM, Montevecchi W, Gilchrist HG & Mallory M (2011). Dataset 1113: Thick-billed Murre, *Uria lomvia*, Geolocator (GLS), Gannet Islands, Gannet Islands, Canada, 2008–2011. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1113/> on 30.11.2025.
- van Bemmelen R, Hanssen SA, Gilg O, Porter R, Mork KS, Bangjord G, Bollache L & Moe B (*em revisão*). Individual variation in non-breeding movements of Grey Phalaropes across hemispheres. *Journal of Avian Biology*.
- van Bemmelen R, Moe B, Hanssen SA, Schmidt NM, Hansen J, Lang J, Sittler B, Bollache L, Tulp I, Klaassen R & Gilg O (2017). Flexibility in otherwise consistent non-breeding movements of a long-distance migratory seabird, the long-tailed skua. *Marine Ecology Progress Series* 578: 197–211.
- Wakefield E (2018a). Dataset 1587: Sooty Shearwater, *Ardenna grisea*, Geolocator (GLS), Kidney Island, Falkland Islands (Islas Malvinas), Falkland Islands (Malvinas), 2017–2018. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1587/> on 30.11.2025.
- Wakefield E (2018b). Dataset 1588: Cory's Shearwater, *Calonectris borealis*, Geolocator (GLS), Corvo, Azores, Portugal, 2017–2018. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1588/> on 30.11.2025.
- Weimerskirch H & Louzao M (2012). Dataset 1637: Balearic Shearwater, *Puffinus mauretanicus*, PTT, Sa Conillera, Eivissa Island, Spain, 2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1637/> on 30.11.2025.
- Zino F & Biscoito M (2010a). Dataset 826: Zino's Petrel, *Pterodroma madeira*, Geolocator (GLS), Pico do Areeiro, Madeira, Portugal, 2007–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/826/> on 30.11.2025.
- Zino F & Biscoito M (2010b). Dataset 827: Zino's Petrel, *Pterodroma madeira*, Geolocator (GLS), Pico do Areeiro, Madeira, Portugal, 2007–2010. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/827/> on 30.11.2025.
- Zino F & Biscoito M (2012). Dataset 1120: Desertas Petrel, *Pterodroma deserta*, Geolocator (GLS), Bugio, Madeira, Portugal, 2009–2012. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1120/> on 30.11.2025.
- Zino F & Biscoito M (2013). Dataset 1121: Bulwer's Petrel, *Bulweria bulwerii*, Geolocator (GLS), Selvagens, Madeira, Portugal, 2009–2013. *BirdLife International Seabird Tracking Database*. Downloaded from <https://data.seabirdtracking.org/dataset/1121/> on 30.11.2025.

Zino F, Oliveira P, King S, Buckle A, Biscoito M, Neves HC & Vasconcelos A (2001). Conservation of Zino's petrel *Pterodroma madeira* in the archipelago of Madeira. *Oryx* 35: 128–136.

Annex 1: Species and their conservation status

Conservation status at the global, European (IUCN; BirdLife International 2025), and national levels (Cabral *et al.* 2005; Almeida *et al.* 2022), with an indication of the global population trend (BirdLife International 2025) of the species considered within the scope of this publication, *Sentinels of the Ocean*, and the *Atlas of Seabirds of Portugal* (Meirinho *et al.* 2014).

LC	Least Concern	(Bre)	Breeding population
NT	Near Threatened	(Inv)	Wintering population
VU	Vulnerable		
EN	Endangered		
CR	Critically Endangered		
DD	Data Deficient		

Common name	Scientific name	IUCN Red List assessment		Red list category at national level		
		Category at global level	Global Trend	Lista Vermelha das Aves de Portugal Continental	Livro Vermelho dos Vertebrados de Portugal	
				Mainland	Azores	Madeira
Velvet Scoter	<i>Melanitta fusca</i>	VU	Decreasing			
Common Scoter	<i>Melanitta nigra</i>	LC	Unknown	VU		
Red-billed Tropicbird	<i>Phaethon aethereus</i>	LC	Decreasing			
White-tailed Tropicbird	<i>Phaethon lepturus</i>	LC	Decreasing			
Common Loon	<i>Gavia immer</i>	LC	Stable			
Wilson's Storm-petrel	<i>Oceanites oceanicus</i>	LC	Stable			
White-faced Storm-petrel	<i>Pelagodroma marina</i>	LC	Decreasing			VU
European Storm-petrel	<i>Hydrobates pelagicus</i>	LC	Unknown			
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	LC	Decreasing	VU	VU	LC
Monteiro's Storm-petrel	<i>Hydrobates monteiroi</i>	VU	Stable		EN	
Leach's Storm-petrel	<i>Hydrobates leucorhous</i>	VU	Stable			
Swinhoe's Storm-petrel	<i>Hydrobates monorhis</i>	NT	Stable			
Northern Fulmar	<i>Fulmarus glacialis</i>	LC	Increasing			
Trindade Petrel	<i>Pterodroma arminjoniana</i>	VU	Stable			
Bermuda Petrel	<i>Pterodroma cahow</i>	EN	Increasing			
Cape Verde Petrel	<i>Pterodroma feae</i>	NT	Unknown			
Desertas Petrel	<i>Pterodroma deserta</i>	VU	Stable			VU
Zino's Petrel	<i>Pterodroma madeira</i>	EN	Stable			EN
Sooty Shearwater	<i>Ardenna grisea</i>	NT	Decreasing			
Great Shearwater	<i>Ardenna gravis</i>	LC	Stable			
Scopoli's Shearwater	<i>Calonectris diomedea</i>	LC	Decreasing			
Cory's Shearwater	<i>Calonectris borealis</i>	LC	Unknown	EN	LC	LC
Cape verde shearwater	<i>Calonectris edwardsii</i>	NT	Decreasing			
Manx Shearwater	<i>Puffinus puffinus</i>	LC	Unknown		EN	VU
Yelkouan Shearwater	<i>Puffinus yelkouan</i>	VU	Decreasing			
Balearic Shearwater	<i>Puffinus mauretanicus</i>	CR	Decreasing	CR		
Barolo Shearwater	<i>Puffinus baroli</i>	VU	Decreasing		VU	VU
Boyd's Shearwater	<i>Puffinus boydi</i>	VU	Decreasing			
Bulwer's Petrel	<i>Bulweria bulwerii</i>	LC	Stable		EN	LC
Northern Gannet	<i>Morus bassanus</i>	LC	Increasing	LC		
European Shag	<i>Gulosus aristotelis</i>	LC	Decreasing	EN		
Great Cormorant	<i>Phalacrocorax carbo</i>	LC	Increasing	LC (Win)		

Common name	Scientific name	IUCN Red List assessment		Red list category at national level		
		Category at global level	Global Trend	Lista Vermelha das Aves de Portugal Continental	Livro Vermelho dos Vertebrados de Portugal	
				Mainland	Azores	Madeira
Eurasian Oystercatcher	<i>Haematopus ostralegus</i>	NT	Decreasing	RE (Bre) VU (Win)		
Grey Plover	<i>Pluvialis squatarola</i>	VU	Decreasing	NT		
Common Ringed Plover	<i>Charadrius hiaticula</i>	LC	Stable	LC		
Kentish Plover	<i>Charadrius alexandrinus</i>	LC	Decreasing	VU (Bre) EN (Win)	DD	CR
Whimbrel	<i>Numenius phaeopus</i>	LC	Decreasing	NT		
Ruddy Turnstone	<i>Arenaria interpres</i>	NT	Decreasing	VU	DD	
Red Knot	<i>Calidris canutus</i>	NT	Decreasing	EN		
Sanderling	<i>Calidris alba</i>	LC	Decreasing	LC		
Dunlin	<i>Calidris alpina</i>	NT	Decreasing	LC		
Purple Sandpiper	<i>Calidris maritima</i>	LC	Decreasing	EN		
Red Phalarope	<i>Phalaropus fulicarius</i>	LC	Unknown			
Common Sandpiper	<i>Actitis hypoleucos</i>	LC	Stable	VU (Bre) NT (Win)		
Little Gull	<i>Hydrocoloeus minutus</i>	LC	Increasing			
Sabine's Gull	<i>Xema sabini</i>	LC	Stable			
Black-legged Kittiwake	<i>Rissa tridactyla</i>	VU	Decreasing	VU		
Slender-billed Gull	<i>Larus genei</i>	LC	Unknown			
Black-headed Gull	<i>Larus ridibundus</i>	LC	Unknown	DD (Bre) LC (Win)		
Mediterranean Gull	<i>Larus melanocephalus</i>	LC	Decreasing	LC		
Audouin's Gull	<i>Larus audouinii</i>	VU	Decreasing	VU		
Ring-billed Gull	<i>Larus delawarensis</i>	LC	Increasing			
Mew Gull	<i>Larus canus</i>	LC	Unknown			
Lesser Black-backed Gull	<i>Larus fuscus</i>	LC	Increasing	VU (Bre) LC (Win)		
Yellow-legged Gull	<i>Larus michahellis</i>	LC	Increasing	LC	LC	LC
Arctic Herring Gull	<i>Larus smithsonianus</i>	LC	Decreasing			
Great Black-backed Gull	<i>Larus marinus</i>	LC	Unknown			
Sooty Tern	<i>Onychoprion fuscatus</i>	LC	Unknown			
Little Tern	<i>Sternula albifrons</i>	LC	Decreasing	VU		
Common Gull-billed Tern	<i>Gelochelidon nilotica</i>	LC	Decreasing	VU		
Caspian Tern	<i>Hydroprogne caspia</i>	LC	Increasing	VU		
Whiskered Tern	<i>Chlidonias hybrida</i>	LC	Unknown	CR		
Black Tern	<i>Chlidonias niger</i>	LC	Decreasing			
Roseate Tern	<i>Sterna dougallii</i>	LC	Unknown		VU	
Common Tern	<i>Sterna hirundo</i>	LC	Unknown	EN	VU	VU
Arctic Tern	<i>Sterna paradisaea</i>	LC	Decreasing			
Sandwich Tern	<i>Thalasseus sandvicensis</i>	LC	Stable	LC		
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	LC	Stable			
Arctic Jaeger	<i>Stercorarius parasiticus</i>	LC	Stable			
Pomarine Jaeger	<i>Stercorarius pomarinus</i>	LC	Stable			
Great Skua	<i>Catharacta skua</i>	LC	Stable	LC		
South Polar Skua	<i>Catharacta maccormicki</i>	LC	Stable			
Atlantic Puffin	<i>Fratercula arctica</i>	VU	Decreasing	DD		
Razorbill	<i>Alca torda</i>	LC	Increasing	NT		
Thick-billed Murre	<i>Uria lomvia</i>	LC	Increasing			
Common Murre	<i>Uria aalge</i>	LC	Increasing	CR (Bre) NT (Win)		

Annex 2: Sources of tracking data

List of the sources and respective owners of all individual tracking data provided for analysis within the framework of *Sentinels of the Ocean*. This also includes data that were not used to generate the maps but were used to support their

Common name	Scientific name	Colony	Country	Device	Source/owner
Common Scoter	<i>Melanitta nigra</i>		Iceland	GLS	Ib Krag Petersen
Red-billed Tropicbird	<i>Phaethon aethereus</i>	Raso Islet	Cape Verde	GLS	Gonzalez-Solis 2009a
White-faced Storm-petrel	<i>Pelagodroma marina</i>	Selvagem Grande (Madeira)	Portugal	GPS	Catry et al. 2019a
White-faced Storm-petrel	<i>Pelagodroma marina</i>	Pássaros Islet	Cape Verde	GLS	Gonzalez-Solis 2021a
European Storm-petrel	<i>Hydrobates pelagicus</i>	Benidorm	Spain	GLS	Ramos 2020a
European Storm-petrel	<i>Hydrobates pelagicus</i>	Filfla	Malta	GLS	Lago et al. 2017
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Praia Islet (Azores)	Portugal	GPS	Porter et al. 2019
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Praia Islet (Azores)	Portugal	GPS	Porter et al. 2020
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Farilhão Grande (Berlengas)	Portugal	GLS	Carreiro et al. 2020
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Farilhão Grande (Berlengas)	Portugal	GPS	SPEA
Monteiro's Storm-petrel	<i>Hydrobates monteiroi</i>	Praia Islet (Azores)	Portugal	GPS	Neves et al. 2021
Monteiro's Storm-petrel	<i>Hydrobates monteiroi</i>	Praia Islet (Azores)	Portugal	GPS	Hereward et al. 2020
Leach's Storm-petrel	<i>Hydrobates leucorhous</i>	Bon Portage	Canada	GLS	Pollet 2012a
Leach's Storm-petrel	<i>Hydrobates leucorhous</i>	Country Island	Canada	GLS	Pollet 2012b
Northern Fulmar	<i>Fulmarus glacialis</i>	Faroe Islands	Denmark	GLS	SEATRACK
Northern Fulmar	<i>Fulmarus glacialis</i>	Eynehallow	United Kingdom	GLS	Thompson 2013
Northern Fulmar	<i>Fulmarus glacialis</i>	Eynhallow	United Kingdom	GLS	SEATRACK
Northern Fulmar	<i>Fulmarus glacialis</i>	Inishkea	United Kingdom	GLS	SEATRACK
Northern Fulmar	<i>Fulmarus glacialis</i>	Little Saltee	United Kingdom	GLS	SEATRACK
Northern Fulmar	<i>Fulmarus glacialis</i>	Jan Mayen	Norway	GLS	SEATRACK
Northern Fulmar	<i>Fulmarus glacialis</i>	Langanes	Iceland	GLS	SEATRACK
Northern Fulmar	<i>Fulmarus glacialis</i>	Skjalfandi	Iceland	GLS	SEATRACK
Trindade Petrel	<i>Pterodroma arminjoniana</i>	Tartarugas beach (Trindade)	Brazil	GLS	Krüger 2014
Bermuda petrel	<i>Pterodroma cahow</i>	Bermuda	United Kingdom	GLS	Letizia Campioni, Jeremy Lee Madeiros, Carina Gjerdrum
Cape Verde Petrel	<i>Pterodroma feae</i>	Fogo	Cape Verde	GLS	Gonzalez-Solis 2010d
Desertas Petrel	<i>Pterodroma deserta</i>	Bugio (Madeira)	Portugal	GLS	Paiva & Ramirez 2013
Desertas Petrel	<i>Pterodroma deserta</i>	Bugio (Madeira)	Portugal	GLS	Zino & Biscoito 2012
Desertas Petrel	<i>Pterodroma deserta</i>	Bugio (Madeira)	Portugal	GPS	Catry & Granadeiro 2017
Zino's Petrel	<i>Pterodroma madeira</i>	Pico do Areeiro (Madeira)	Portugal	GLS	Zino & Biscoito 2010a
Zino's Petrel	<i>Pterodroma madeira</i>	Pico do Areeiro (Madeira)	Portugal	GLS	Zino & Biscoito 2010b
Zino's Petrel	<i>Pterodroma madeira</i>	Pico do Areeiro (Madeira)	Portugal	GPS	Catry et al. 2019b
Sooty Shearwater	<i>Ardenna grisea</i>	Kidney Island	Falkland Islands	GLS	Wakefield 2018a
Sooty Shearwater	<i>Ardenna grisea</i>	At sea	Falkland Islands	PTT	Ronconi & Westgate 2009
Great Shearwater	<i>Ardenna gravis</i>	At sea	High seas	PTT	Ronconi & Ryan 2010
Great Shearwater	<i>Ardenna gravis</i>	Gough Island	Tristão da Cunha	GLS	Gonzalez-Solis & Ryan 2014
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Pantaleu (Balearic Islands)	Spain	GLS	Gonzalez-Solis 2003b
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Menorca/Cala Morell (Balearic Islands)	Spain	GLS	Gonzalez-Solis 2016f

Common name	Scientific name	Colony	Country	Device	Source/owner
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Na Pobra (Balearic Islands)	Spain	GLS	Gonzalez-Solis 2016g
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Na Foradada (Balearic Islands)	Spain	GLS	Gonzalez-Solis 2016h
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Palomas	Spain	GLS	Gonzalez-Solis 2016i
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Pantaleu (Balearic Islands)	Spain	GLS	Gonzalez-Solis 2015c
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Pantaleu (Balearic Islands)	Spain	GLS	Gonzalez-Solis 2003c
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Pantaleu (Balearic Islands)	Spain	GLS	Gonzalez-Solis 2013g
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Pantaleu (Balearic Islands)	Spain	GLS	Gonzalez-Solis 2012c
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Pantaleu (Balearic Islands)	Spain	GLS	Gonzalez-Solis 2015d
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Chafarinas	Spain	PTT	Arcos 2007
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Chafarinas	Spain	GPS	Arcos 2011
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Chafarinas	Spain	GLS	Gonzalez-Solis 2001
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Chafarinas	Spain	GLS	Gonzalez-Solis 2013f
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Pantaleu	Spain	GLS	Gonzalez-Solis & Oro 2012
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Riou	France	GPS	David Gremillet, Nicolas Courbin (OrnitEOF, MigraLion, PGL)
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Porquerolles	France	GLS	Gremillet & Péron 2012a
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Frioul	France	GLS	Gremillet & Péron 2012b
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Giraglia	France	GLS	Gremillet & Péron 2012c
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Lavezzi	France	GLS	Gremillet & Péron 2012d
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Riou	France	GLS	Gremillet & Péron 2012e
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Stamfani Island	Grécia	GLS	Karris 2014
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Strofades	Grécia	GLS	Ramos 2016b
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Capraia	Italy	GLS	Cecere et al. 2013
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Spargiotto-Barettini	Italy	GLS	Cecere et al. 2019
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Filfla	Malta	GLS	Metzger & BirdLife Malta 2014b
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Gharb (Gozo)	Malta	GLS	Metzger & BirdLife Malta 2014c
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Ghar Lapsi	Malta	GLS	Metzger & BirdLife Malta 2011
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Hal Far	Malta	GLS	Metzger & BirdLife Malta 2016
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Hal Far	Malta	GLS	Metzger & BirdLife Malta 2014a
Scopoli's Shearwater	<i>Calonectris diomedea</i>	Zembra	Tunisia	GLS	Ramos 2016a
Cory's Shearwater	<i>Calonectris borealis</i>	Alegranza (Canary Islands)	Spain	PTT	Arcos 2006
Cory's Shearwater	<i>Calonectris borealis</i>	Alegranza (Canary Islands)	Spain	GPS	Arcos 2010b
Cory's Shearwater	<i>Calonectris borealis</i>	Chafarinas	Spain	GLS	Gonzalez-Solis 2013c
Cory's Shearwater	<i>Calonectris borealis</i>	Lanzarote/Timanfaya (Canary Islands)	Spain	GLS	Gonzalez-Solis 2016e
Cory's Shearwater	<i>Calonectris borealis</i>	Montaña Clara (Canary Islands)	Spain	GPS	Gonzalez-Solis 2015a
Cory's Shearwater	<i>Calonectris borealis</i>	Montaña Clara (Canary Islands)	Spain	GLS	Gonzalez-Solis 2012b
Cory's Shearwater	<i>Calonectris borealis</i>	Montaña Clara (Canary Islands)	Spain	GPS	Gonzalez-Solis 2015b
Cory's Shearwater	<i>Calonectris borealis</i>	Montaña Clara (Canary Islands)	Spain	GPS	Gonzalez-Solis 2020b
Cory's Shearwater	<i>Calonectris borealis</i>	Montaña Clara (Canary Islands)	Spain	GPS	Gonzalez-Solis 2021c
Cory's Shearwater	<i>Calonectris borealis</i>	Sisargas	Spain	GLS	Gonzalez-Solis 2016c
Cory's Shearwater	<i>Calonectris borealis</i>	Terreros	Spain	GLS	Gonzalez-Solis 2016d
Cory's Shearwater	<i>Calonectris borealis</i>	Veneguera (Canary Islands)	Spain	GLS	Gonzalez-Solis 2016a
Cory's Shearwater	<i>Calonectris borealis</i>	Veneguera (Canary Islands)	Spain	GLS	Gonzalez-Solis 2005
Cory's Shearwater	<i>Calonectris borealis</i>	Veneguera (Canary Islands)	Spain	GLS	Gonzalez-Solis 2013d
Cory's Shearwater	<i>Calonectris borealis</i>	Corvo (Azores)	Portugal	GPS	Tânia Pipa (SPEA)
Cory's Shearwater	<i>Calonectris borealis</i>	Corvo (Azores)	Portugal	GPS	Paiva & Ramos 2015b
Cory's Shearwater	<i>Calonectris borealis</i>	Corvo (Azores)	Portugal	GPS	Paiva & Ramos 2015c

Common name	Scientific name	Colony	Country	Device	Source/owner
Cory's Shearwater	<i>Calonectris borealis</i>	Corvo (Azores)	Portugal	GPS	Paiva & Ramírez 2007a
Cory's Shearwater	<i>Calonectris borealis</i>	Corvo (Azores)	Portugal	GLS	Wakefield 2018b
Cory's Shearwater	<i>Calonectris borealis</i>	Corvo (Azores)	Portugal	GLS	Magalhães 2011a
Cory's Shearwater	<i>Calonectris borealis</i>	Faial (Azores)	Portugal	GPS, PTT	Gagliardo et al. 2013
Cory's Shearwater	<i>Calonectris borealis</i>	Capelo - Faial (Azores)	Portugal	GLS	Magalhães 2011b
Cory's Shearwater	<i>Calonectris borealis</i>	Ilhéu da Praia (Azores)	Portugal	GLS	Magalhães 2011c
Cory's Shearwater	<i>Calonectris borealis</i>	Vila Islet (Azores)	Portugal	GLS	Magalhães 2011d
Cory's Shearwater	<i>Calonectris borealis</i>	Ilhéu da Praia (Azores)	Portugal	GLS	Magalhães 2011c
Cory's Shearwater	<i>Calonectris borealis</i>	Vila Islet (Azores)	Portugal	GLS	Magalhães 2011d
Cory's Shearwater	<i>Calonectris borealis</i>	Vila Islet (Azores)	Portugal	GLS	Gonzalez-Solis 2016b
Cory's Shearwater	<i>Calonectris borealis</i>	Vila Islet (Azores)	Portugal	GLS	Gonzalez-Solis 2003a
Cory's Shearwater	<i>Calonectris borealis</i>	Vila Islet (Azores)	Portugal	GLS	Gonzalez-Solis 2013e
Cory's Shearwater	<i>Calonectris borealis</i>	Vila Islet (Azores)	Portugal	PTT	Magalhães 2005
Cory's Shearwater	<i>Calonectris borealis</i>	Pico (Azores)	Portugal	GLS	Magalhães 2011e
Cory's Shearwater	<i>Calonectris borealis</i>	Cima Islet (Madeira)	Portugal	GPS	Paiva & Ramos 2015a
Cory's Shearwater	<i>Calonectris borealis</i>	Madeira Island	Portugal	GPS	Tiago Dias (SPEA)
Cory's Shearwater	<i>Calonectris borealis</i>	Madeira Island	Portugal	GLS	Tiago Dias (SPEA)
Cory's Shearwater	<i>Calonectris borealis</i>	Deserta Grande (Madeira)	Portugal	GPS	Tiago Dias (SPEA)
Cory's Shearwater	<i>Calonectris borealis</i>	Deserta Grande (Madeira)	Portugal	GLS	Tiago Dias (SPEA)
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GPS	Catry & Granadeiro 2009
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GPS	Catry & Granadeiro 2010
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GPS	Catry & Granadeiro 2011
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GPS	Catry & Granadeiro 2012
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GPS	Catry & Granadeiro 2013
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GLS	Dias & Granadeiro 2008
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GLS	Dias & Catry 2010
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GPS	Paiva 2008
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GLS	Dias et al. 2011
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GLS	Campioni et al 2016
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens (Madeira)	Portugal	GLS	Granadeiro et al. 2012
Cory's Shearwater	<i>Calonectris borealis</i>	Berlengas	Portugal	GPS	Paiva & Ramírez 2007b
Cory's Shearwater	<i>Calonectris borealis</i>	Berlengas	Portugal	GPS	Paiva & Ramos 2014a
Cory's Shearwater	<i>Calonectris borealis</i>	Berlengas	Portugal	GPS	Paiva & Ramos 2014b
Cory's Shearwater	<i>Calonectris borealis</i>	Berlengas	Portugal	GPS	Paiva & Ramos 2015d
Cory's Shearwater	<i>Calonectris borealis</i>	Berlengas	Portugal	GLS	Paiva & Ramos 2016
Cape Verde Shearwater	<i>Calonectris edwardsii</i>	Curral Velho (Boavista)	Cape Verde	GLS	Gonzalez-Solis 2010b
Cape Verde Shearwater	<i>Calonectris edwardsii</i>	Curral Velho (Boavista)	Cape Verde	GLS	Gonzalez-Solis 2015e
Cape Verde Shearwater	<i>Calonectris edwardsii</i>	Raso Islet	Cape Verde	GLS	Gonzalez-Solis 2010c
Manx Shearwater	<i>Puffinus puffinus</i>	Heimaey	Iceland	GLS	Gonzalez-Solis 2014b
Yelkouan Shearwater	<i>Puffinus yelkouan</i>	Iles Hyeres	France	GLS	Gonzalez-Solis 2010e
Balearic Shearwater	<i>Puffinus mauretanicus</i>	Formentera (Balearic Islands)	Spain	PTT	Arcos & Ruiz 2000a
Balearic Shearwater	<i>Puffinus mauretanicus</i>	Ibiza (Balearic Islands)	Spain	PTT	Arcos & Ruiz 2000b
Balearic Shearwater	<i>Puffinus mauretanicus</i>	Sa Conillera	Spain	PTT	Weimerskirch & Louzao 2012
Balearic Shearwater	<i>Puffinus mauretanicus</i>	At sea	France	GPS	David Grémillet, Nicolas Courbin (PNA Puffin Balearic Islands)
Barolo Shearwater	<i>Puffinus baroli</i>	Vila Islet (Azores)	Portugal	GLS	Neves & Gonzalez-Solis 2008
Barolo Shearwater	<i>Puffinus baroli</i>	Cima Islet (Madeira)	Portugal	GLS	Paiva 2014

Common name	Scientific name	Colony	Country	Device	Source/owner
Barolo Shearwater	<i>Puffinus baroli</i>	Selvagem Grande (Madeira)	Portugal	GLS	Paiva 2013
Boyd's Shearwater	<i>Puffinus boydi</i>	Cima Islet	Cape Verde	GLS	Gonzalez-Solis 2014a
Boyd's Shearwater	<i>Puffinus boydi</i>	Raso Islet	Cape Verde	GLS	Gonzalez-Solis 2009b
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Cima Islet	Cape Verde	GLS	Gonzalez-Solis 2012a
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Raso Islet	Cape Verde	GLS	Gonzalez-Solis 2010a
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Aleganza (Canary Islands)	Spain	PTT	Arcos 2010a
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Montaña Clara (Canary Islands)	Spain	GLS	Gonzalez-Solis 2013a
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Montaña Clara (Canary Islands)	Spain	GPS	Gonzalez-Solis 2020a
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Montaña Clara (Canary Islands)	Spain	GPS	Gonzalez-Solis 2021b
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Vila Islet (Azores)	Portugal	GLS	Gonzalez-Solis 2013b
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Deserta Grande (Madeira)	Portugal	GPS	Granadeiro & Catry 2015
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Selvagens (Madeira)	Portugal	GLS	Zino & Bischoito 2013
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Selvagens (Madeira)	Portugal	GPS	Granadeiro & Catry 2021a
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Selvagens (Madeira)	Portugal	GPS	Granadeiro & Catry 2021b
Northern Gannet	<i>Morus bassanus</i>	Ile Rouzic	France	GLS	Gremillet & Dossa 2011
Northern Gannet	<i>Morus bassanus</i>	Bass Rock	United Kingdom	GPS, PTT	Hamer & Lane 2019
European Shag	<i>Gulosus aristotelis</i>	Berlenga	Portugal	GPS	SPEA
Red Phalarope	<i>Phalaropus fulicarius</i>	Hochstetter (Greenland)	Denmark	GLS	van Bemmelen et al. (em revisão)
Sabine's Gull	<i>Xema sabini</i>	Ilha de Nasaruvaalik	Canada	GLS	Davis et al. 2016
Sabine's Gull	<i>Xema sabini</i>	Ilha de Nasaruvaalik	Canada	GLS	Mallory 2012
Sabine's Gull	<i>Xema sabini</i>	Juan de Fuca Eddy	Canada	GLS	Mark Maftei
Sabine's Gull	<i>Xema sabini</i>	Ilha de Sand (Greenland)	Denmark	GLS	Stenhouse & Egevang 2008
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Witless Bay	Canada	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Faroe Islands	Denmark	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Kippaku (Greenland)	Denmark	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Hafnarholmi	Iceland	GLS	Thorarinsson 2011
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Langanes	Iceland	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Skjalfandi	Iceland	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Anda	Norway	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Alkefjellet (Svalbard)	Norway	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Bjørnøya (Svalbard)	Norway	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Isfjorden (Svalbard)	Norway	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Kongsfjorden (Svalbard)	Norway	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Røst	Norway	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Runde & Ålesund	Norway	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Sklinna	Norway	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Canna	United Kingdom	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Isle of May	United Kingdom	GLS	Daunt 2010
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Isle of May	United Kingdom	GLS	Daunt 2008
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Isle of May	United Kingdom	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Cape Krutik	Russia	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Franz Josef Land	Russia	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Hornøya	Russia	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Kara Gate	Russia	GLS	SEATRACK
Black-legged Kittiwake	<i>Rissa tridactyla</i>	Russkaya Gavan	Russia	GLS	SEATRACK
Black-headed Gull	<i>Larus ridibundus</i>	Doñana	Spain	GLS	Victor Martin Velez, Andy J. Green (CSIC)

Common name	Scientific name	Colony	Country	Device	Source/owner
Mediterranean Gull	<i>Larus melanocephalus</i>	Antuérpia	Belgium	GPS	Stienen et al. 2022
Mediterranean Gull	<i>Larus melanocephalus</i>	Adriatic Sea	Italy	GPS	Lorenzo Serra, Simone Pirrello, Jacopo G. Cecere (ISPRA & Ministero dell'Ambiente e della Sicurezza Energetica)
Audouin's Gull	<i>Larus audouinii</i>	Ebro Delta	Spain	GPS	Gonzalez-Solis 2016j
Audouin's Gull	<i>Larus audouinii</i>	San Pedro	Spain	GPS	Ramos 2021a
Audouin's Gull	<i>Larus audouinii</i>	Barreta	Portugal	GPS	Vitor Paiva
Lesser Black-backed Gull	<i>Larus fuscus</i>	Amrum	Germany	GPS	Corman et al. 2016
Lesser Black-backed Gull	<i>Larus fuscus</i>	Zeebrugge	Belgium	GPS	Stienen et al. 2019
Lesser Black-backed Gull	<i>Larus fuscus</i>	Zeebrugge	Belgium	GPS	Stienen et al. 2021
Lesser Black-backed Gull	<i>Larus fuscus</i>	Eyjafjördur	Iceland	GLS	SEATRACK
Lesser Black-backed Gull	<i>Larus fuscus</i>	Faxaflói	Iceland	GLS	SEATRACK
Lesser Black-backed Gull	<i>Larus fuscus</i>	Mandal & Lindesnes	Norway	GLS	SEATRACK
Lesser Black-backed Gull	<i>Larus fuscus</i>	Neeltje Jans	Netherlands	GPS	Stienen et al. 2023
Lesser Black-backed Gull	<i>Larus fuscus</i>	Clyde Muirshiel	United Kingdom	GPS	Hayley Douglas
Yellow-legged Gull	<i>Larus michahellis</i>	San Pedro	Spain	GPS	Ramos 2021b
Yellow-legged Gull	<i>Larus michahellis</i>	San Pedro	Spain	GPS	Ramos 2022
Yellow-legged Gull	<i>Larus michahellis</i>	Berlenga	Portugal	GPS	SPEA
Yellow-legged Gull	<i>Larus michahellis</i>	Oporto	Portugal	GPS	Vitor Paiva
Yellow-legged Gull	<i>Larus michahellis</i>	Berlenga	Portugal	GPS	Vitor H. Paiva, Filipe Ceia
Yellow-legged Gull	<i>Larus michahellis</i>	Barreta	Portugal	GPS	Vitor H. Paiva, Filipe Ceia
Yellow-legged Gull	<i>Larus michahellis</i>	Ebro Delta	Spain	GPS	Ramos 2020b
Arctic Herring Gull	<i>Larus smithsonianus</i>	East Bay	Canada	GLS	Mallory 2010
Little Tern	<i>Sternula albifrons</i>	Barreta	Portugal	GPS	Vitor Paiva
Caspian Tern	<i>Hydroprogne caspia</i>		Finland and Sweden	GPS	Byholm et al. 2022
Caspian Tern	<i>Hydroprogne caspia</i>		Sweden	GPS	Åkesson et al. 2022
Black Tern	<i>Chlidonias niger</i>	Scania	Sweden	GLS	Alerstam et al. 2025
Roseate Tern	<i>Sterna dougallii</i>	Rockabill	Irlanda	GLS	Redfern 2018a
Roseate Tern	<i>Sterna dougallii</i>	Coquet	United Kingdom	GLS	Redfern 2019
Common Tern	<i>Sterna hirundo</i>	Lake Bant	Germany	GLS	Gonzalez-Solis & Becker 2011
Common Tern	<i>Sterna hirundo</i>	Praia Islet (Azores)	Portugal	GLS	Neves et al. 2015
Common Tern	<i>Sterna hirundo</i>	Scania e lago Krankesjön	Sweden	GLS	Alerstam et al. 2025
Arctic Tern	<i>Sterna paradisaea</i>	Sand Island (Greenland)	Denmark	GLS	Egevang 2008
Arctic Tern	<i>Sterna paradisaea</i>	Sandgerdi	Iceland	GPS	Morten et al. 2018
Arctic Tern	<i>Sterna paradisaea</i>	Delfzijl, Eemshaven	Netherlands	GLS	Fijn et al. 2013
Arctic Tern	<i>Sterna paradisaea</i>	Ilhas de Farne	United Kingdom	GLS	Redfern 2018b
Arctic Tern	<i>Sterna paradisaea</i>	Ilhas de Farne	United Kingdom	GLS	Redfern 2018c
Sandwich Tern	<i>Thalasseus sandvicensis</i>		Netherlands	GPS	Ruben Fijn
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	Hochstetter (Greenland)	Denmark	GLS	Olivier Gilg
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	Hochstetter Forland, Karupelv (Greenland)	Denmark	GLS	van Bemmelen et al. (2017)
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	Karupelv (Greenland)	Denmark	GLS	Lang 2013
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	North East Greenland (Greenland)	Denmark	PTT	Sittler et al. 2011
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	Zackenbergl (Greenland)	Denmark	GLS	van Bemmelen et al. (2017)
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	Kongsfjorden (Svalbard)	Norway	GLS	Borge Moe, Sveinn Are Hansen
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	Ammarnäs	Sweden	GLS	van Bemmelen et al. (2017)
Arctic Jaeger	<i>Stercorarius parasiticus</i>	Hochstetter, Karupelv (Greenland)	Denmark	GLS	Olivier Gilg

Common name	Scientific name	Colony	Country	Device	Source/owner
Arctic Jaeger	<i>Stercorarius parasiticus</i>	Brensholmen (Svalbard)	Norway	GLS	Borge Moe, Sveinn Are Hansen
Arctic Jaeger	<i>Stercorarius parasiticus</i>	Slettnes	Norway	GLS	Rob van Bemmelen
Great Skua	<i>Catharacta skua</i>	Bjørnøya (Svalbard)	Norway	GLS	SEATRACK
Great Skua	<i>Catharacta skua</i>	Bjørnøya (Svalbard)	Norway	GLS	Furness et al. 2010
Great Skua	<i>Catharacta skua</i>	Breidamerkursandur	Iceland	GLS	Furness et al. 2009a
Great Skua	<i>Catharacta skua</i>	Foula	United Kingdom	GLS	Furness et al. 2009b
South Polar Skua	<i>Catharacta macormicki</i>	King George Island	South Shetland Islands	GLS	Kopp et al. 2010
Atlantic Puffin	<i>Fratercula arctica</i>	Dalrymple Rock (Greenland)	Denmark	GLS	Burnham et al. 2021
Atlantic Puffin	<i>Fratercula arctica</i>	Faroe Islands	Denmark	GLS	SEATRACK
Atlantic Puffin	<i>Fratercula arctica</i>	Faroe Islands	Denmark	GLS	SEATRACK
Atlantic Puffin	<i>Fratercula arctica</i>	Skellig Michael	Irlanda	GLS	SEATRACK
Atlantic Puffin	<i>Fratercula arctica</i>	Skellig Michael	Irlanda	GLS	Jessopp 2021
Atlantic Puffin	<i>Fratercula arctica</i>	Skellig Michael	Irlanda	GLS	Jessopp 2013
Atlantic Puffin	<i>Fratercula arctica</i>	Grimsey	Iceland	GLS	Hansen & Thorarinsson 2014a
Atlantic Puffin	<i>Fratercula arctica</i>	Heimaey	Iceland	GLS	Hansen & Thorarinsson 2014b
Atlantic Puffin	<i>Fratercula arctica</i>	Papey	Iceland	GLS	Hansen & Thorarinsson 2014c
Atlantic Puffin	<i>Fratercula arctica</i>	Papey	Iceland	GLS	SEATRACK
Atlantic Puffin	<i>Fratercula arctica</i>	Vestmannaeyjar	Iceland	GLS	SEATRACK
Atlantic Puffin	<i>Fratercula arctica</i>	Westman and Flatey	Iceland	GLS	Fayet et al. 2017
Atlantic Puffin	<i>Fratercula arctica</i>	Runde & Ålesund	Norway	GLS	SEATRACK
Atlantic Puffin	<i>Fratercula arctica</i>	Little Saltee	United Kingdom	GLS	SEATRACK
Atlantic Puffin	<i>Fratercula arctica</i>	Shiant Isles	United Kingdom	GLS	SEATRACK
Atlantic Puffin	<i>Fratercula arctica</i>	Skomer	United Kingdom	GLS	Fayet & Guilford 2014
Atlantic Puffin	<i>Fratercula arctica</i>	Treshnish Isles	United Kingdom	GLS	SEATRACK
Razorbill	<i>Alca torda</i>	Langanes	Iceland	GLS	Thorarinsson & Kolbeinsson 2014a
Razorbill	<i>Alca torda</i>	Latrabjarg	Iceland	GLS	Thorarinsson & Kolbeinsson 2015b
Razorbill	<i>Alca torda</i>	Grimsey	Iceland	GLS	Thorarinsson & Kolbeinsson 2015a
Thick-billed Murre	<i>Uria lomvia</i>	Prince Leopold Island	Canada	GLS	Tranquilla et al. 2010
Thick-billed Murre	<i>Uria lomvia</i>	Gannet Islands	Canada	GLS	Tranquilla et al. 2011
Thick-billed Murre	<i>Uria lomvia</i>	Minarets	Canada	GLS	Tranquilla et al. 2008
Thick-billed Murre	<i>Uria lomvia</i>	Innaq (Greenland)	Denmark	GLS	Merkel 2012
Thick-billed Murre	<i>Uria lomvia</i>	Kippaku (Greenland)	Denmark	GLS	Frederiksen 2013
Thick-billed Murre	<i>Uria lomvia</i>	Kitsissut Avaaliit (Greenland)	Denmark	GLS	Linnebjerg & Frederiksen 2011
Thick-billed Murre	<i>Uria lomvia</i>	Langanes	Iceland	GLS	Thorarinsson & Kolbeinsson 2014d
Thick-billed Murre	<i>Uria lomvia</i>	Grimsey	Iceland	GLS	Thorarinsson & Kolbeinsson 2014e
Common Murre	<i>Uria aalge</i>	Látrabjarg	Iceland	GLS	Thorarinsson & Kolbeinsson 2014c

Annex 3: Sources of colony location, abundance and productivity data

List of the sources and respective owners of all colonies location, abundance and productivity data relating to breeding seabird populations in Portugal that were provided for analysis within the framework of *Sentinels of the Ocean*. Abundance data for the common scoter, a non-breeding species in Portugal, obtained during the wintering period are also included in this list.

Common name	Scientific name	Colony	Region	Parameter	Source/owner
Common Scoter	<i>Melanitta nigra</i>	Miramar-Nazaré	Mainland	Abundance	Rufino & Neves 2004; Catry <i>et al.</i> 2010; Jesus 2018; SPEA
White-faced storm-petrel	<i>Pelagodroma marina</i>	Selvagens	Madeira	Location and abundance	Granadeiro & Campos 1998; Catry <i>et al.</i> 2010; Moniz <i>et al.</i> 2012
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Corvo	Azores	Location and abundance	Tânia Pipa (SPEA)
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Flores (Sentado Islet)	Azores	Location and abundance	Pipa & Silva 2021
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Graciosa	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Bried & Neves 2015; Pipa <i>et al.</i> 2023; Pipa <i>et al.</i> 2024
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Baixo Islet	Azores	Abundance	Monteiro <i>et al.</i> 1996; Pipa <i>et al.</i> 2024
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Praia Islet	Azores	Abundance	Monteiro <i>et al.</i> 1996; Pipa <i>et al.</i> 2024
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Praia Islet	Azores	Productivity	Joël Bried
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Vila Islet	Azores	Abundance	Monteiro <i>et al.</i> 1996; Pipa <i>et al.</i> 2024
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Vila Islet	Azores	Productivity	Joël Bried
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	São Jorge	Azores	Location and abundance	Monteiro <i>et al.</i> 1999
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	São Miguel	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2021
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Santa Maria	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2023; Pipa <i>et al.</i> 2024; Joël Bried
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Desertas	Madeira	Location and abundance	Costa <i>et al.</i> 2003
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Madeira	Madeira	Location and abundance	Geraldes 2000
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Porto Santo	Madeira	Location and abundance	Costa <i>et al.</i> 2003
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Selvagens	Madeira	Location and abundance	Costa <i>et al.</i> 2003
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Berlengas and Farilhões	Mainland	Location and abundance	SPEA
Band-rumped Storm-petrel	<i>Hydrobates castro</i>	Farilhão Grande	Mainland	Abundance and productivity	Oliveira <i>et al.</i> 2025
Monteiro's Storm-petrel	<i>Hydrobates monteiroi</i>	Corvo	Azores	Location and abundance	Equipa Atlas 2022
Monteiro's Storm-petrel	<i>Hydrobates monteiroi</i>	Flores	Azores	Location and abundance	Pipa <i>et al.</i> 2024
Monteiro's Storm-petrel	<i>Hydrobates monteiroi</i>	Graciosa	Azores	Location and abundance	Bried & Neves 2015; Pipa <i>et al.</i> 2023; Pipa <i>et al.</i> 2024
Monteiro's Storm-petrel	<i>Hydrobates monteiroi</i>	Baixo Islet	Azores	Abundance	Monteiro <i>et al.</i> 1999; Oliveira <i>et al.</i> 2016; Pipa & Silva 2021; Pipa <i>et al.</i> 2024
Monteiro's Storm-petrel	<i>Hydrobates monteiroi</i>	Praia Islet	Azores	Abundance	Monteiro <i>et al.</i> 1999; Oliveira <i>et al.</i> 2016; Pipa & Silva 2021; Pipa <i>et al.</i> 2024
Monteiro's Storm-petrel	<i>Hydrobates monteiroi</i>	Praia Islet	Azores	Productivity	Oliveira <i>et al.</i> 2016; Pipa <i>et al.</i> 2024
Monteiro's Storm-petrel	<i>Hydrobates monteiroi</i>	São Jorge	Azores	Location and abundance	Equipa Atlas 2022
Desertas Petrel	<i>Pterodroma deserta</i>	Bugio	Madeira	Abundance and productivity	Menezes <i>et al.</i> 2010; DQEM 2020; DQEM 2024
Desertas Petrel	<i>Pterodroma deserta</i>	Bugio	Madeira	Location and abundance	Menezes <i>et al.</i> 2010
Zino's Petrel	<i>Pterodroma madeira</i>	Madeira	Madeira	Abundance	Equipa Atlas 2008
Zino's Petrel	<i>Pterodroma madeira</i>	Madeira	Madeira	Abundance and productivity	Zino <i>et al.</i> 2001; DQEM 2020; DQEM 2024
Zino's Petrel	<i>Pterodroma madeira</i>	Madeira	Madeira	Location and abundance	Menezes <i>et al.</i> 2010
Cory's Shearwater	<i>Calonectris borealis</i>	Corvo	Azores	Abundance	Henriques 2010; Tânia Pipa (SPEA)
Cory's Shearwater	<i>Calonectris borealis</i>	Corvo	Azores	Productivity	Tânia Pipa (SPEA)
Cory's Shearwater	<i>Calonectris borealis</i>	Corvo	Azores	Location and abundance	Monteiro <i>et al.</i> 2001; Ramírez <i>et al.</i> 2009; Henriques 2010; Oppel <i>et al.</i> 2014
Cory's Shearwater	<i>Calonectris borealis</i>	Faial	Azores	Location and abundance	Costa <i>et al.</i> 2003; Saavedra <i>et al.</i> 2018; Atchoi 2024; Biodiversity4all
Cory's Shearwater	<i>Calonectris borealis</i>	Flores	Azores	Location and abundance	Monteiro <i>et al.</i> 2001

Common name	Scientific name	Colony	Region	Parameter	Source/owner
Cory's Shearwater	<i>Calonectris borealis</i>	Graciosa	Azores	Location and abundance	Costa <i>et al.</i> 2003; Saavedra <i>et al.</i> 2018; Tânia Pipa; Elizabeth Atchoi; Carlos Silva
Cory's Shearwater	<i>Calonectris borealis</i>	Praia Islet	Azores	Abundance and productivity	Pipa <i>et al.</i> 2024
Cory's Shearwater	<i>Calonectris borealis</i>	Vila Islet	Azores	Abundance	Ramos <i>et al.</i> 1997; Heath & Evans 2000; Pipa <i>et al.</i> 2024
Cory's Shearwater	<i>Calonectris borealis</i>	Vila Islet	Azores	Productivity	Fontaine <i>et al.</i> 2011; Pipa <i>et al.</i> 2024
Cory's Shearwater	<i>Calonectris borealis</i>	Baixo Islet	Azores	Abundance and productivity	Pipa <i>et al.</i> 2024
Cory's Shearwater	<i>Calonectris borealis</i>	Vila Franca do Campo Islet	Azores	Abundance	Heath & Evans 2000; Rodrigues <i>et al.</i> 2009; Pipa & Silva 2021; Tânia Pipa (SPEA)
Cory's Shearwater	<i>Calonectris borealis</i>	Vila Franca do Campo Islet	Azores	Productivity	Pipa & Silva 2021; Tânia Pipa (SPEA)
Cory's Shearwater	<i>Calonectris borealis</i>	Pico	Azores	Location and abundance	Costa <i>et al.</i> 2003; Saavedra <i>et al.</i> 2018; Biodiversity4all; eBird 2026
Cory's Shearwater	<i>Calonectris borealis</i>	Santa Maria	Azores	Location and abundance	Costa <i>et al.</i> 2003; Joël Bried; Karen Bourgeois
Cory's Shearwater	<i>Calonectris borealis</i>	São Jorge	Azores	Location and abundance	Costa <i>et al.</i> 2003; eBird 2026; Biodiversity4all
Cory's Shearwater	<i>Calonectris borealis</i>	São Miguel	Azores	Location and abundance	Costa <i>et al.</i> 2003; Pipa & Silva 2021; eBird 2026; Biodiversity4all
Cory's Shearwater	<i>Calonectris borealis</i>	Terceira	Azores	Location and abundance	Costa <i>et al.</i> 2003; Lamelas-López 2023; eBird 2026; Rúben Coelho; Biodiversity4all
Cory's Shearwater	<i>Calonectris borealis</i>	Desertas	Madeira	Location and abundance	Costa <i>et al.</i> 2003; SPNM 2015; IFCN 2020; Biodiversity4all
Cory's Shearwater	<i>Calonectris borealis</i>	Madeira	Madeira	Location and abundance	Geraldes 2000; eBird 2026; SPEA Madeira; Biodiversity4all
Cory's Shearwater	<i>Calonectris borealis</i>	Porto Santo (including islets)	Madeira	Location and abundance	Costa <i>et al.</i> 2003; SPNM 2015; IFCN 2020
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagem Grande	Madeira	Abundance	Mougin & Stahl 1982; Mougin <i>et al.</i> 1984; Mougin <i>et al.</i> 1994; Mougin <i>et al.</i> 1996; Heath & Evans 2000; Mougin <i>et al.</i> 2000; Mougin & Mougin 2000; Granadeiro <i>et al.</i> 2006; Catry <i>et al.</i> 2025
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagem Grande	Madeira	Productivity	Zino <i>et al.</i> 2022
Cory's Shearwater	<i>Calonectris borealis</i>	Selvagens	Madeira	Location and abundance	Catry <i>et al.</i> 2010; Catry <i>et al.</i> 2025
Cory's Shearwater	<i>Calonectris borealis</i>	Berlengas	Mainland	Abundance	Lecoq <i>et al.</i> 2010; Lecoq <i>et al.</i> 2011; Oliveira <i>et al.</i> 2020; Equipa Atlas 2022
Cory's Shearwater	<i>Calonectris borealis</i>	Berlengas	Mainland	Productivity	Oliveira <i>et al.</i> 2025
Cory's Shearwater	<i>Calonectris borealis</i>	Berlengas	Mainland	Location and abundance	Equipa Atlas 2022
Cory's Shearwater	<i>Calonectris borealis</i>	Peniche	Mainland	Location and abundance	Equipa Atlas 2022
Manx shearwater	<i>Puffinus puffinus</i>	Corvo	Azores	Location and abundance	Monteiro <i>et al.</i> 1999
Manx shearwater	<i>Puffinus puffinus</i>	Flores	Azores	Location and abundance	Monteiro <i>et al.</i> 1999
Manx shearwater	<i>Puffinus puffinus</i>	Graciosa	Azores	Location and abundance	Monteiro <i>et al.</i> 1999
Manx shearwater	<i>Puffinus puffinus</i>	Santa Maria	Azores	Location and abundance	Monteiro <i>et al.</i> 1999
Manx shearwater	<i>Puffinus puffinus</i>	Terceira	Azores	Location and abundance	Tânia Pipa (SPEA); Rúben Coelho
Manx shearwater	<i>Puffinus puffinus</i>	São Miguel	Azores	Location and abundance	Groz <i>et al.</i> 2005; Tânia Pipa
Manx shearwater	<i>Puffinus puffinus</i>	Madeira	Madeira	Location and abundance	Geraldes 2000; Nunes <i>et al.</i> 2010; SPEA Madeira
Barolo Shearwater	<i>Puffinus baroli</i>	Corvo	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2021
Barolo Shearwater	<i>Puffinus baroli</i>	Faial	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2021
Barolo Shearwater	<i>Puffinus baroli</i>	Flores	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2021
Barolo Shearwater	<i>Puffinus baroli</i>	Graciosa	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2021; Pipa <i>et al.</i> 2024
Barolo Shearwater	<i>Puffinus baroli</i>	Vila Islet	Azores	Abundance	Monteiro <i>et al.</i> 1996
Barolo Shearwater	<i>Puffinus baroli</i>	Vila Islet	Azores	Abundance and productivity	Atchoi 2021; Pipa <i>et al.</i> 2024
Barolo Shearwater	<i>Puffinus baroli</i>	Praia Islet	Azores	Abundance	Monteiro <i>et al.</i> 1996; Joël Bried
Barolo Shearwater	<i>Puffinus baroli</i>	Praia Islet	Azores	Abundance and productivity	Pipa <i>et al.</i> 2024
Barolo Shearwater	<i>Puffinus baroli</i>	Pico	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2021
Barolo Shearwater	<i>Puffinus baroli</i>	Santa Maria	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2021; Pipa <i>et al.</i> 2024
Barolo Shearwater	<i>Puffinus baroli</i>	São Jorge	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2021
Barolo Shearwater	<i>Puffinus baroli</i>	Terceira	Azores	Location and abundance	Tânia Pipa (SPEA); Rúben Coelho
Barolo Shearwater	<i>Puffinus baroli</i>	São Miguel	Azores	Location and abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2021
Barolo Shearwater	<i>Puffinus baroli</i>	Desertas	Madeira	Location and abundance	Costa <i>et al.</i> 2003

Common name	Scientific name	Colony	Region	Parameter	Source/owner
Barolo Shearwater	<i>Puffinus baroli</i>	Porto Santo	Madeira	Location and abundance	Isabel Fagundes; Jaime A. Ramos; Cátia Gouveia; Laura Castelló; Vitor Paiva
Barolo Shearwater	<i>Puffinus baroli</i>	Selvagens	Madeira	Location and abundance	Isabel Fagundes; Jaime A. Ramos; Cátia Gouveia; Laura Castelló; Vitor Paiva
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Praia Islet	Azores	Location and abundance	Pipa <i>et al.</i> 2024
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Vila Islet	Azores	Abundance	Monteiro <i>et al.</i> 1999; Pipa <i>et al.</i> 2024; Joël Bried; Karen Bourgeois
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Vila Islet	Azores	Productivity	Pipa <i>et al.</i> 2024; Joël Bried; Karen Bourgeois
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Vila Islet	Azores	Location and abundance	DQEM 2020; Pipa <i>et al.</i> 2024; Joël Bried; Karen Bourgeois
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Baixo Islet	Azores	Location and abundance	Pipa <i>et al.</i> 2024
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Deserta Grande, Bugio and Chão	Madeira	Location and abundance	Catry <i>et al.</i> 2015
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Ponta de São Lourenço	Madeira	Location and abundance	Costa <i>et al.</i> 2003
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Porto Santo islets	Madeira	Location and abundance	SPNM 2015
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Selvagem Grande	Madeira	Location and abundance	Costa <i>et al.</i> 2003
Bulwer's Petrel	<i>Bulweria bulwerii</i>	Selvagem Pequena	Madeira	Location and abundance	Catry <i>et al.</i> 2010
European Shag	<i>Gulosus aristotelis</i>	Berlenga	Mainland	Abundance	Lockley 1952; Oliveira <i>et al.</i> 2025
European Shag	<i>Gulosus aristotelis</i>	Berlenga	Mainland	Productivity	Oliveira <i>et al.</i> 2025
European Shag	<i>Gulosus aristotelis</i>	Berlenga	Mainland	Location and abundance	Equipa Atlas 2022
European Shag	<i>Gulosus aristotelis</i>	Cape Roca	Mainland	Abundance	Teixeira 1984; Catry 2002; del Moral & Oliveira 2019
European Shag	<i>Gulosus aristotelis</i>	Cape Espichel	Mainland	Abundance	Teixeira 1984; Catry 2002; del Moral & Oliveira 2019
European Shag	<i>Gulosus aristotelis</i>	Southwest coast	Mainland	Abundance	Araújo & Rufino 1981; Teixeira 1984; Catry 2002; del Moral & Oliveira 2019
European Shag	<i>Gulosus aristotelis</i>	Southwest coast, Cape Roca, Cape Espichel and Peniche	Mainland	Location and abundance	Equipa Atlas 2022
European Shag	<i>Gulosus aristotelis</i>	Baleeira harbour	Mainland	Location and abundance	Tiago Caldeira; Amândio Custódio
Great Cormorant	<i>Phalacrocorax carbo</i>	Guadiana Basin	Mainland	Abundance	Almeida 2008; Encarnação 2014; Equipa Atlas 2022
Great Cormorant	<i>Phalacrocorax carbo</i>	Tagus Basin	Mainland	Abundance	Encarnação 2014; Equipa Atlas 2022
Great Cormorant	<i>Phalacrocorax carbo</i>	Sado Basin	Mainland	Abundance	Encarnação 2014; Equipa Atlas 2022
Great Cormorant	<i>Phalacrocorax carbo</i>	Several	Mainland	Location and abundance	eBird 2026; Biodiversity4all
Black-headed gull	<i>Larus ridibundus</i>	Several	Mainland	Location and abundance	eBird 2026
Audouin's Gull	<i>Larus audouinii</i>	Barreta	Mainland	Abundance	Equipa Atlas 2022; Vitor Paiva
Audouin's Gull	<i>Larus audouinii</i>	Barreta	Mainland	Location and abundance	ICNF; Vitor Paiva
Audouin's Gull	<i>Larus audouinii</i>	Culatra	Mainland	Abundance	Vitor Paiva
Audouin's Gull	<i>Larus audouinii</i>	Culatra	Mainland	Location and abundance	ICNF; Vitor Paiva
Lesser Black-backed Gull	<i>Larus fuscus</i>	Barreta	Mainland	Abundance	Araújo & Rufino 1981; Equipa Atlas 2008; Equipa Atlas 2022; SPEA
Lesser Black-backed Gull	<i>Larus fuscus</i>	Barreta	Mainland	Location and abundance	SPEA
Lesser Black-backed Gull	<i>Larus fuscus</i>	Berlenga	Mainland	Abundance	Oliveira <i>et al.</i> 2025
Lesser Black-backed Gull	<i>Larus fuscus</i>	Berlenga	Mainland	Location and abundance	SPEA
Lesser Black-backed Gull	<i>Larus fuscus</i>	Oporto	Mainland	Abundance	Equipa Atlas 2008; Equipa Atlas 2022
Lesser Black-backed Gull	<i>Larus fuscus</i>	Oporto	Mainland	Location and abundance	Equipa Atlas 2022
Yellow-legged Gull	<i>Larus michahellis</i>	Corvo	Azores	Abundance	Neves <i>et al.</i> 2006; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Flores	Azores	Abundance	Neves <i>et al.</i> 2006; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Graciosa	Azores	Abundance	Neves <i>et al.</i> 2006; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Pico	Azores	Abundance	Neves <i>et al.</i> 2006; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Santa Maria	Azores	Abundance	Neves <i>et al.</i> 2006; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	São Jorge	Azores	Abundance	Neves <i>et al.</i> 2006; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Terceira	Azores	Abundance	Neves <i>et al.</i> 2006; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	All archipelago	Azores	Location and abundance	Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Chão Islet	Madeira	Abundance	Fagundes <i>et al.</i> 2002; Oliveira <i>et al.</i> 2023

Common name	Scientific name	Colony	Region	Parameter	Source/owner
Yellow-legged Gull	<i>Larus michahellis</i>	Desembarcadouro Islet	Madeira	Abundance	Fagundes <i>et al.</i> 2002; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	All archipelago	Madeira	Location and abundance	Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Barreta	Mainland	Abundance	Araújo & Rufino 1981; Oliveira <i>et al.</i> 2023; Oliveira <i>et al.</i> 2025; Vitor Paiva
Yellow-legged Gull	<i>Larus michahellis</i>	Cape Roca	Mainland	Abundance	Araújo & Rufino 1981; Catry 2002; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Cape São Vicente	Mainland	Abundance	Araújo & Rufino 1981; Catry 2002; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Culatra	Mainland	Abundance	Araújo & Rufino 1981; Oliveira <i>et al.</i> 2023; Vitor Paiva
Yellow-legged Gull	<i>Larus michahellis</i>	Lagoa	Mainland	Abundance	Araújo & Rufino 1981; Catry 2002; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Lagos	Mainland	Abundance	Araújo & Rufino 1981; Catry 2002; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Portimão	Mainland	Abundance	Araújo & Rufino 1981; Catry 2002; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Porto	Mainland	Abundance	Equipa Atlas 2008; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	Sagres	Mainland	Abundance	Araújo & Rufino 1981; Catry 2002; Oliveira <i>et al.</i> 2023
Yellow-legged Gull	<i>Larus michahellis</i>	All region	Mainland	Location and abundance	Oliveira <i>et al.</i> 2023
Sooty Tern	<i>Onychoprion fuscatus</i>	Praia Islet	Azores	Abundance	Equipa Atlas 2008; DRPM
Sooty Tern	<i>Onychoprion fuscatus</i>	Praia Islet	Azores	Location and abundance	DRPM
Sooty Tern	<i>Onychoprion fuscatus</i>	Vila Islet	Azores	Abundance	Monteiro <i>et al.</i> 1996; Equipa Atlas 2008; DRPM
Little Tern	<i>Sternula albifrons</i>	Caia Reservoir	Mainland	Abundance	Luís Venâncio
Little Tern	<i>Sternula albifrons</i>	Castro Marim	Mainland	Abundance	Araújo & Rufino 1981; Teixeira 1984; Equipa Atlas 2008
Little Tern	<i>Sternula albifrons</i>	Castro Marim	Mainland	Abundance and productivity	Catry <i>et al.</i> 2004
Little Tern	<i>Sternula albifrons</i>	Sado Estuary	Mainland	Abundance	Araújo & Rufino 1981; Equipa Atlas 2008; Catry <i>et al.</i> 2004; ICNF
Little Tern	<i>Sternula albifrons</i>	Tagus Estuary	Mainland	Abundance	Equipa Atlas 2008; ICNF
Little Tern	<i>Sternula albifrons</i>	Tagus Estuary	Mainland	Abundance and productivity	Catry <i>et al.</i> 2004
Little Tern	<i>Sternula albifrons</i>	Santo André Lagoon	Mainland	Abundance	Araújo & Rufino 1981; Teixeira 1984; Equipa Atlas 2008
Little Tern	<i>Sternula albifrons</i>	Santo André Lagoon	Mainland	Abundance and productivity	Catry <i>et al.</i> 2004
Little Tern	<i>Sternula albifrons</i>	Ria de Alvor	Mainland	Abundance	Teixeira 1984
Little Tern	<i>Sternula albifrons</i>	Ria de Alvor	Mainland	Abundance and productivity	Catry <i>et al.</i> 2004
Little Tern	<i>Sternula albifrons</i>	Ria de Aveiro	Mainland	Abundance	Araújo & Rufino 1981; Catry <i>et al.</i> 2004; Equipa Atlas 2008; ICNF
Little Tern	<i>Sternula albifrons</i>	Ria Formosa	Mainland	Abundance	Araújo & Rufino 1981; Teixeira 1984; Calado 1996; Catry <i>et al.</i> 2004;
Little Tern	<i>Sternula albifrons</i>	Ria Formosa	Mainland	Abundance and productivity	Jaime A. Ramos
Little Tern	<i>Sternula albifrons</i>	Several	Mainland	Location and abundance	eBird 2026; Equipa Atlas 2022; Afonso Rocha
Common Gull-billed Tern	<i>Gelochelidon nilotica</i>	Caia Reservoir	Mainland	Abundance	Luís Venâncio
Common Gull-billed Tern	<i>Gelochelidon nilotica</i>	Caia Reservoir	Mainland	Location and abundance	Luís Venâncio
Common Gull-billed Tern	<i>Gelochelidon nilotica</i>	Several	Mainland	Location and abundance	eBird 2026; Equipa Atlas 2022
Whiskered tern	<i>Chlidonias hybrida</i>	Several	Mainland	Location and abundance	eBird 2026; Catry <i>et al.</i> 2010
Roseate Tern	<i>Sterna dougallii</i>	All islands	Azores	Abundance	Neves 2005; OSPAR 2009; Piec & Dunn 2021; DRPM
Roseate Tern	<i>Sterna dougallii</i>	All islands	Azores	Location and abundance	DRPM
Roseate Tern	<i>Sterna dougallii</i>	Madeira	Madeira	Location and abundance	eBird 2026
Roseate Tern	<i>Sterna dougallii</i>	Porto Santo	Madeira	Location and abundance	IFCN 2015
Roseate Tern	<i>Sterna dougallii</i>	Selvagens	Madeira	Location and abundance	Catry <i>et al.</i> 2023
Common Tern	<i>Sterna hirundo</i>	All islands	Azores	Abundance	Neves 2005; DQEM 2024; DRPM
Common Tern	<i>Sterna hirundo</i>	All islands	Azores	Location and abundance	DRPM
Common Tern	<i>Sterna hirundo</i>	Madeira	Madeira	Location and abundance	eBird 2026
Common Tern	<i>Sterna hirundo</i>	Porto Santo	Madeira	Location and abundance	eBird 2026; IFCN 2015
Common Tern	<i>Sterna hirundo</i>	Selvagens	Madeira	Location and abundance	Catry <i>et al.</i> 2010; Catry <i>et al.</i> 2023
Common Tern	<i>Sterna hirundo</i>	Sado and Tagus estuaries	Mainland	Location and abundance	eBird 2026

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