5-years after-Life Berlengas: Conservation efforts and monitoring in Berlengas Archipelago (2019-2024)

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Life Berlengas

5-years after-Life Berlengas

Conservation efforts and monitoring in Berlengas Archipelago (2019-2024)

Lisboa, January, 2025

5-years after-Life Berlengas

Conservation efforts and monitoring in Berlengas Archipelago (2019-2024)

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The **LIFE Berlengas** (LIFE13 NAT/PT/000458) was a partnership of SPEA with the Institute of Conservation of Nature and Forests (ICNF), Peniche City Hall, the Faculty of Social Sciences and Humanities of the University Nova of Lisbon (FCSH) and has as external observer the School of Tourism and Maritime Technology of the Polytechnic Institute of Leiria (ESTM - IPL).

Mission

To work towards the study and the conservation of wild birds and their habitats by promoting sustainable development for the benefit of the future generations.

SPEA – Portuguese Society for the Study of Birds is a non-profit scientific association that promotes the study and conservation of birds in Portugal. As a non-profit association, it depends on the support of partners and various entities to carry out their actions. SPEA is a member of BildLife Partnes, a worldwide network which operates in 120 countries and aims to preserve biological diversity through the conservation of birds, their habitats and the promotion of sustainable use of natural resources.

SPEA was recognized as a public utility organization in 2012.

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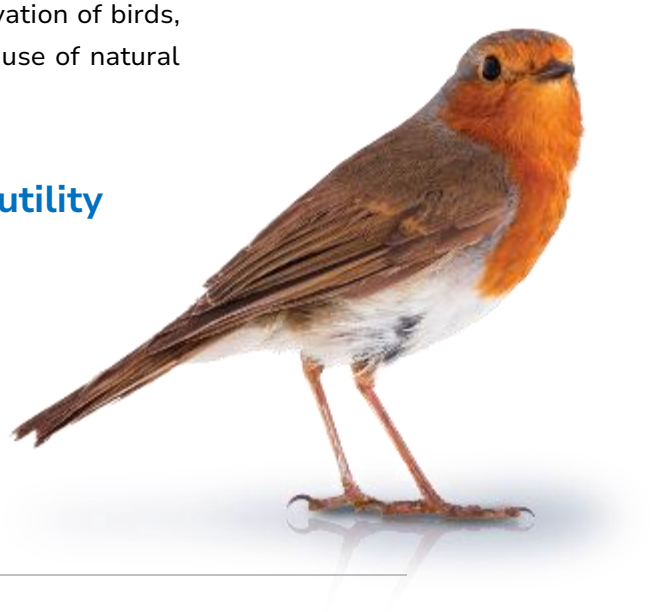

5-years after-Life Berlengas

Sociedade Portuguesa para o Estudo das Aves, 2025

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RESUMO

O pós-LIFE Berlengas teve início em 2019. Neste relatório são apresentadas as tarefas realizadas durante 2019-2024, nomeadamente, monitorização e conservação de aves marinhas, biossegurança, controlo de plantas invasoras e monitorização da flora. Os resultados alcançados em termos de investigação, voluntariado, apoio, visitação e ações de sensibilização são também apresentados. A informação recolhida anteriormente ao pós-LIFE foi compilada de forma a apresentar todas as séries temporais disponíveis.

- Em termos de aves marinhas reprodutoras, foram monitorizados os tamanhos populacionais, a produtividade, as taxas de sobrevivência individual, seguimento individual, a ocupação dos ninhos artificiais e outras atividades de conservação. As espécies-alvo foram o roque-de-castro *Hydrobates castro*, a cagarra *Calonectris borealis*, a galheta *Gulosus aristotelis*, a gaivota-d'asa-escura *Larus fuscus*, a gaivota-de-patas-amarelas *Larus michahellis* e o airo *Uria aalge*.
- Foram testadas medidas de mitigação para reduzir a captura acidental de aves marinhas e a interação com as pesca durante 229 dias de pesca.
- As aves terrestres reprodutoras e migradoras foram monitorizadas através de sessões de anilhagem e observações no terreno. Das 72 espécies observadas nas ilhas, foram anilhadas 20 espécies distintas.
- As medidas de biossegurança foram monitorizadas ao longo de cada ano na ilha da Berlenga. Não foram detetados sinais de roedores nas armadilhas A24 ©GoodNature nem nas caixas-rateiras. Apesar dos cinco alertas da potencial presença de roedores emitidos. As Berlengas continuam livres de roedores. No entanto foi feita a observação de fezes frescas de coelho-bravo *Oryctolagus cuniculus* em maio de 2024.
- Anualmente em abril, a vegetação foi monitorizada através de 75 quadrados de 2x2m. A cobertura e diversidade da vegetação aumentou ao longo dos anos, com 2024 a atingir o maior número de espécies registadas - 80.
- Foi monitorizada uma área de exclusão de gaivota-de-patas-amarelas durante a primavera. Foram observadas diferenças significativas entre as subáreas, com maiores abundâncias de *Armeria berlengensis* na subárea de exclusão, quando comparada com a área de não exclusão.
- Os novos rebentos de chorão *Carpobrotus edulis* foram removidos das áreas intervencionadas no âmbito do LIFE Berlengas, o que resultou num esforço anual de monitorização de 466 pessoas*hora.
- Desde 2019, foram publicados 16 artigos em revistas científicas.
- Entre 2019 e 2024, 71 voluntários estiveram envolvidos nos trabalhos das Berlengas. A SPEA implementou 4 projetos para assegurar as tarefas do Pós-LIFE.
- A visitação na ilha da Berlenga foi monitorizada anualmente. As melhorias que decorreram incluíram a implementação da Capacidade de Carga Humana e a plataforma de acesso à ilha da Berlenga.
- A câmara "ninho ao vivo" esteve ativa ao longo de todo o período, transmitindo imagens em tempo real a partir de um ninho de cagarra e de um ninho de roque-de-castro, em alternado.
- Foram desenvolvidas diversas ações para sensibilização e de educação ambiental pela SPEA e ICNF. Tais atividades tiveram como público-alvo os visitantes da ilha da Berlenga, os pescadores de Peniche, grupos internacionais, operadores marítimo-turísticos, professores e alunos das escolas locais.

SUMMARY

The After-Life Berlengas started in 2019. Here, we report the tasks carried out during 2019-2024 on seabird monitoring and conservation, biosecurity, control of invasive plants and monitoring of flora. Results on the research, volunteers, support, visitation and awareness activities are also presented. Data from before After-LIFE were also collated in order to put together all available time-series.

- In terms of breeding seabirds, monitoring included population size, productivity, individual survival rates, individual tracking, occupancy of artificial nests and other conservation activities. Target species included Band-rumped Storm-petrel *Hydrobates castro*, Cory's Shearwater *Calonectris borealis*, European Shag *Gulosus aristotelis*, Lesser Black-backed Gull *Larus fuscus*, Yellow-legged Gull *Larus michahellis* and Common Murre *Uria aalge*.
- Mitigation measures to reduce seabird bycatch and fisheries interactions were tested during 229 fishing days.
- Breeding and migrant terrestrial birds were monitored through ringing sessions and on land observations. Of the 72 different species observed in the islands, individuals of 20 different species were ringed.
- The biosecurity measures were monitored across each year on Berlenga Island. No signs of rodents were recorded in A24 ©GoodNature traps or rat-boxes, although five alerts for the potential presence of rodents were made. Berlengas was still free of rodents. An observation of relatively fresh faeces of European Rabbit *Oryctolagus cuniculus* was made in May 2024.
- Every April, the vegetation was monitored using 75 plots of 2X2m to assess the removal of alien species. Plant coverage and diversity was increasing each year, with 2024 being the year with the highest number of species - 80.
- During Spring, an exclusion area for Yellow-legged Gulls was monitored. Significant differences were observed between exclusion subareas, with higher abundance of *Armeria berlengensis* on exclusion areas when compared with non-exclusion areas.
- All new sprouts of Hotentot Fig *Carpobrotus edulis* were removed from the areas intervened during LIFE Berlengas, resulting in an annual effort of 466 person*hour.
- 16 scientific papers were published in peer-reviewed journals from 2019 onwards.
- From 2019 to 2024, 71 volunteers were involved in Berlengas work. Four different projects were implemented by SPEA to secure the After-LIFE tasks.
- Tourist visitation to Berlenga Island was annual monitored. Improvements were made through the Human Carrying Capacity and the Berlenga Island access platform.
- The seabird live webcam was kept active along the entire period, broadcasting images alternatively between a Corys' Shearwater and a Band-rumped Storm-petrel nest.
- Several awareness and environmental education actions were carried out by SPEA and ICNF. Those activities targeted mostly visitors on Berlenga Island, fishermen from Peniche, international groups, tour operators, teachers and local students.

1. INTRODUCTION

Since the end of the **LIFE Berlengas** in 2019, SPEA with the full support of ICNF and remaining partners kept several tasks in the Berlengas Archipelago (Figure 1) under the scope of the after-Life conservation plan (SPEA 2019). Those tasks were most related with seabird monitoring and conservation, biosecurity, control of invasive plants and monitoring of flora.

The After-LIFE started in 2019, just after the ending of LIFE Berlengas.

Berlengas archipelago is one of the most important breeding sites for seabirds on Portugal mainland coast. Five species regularly breed on these islands: Band-rumped Storm-petrel *Hydrobates castro*, Cory's Shearwater *Calonectris borealis*, European Shag *Gulosus aristotelis*, Yellow-legged Gull *Larus michahellis* and Lesser Black-backed Gull *Larus fuscus*. Common Murre *Uria aalge* also used to to breed on Berlenga Island, with the last attempt recorded in 2002 (Lecoq 2003).

In terms of flora, Berlengas hold two endemic species, *Armeria berlengensis* and *Pulicaria microcephala*, and two endemic subspecies, *Herniaria lusitanica berlengiana* and *Echium rosulatum davaei*.

Black-rat Rattus rattus and European Rabbit Oryctolagus cuniculus were removed from Berlenga Island under the LIFE Berlengas.

Here we present all data collected from 2019 to 2024. Historical data was also collated in order to have longer time-series.

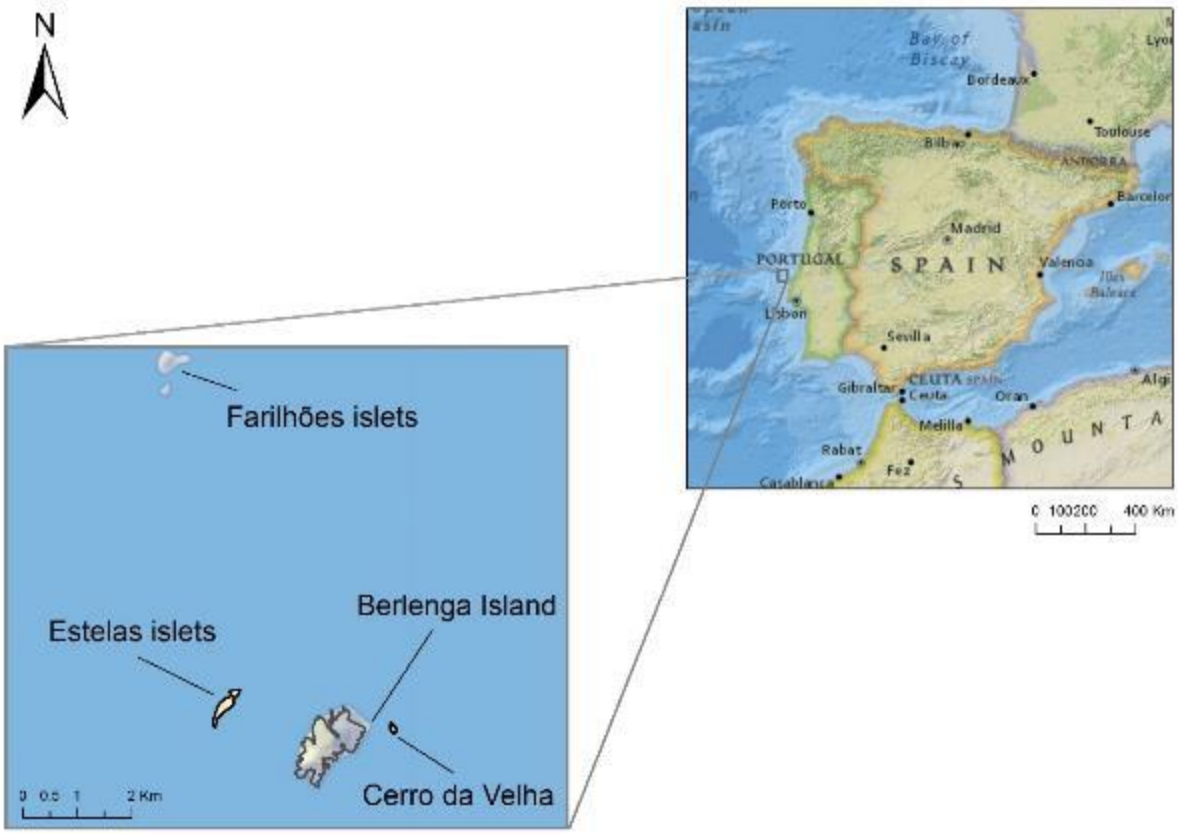

Figure 1 | Geographic location of Berlengas archipelago and the different groups of islets and island.

2. BIOLOGICAL RECORDING

2.1 Introduction to breeding seabirds

SPEA and ICNF are monitoring the breeding seabird populations in order to evaluate trends on population size, productivity and individual survival over time. Those analyses aim to inform the managers of the area (ICNF) about the status of those species. All data has been also used in several official reports, e.g. the assessment of the Marine Strategy Framework Directive (MSFD), the Bird Reporting (Article 12) of the Birds Directive and the Red List of Portugal Mainland 2022.

SPEA is monitoring all breeding species, except Yellow-legged Gull on Berlenga Island, from which population size and breeding productivity is monitored by ICNF. Plus, SPEA and ICNF are keeping a long term ringing scheme of this species using colour rings.

2.2 Population monitoring of breeding seabirds

2.2.1 Population size

The detailed methodology for the monitoring of the population size of the five breeding seabirds (Band-rumped Storm-petrel, Cory's Shearwater, European Shag, Lesser Black-backed Gull and Yellow-legged Gull) and the former breeder Common Murre can be consulted in Oliveira (et al. 2016) and Morais et al. (2014).

Band-rumped Storm-petrel is being monitored using mist-nets in Farilhão Grande Islet. Five mist-nets of 15 meters long, with 4 pockets (20x20mm mesh), were set up in the locations indicated in figure 2. Mist-nets were setting up about 60m apart, covering as much area as possible. Mist-netting session usually occurred during the third week of October, when most of the birds are starting the incubation period. Each session comprehended 4-5 nights of ringing in a row, when weather conditions allowed. Mist-nets were opened daily 1-2 hours after sunset and visited at 1-hour intervals in order to minimize the time spent by the animals captured in the mist-nets and subsequent stress. Birds were marked with a metal numbered ring and the length of the wing, tarsus and beak were measured, the presence of incubation plate, other characteristics (e.g., morphological deformations), weight and hour of capture were also recorded. The population size was estimated using a Capture-Mark-Recapture approach, through the function "openp" of Rcapture that fits both the Cormack-Jolly-Seber and the Joly-Seber model for open populations following a log-linear approach. More details on data collection and analysis can be found in Oliveira et al. (2023).

Figure 2 | Location of the mist-nets (greed dots) set on Farilhão Grande Islet to capture Band-rumped Storm-petrels. The subarea of Farilhão Grande where Cory's Shearwater nests were counted every year, is depicted in grey.

Cory's Shearwater occupied nests were counted every year in 5 subcolonies of Berlenga Island (Melreu, Capitão, Furado, Flandres and Quebradas; Figure 3) and one subarea of Farilhão Grande (covering all accessible area between the landing site and the lighthouse; Figure 2). Counts took place during the first week of June, when the peak of egg laying occurred. A nest was considered active when an adult incubating an egg was found inside or when strong breeding evidences were present, namely a broken and/or deserted egg. All artificial and natural nests were monitored, and nest number and status of the nest were recorded. In 2020, a census of the entire archipelago took place during this same first week of June. Accessible areas of Berlenga Island, Cerro da Velha and Farilhão do Nordeste were directly prospected and active nests counted. Farilhão Grande and Farilhão da Cova islets were prospected using climbing equipment. The number of pairs breeding in inaccessible areas was estimated (and presented separately) by assessing the proportion of available breeding habitat in these areas.

Figure 3 | Location of main Cory's Shearwater subcolonies on Berlenga Island.

Four to six counts per year of **European Shags** nests were carried out from February to July on Berlenga Island. Nests are usually located on cliffs and caves (Figure 4), so the counts were mostly done from land using binoculars and telescope. Number of adults present on each nest was recorded, as well as the location of the nest and the number of eggs/chicks.

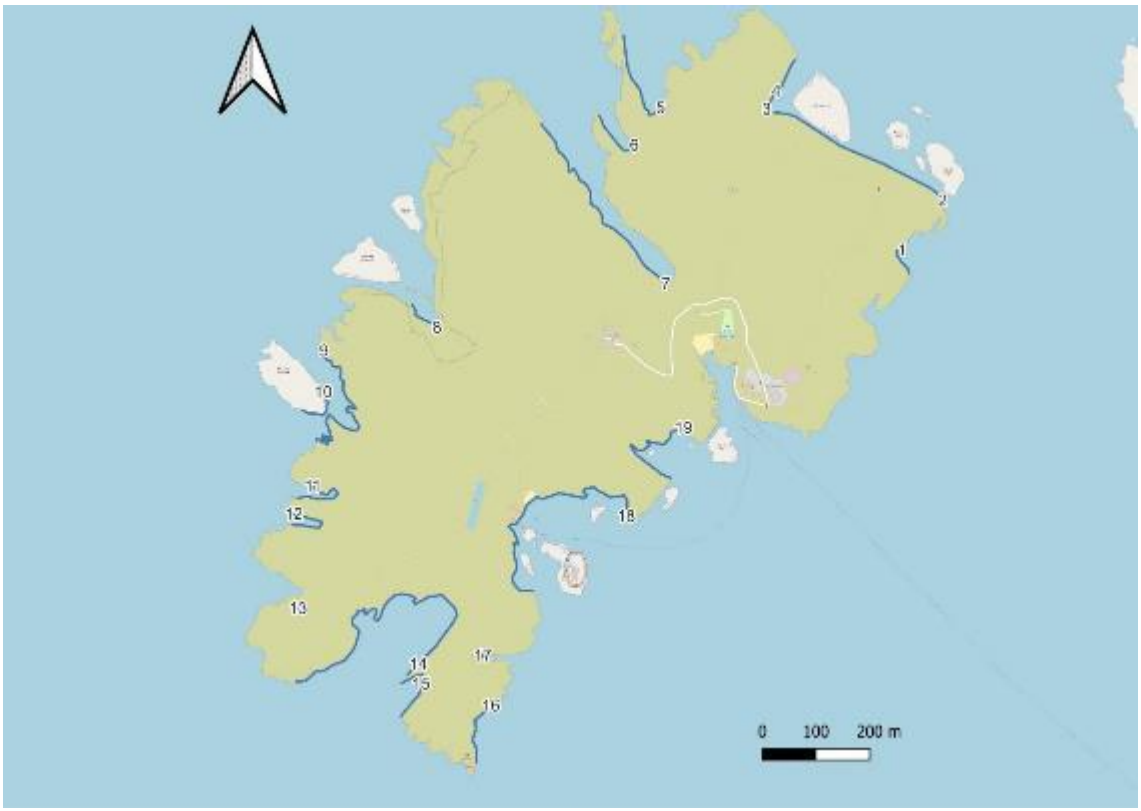

Figure 4 | Location of European Shag subcolonies on Berlenga Island. 1 - Forninho, 2 - Rio da Poveira, 3 - Gruta do Nicho, 4 - Carreiro Maldito, 5 - Cerro do Cão, 6 - Ponta Norte do Carreiro dos Cações, 7 - Carreiro dos Cações, 8 - Quebrada, 9 - Zona da Gruta das Pombas, 10 - Ilhéu dos Soldados, 11 - Carreiro do Zé da Carolina, 12 - Carreiro da Carolina do Sul, 13 - Gruta dos Olhos, 14 - Cova do Sono, 15 - Ouvido do Furado, 16 - Gruta dos Mosquitos/Relaxe, 17 - Furado Grande (gruta por cima da entrada), 18 - Carreiro da Fortaleza, 19 - Flandres.

Lesser Black-backed Gulls were counted along a transect covering the entire Berlenga Island, mostly taking advantage of the fieldwork team movements during the other tasks. Counts took place mostly during May and June. The number of pairs (pure or mixed with Yellow-legged Gull) was counted and the location was recorded.

Yellow-legged Gull counts were carried out on two consecutive days on Berlenga Island, begin around an hour and a half before sunset, when most birds have already returned to the colony. On one day, the birds present on the slopes of Berlenga were counted and on the other, those on the plateau. An annual count is carried out at the beginning of the breeding season. The dense flocks present are counted separately as the majority are made up of non-breeding and immature adults, who are driven away from nesting territories by nesting adults, agglomerating mainly on plateaus. Regarding the monitoring in Farilhões, counts were performed along the year when the field team had visited the islets for monitoring the other seabird species. Number of birds were recorded for each islet, and age assigned to each bird when possible. Counts of Yellow-legged gulls at the sea portion among the islets were also recorded.

Common Murre surveys were conducted simultaneously with European Shag surveys. Special attention was paid to historical reference sites, where the species used to breed.

2.2.2 Breeding productivity

Breeding productivity was monitored every year and assumed to reflect the number of chicks near fledging per number of active nests, for all species except Yellow-legged and Lesser Black-backed Gull.

Band-rumped Storm-petrel surveys took place during two to four times during breeding season, i.e. from October to March, depending on weather conditions in order to record the different breeding stages. Data was collected mostly from natural and artificial nests in Farilhão Grande, but also on Berlenga Island (at Capitão subcolony).

Cory's Shearwater surveys took place during 3 visits to Berlenga Island main subcolonies (Melreu, Capitão, Furado, Flandres and Quebradas) and the same plot used to monitor population size in Farilhão Grande. Three surveys were conducted in order to record the different stages of breeding season. The first one was done from June 5 to 10 (coincident with laying period), the second from July 24 to August 10 (coincident with hatching period) and the third from October 20 to November 3 (coincident with fledgling period).

European Shag monitoring took place during the surveys used to estimate population size.

Yellow-legged Gull surveys took place from just before egg laying (end of April) to early chick rearing phase (end of June) on Berlenga Island. Three plots 20x40m each are used in these surveys. One site is used to monitor the efficacy of egg culling, where eggs were destroyed as in the remaining accessible areas of the island. While the other two areas are kept undisturbed. Number of nests, eggs and chicks are counted during each survey. A full description of the methodology is available in Morais et al. (2024).

2.2.3 Individual survival rates

Mostly juveniles but also adult birds from all five species were ringed every year.

Band-rumped Storm-petrels were ringed with a metal ring and recaptured during mist-netting sessions described above to estimate population size or during the visits to the nests for breeding productivity monitoring.

Cory's Shearwater were ringed with a metal ring and recaptured while monitoring breeding productivity. Estimates of individual survival rates for these two species were based on sightings of individually ringed birds and are therefore, strictly speaking, return rates.

European Shag and **Yellow-legged Gull** were mostly ringed as juveniles in the nest or nesting areas during the late phase of chick rearing, respectively. Resightings at the colony were done along the entire year. We also collate resightings from areas outside Berlengas Archipelago, which were reported by volunteer observers along the entire year.

2.2.4 Occupancy of artificial nests

The first attempts to build artificial structures for **Band-rumped Storm-petrel** in Farilhão Grande took place in 1994-1995. By that time, a couple of rocky walls were raised first to keep the access trail to the lighthouse but also allowing storm-petrels to build their nests among those rocks. Those nests resulted in very limited access to the nesting chamber, preventing any monitoring of

the nest contents. Alternatively, in 2011 the first 20 artificial nests made of PVC plant pods were put in place. Later, 55 artificial nests following mostly this same model were added resulting in a total of 75 artificial nests built for storm-petrels in Farilhão Grande. On Berlenga Island, 21 artificial nests made of clay plant pods were set up in 2017.

Artificial nests for **Cory's Shearwater** were first build in 1989 on Berlenga Island. Since then, 227 artificial nests have been added, including the ones built under Life Berlengas. Also in Farilhão Grande, 30 artificial nests were set for Cory's Shearwater in 2019.

More details on the artificial nests built under Life Berlengas can be seen in Oliveira et al. (2018).

2.3 Results of breeding seabirds

The 2019-2024 estimates for each of the five breeding species in Berlengas Archipelago plus Common Murre are shown in Table A.1 of Annex A. Counts from previous years are also shown for comparison. A comparison between the year 1 of LIFE Berlengas (2014) and the end of the After-Life (2024), percentage change, is seen in Table A.2. Breeding success, individual survival and occupancy of artificial nests are shown in Table A.6, Table A.7 and Table A.9, respectively.

2.3.1 Band-rumped Storm-petrel *Hydrobates castro*

Mist-netting sessions in 2018 and 2022 did not occur due to bad weather conditions. Also, not every alive bird was captured each year, which had a bigger effect on the most recent estimates, resulting in very high standard errors. Thus, estimate for the last year of data (2023) is not presented (Figure 5). In 2021, the population of Band-rumped Storm-petrel in Farilhão Grande was estimated at 1904±467 individuals.

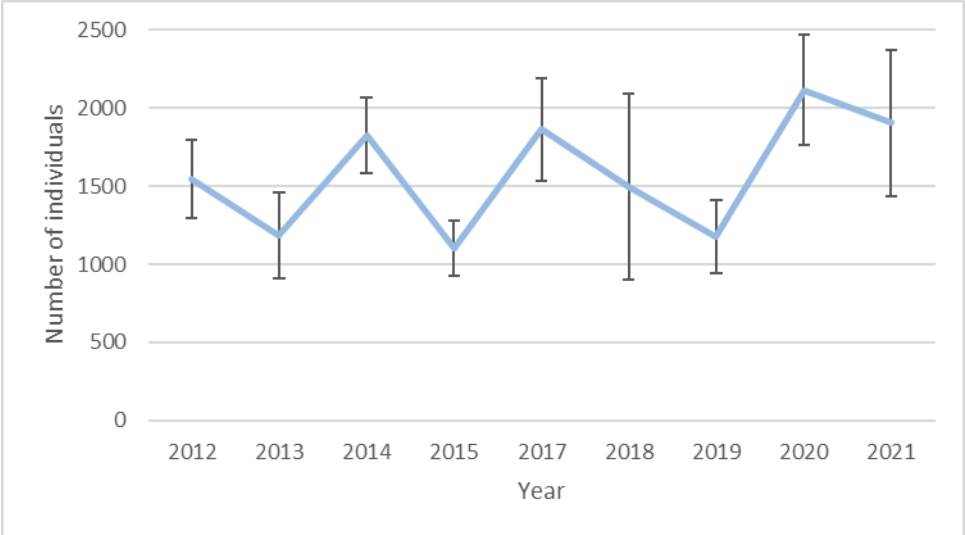

Figure 5 | Number of Band-rumped Storm-petrels (estimated individuals), Farilhão Grande, 2012-2021. Standard error of each estimate is also given.

Breeding productivity (0.77 chicks fledged per active nest) in 2023 was the highest of the time series (Figure 6).

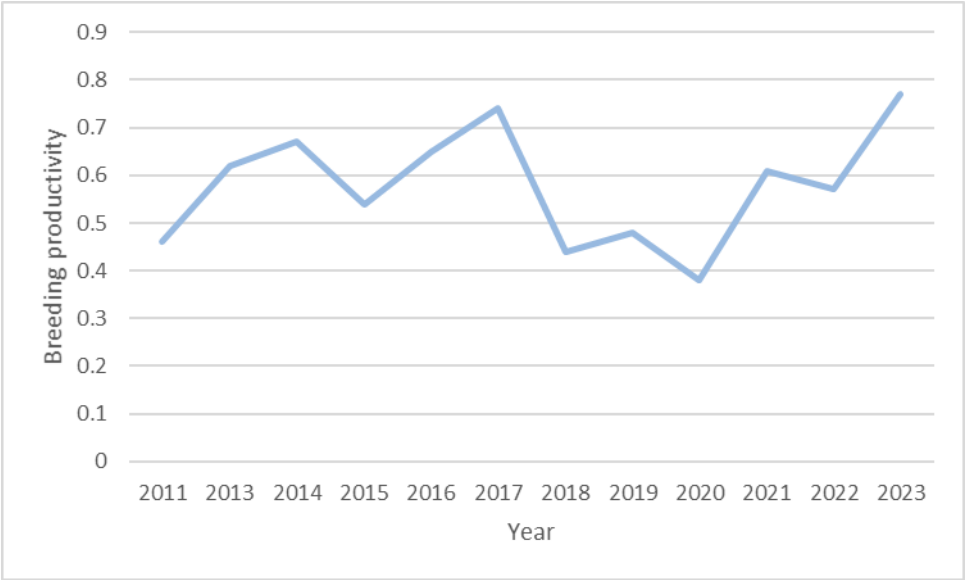

Figure 6 | Breeding productivity (number of chicks near fledging per number of active nests monitored) of Band-rumped Storm-petrels, Farilhão Grande, 2011-2023.

The adult survival for 2023 (0.80) was below average (time-series average considering homogenous survival and capture probabilities was 0.87±0.03; Figure 7). Not every adult alive was seen each year and thus adult survival (return rates) for 2023 need to be understand as minimum estimates.

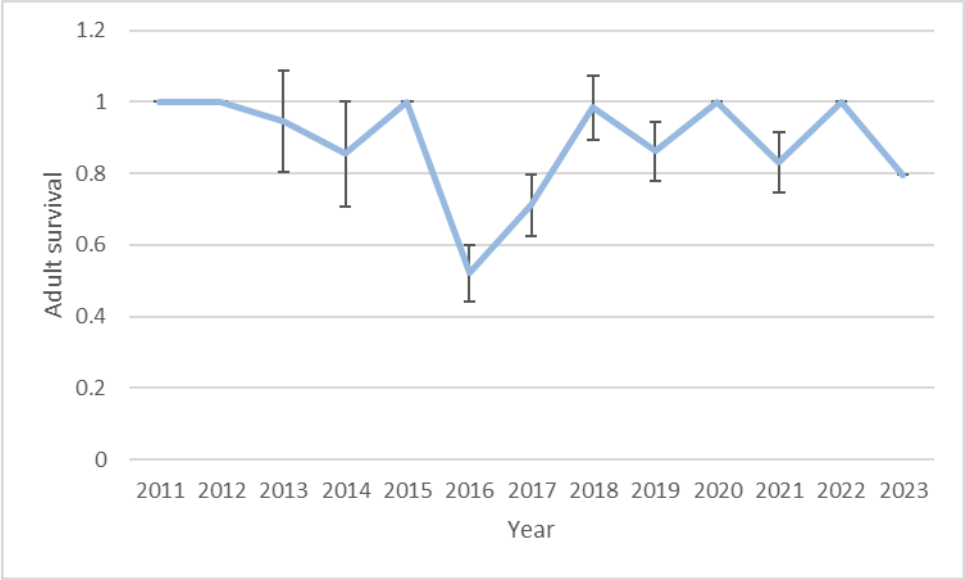

Figure 7 | Annual adult survival (return rates) of Band-rumped Storm-petrels, Farilhão Grande, 2011-2023. Standard error of each estimate is also given.

Occupancy of artificial nests in Farilhão Grande showed a near linear increasing since the installation of the first nests in 2011 (Figure 8). 2024 showed a new maximum with 35 nests occupied. On Berlenga (in Capitão site), the same two artificial nests were occupied until 2022, since then, only one nest has been occupied. Also in 2021, a breeding pair successfully raised a chick inside an artificial nest built for Cory's Shearwater in Furado subcolony.

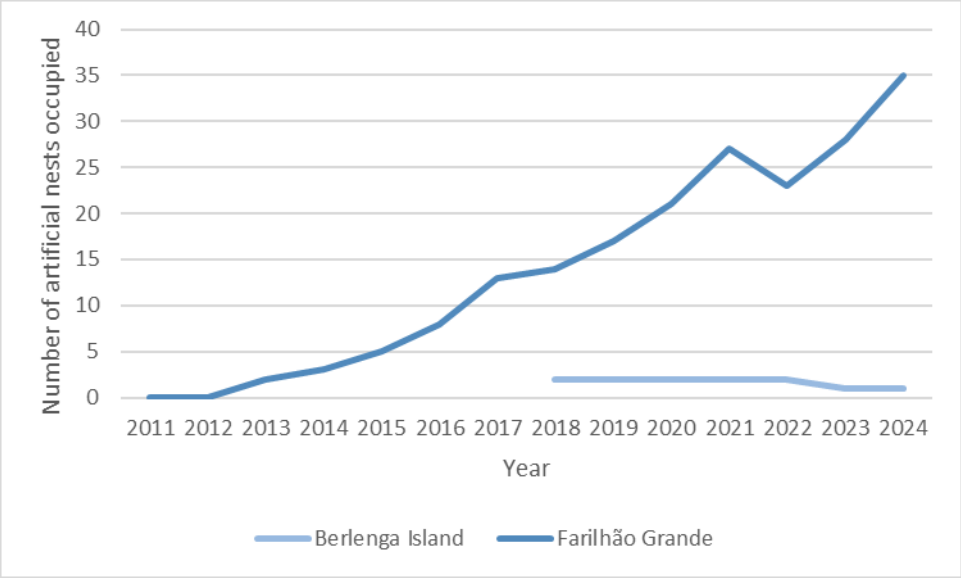

Figure 8 | Occupancy of artificial nests built for Band-rumped Storm-petrels, Berlengas Archipelago, 2011-2024.

2.3.2 Cory's Shearwater *Calonectris borealis*

In 2020, the population of Cory's Shearwater breeding in the Berlengas Archipelago was estimated at 550-800 breeding pairs. At the annual monitored subcolonies of Berlenga Island, the number of breeding pairs has increased along the time series (Figure 9). Conversely, the species showed a serious decreasing in Farilhão Grande along all archipelago censuses, which has not being depicted by the monitoring at the annual monitored subarea in Farilhão Grande.

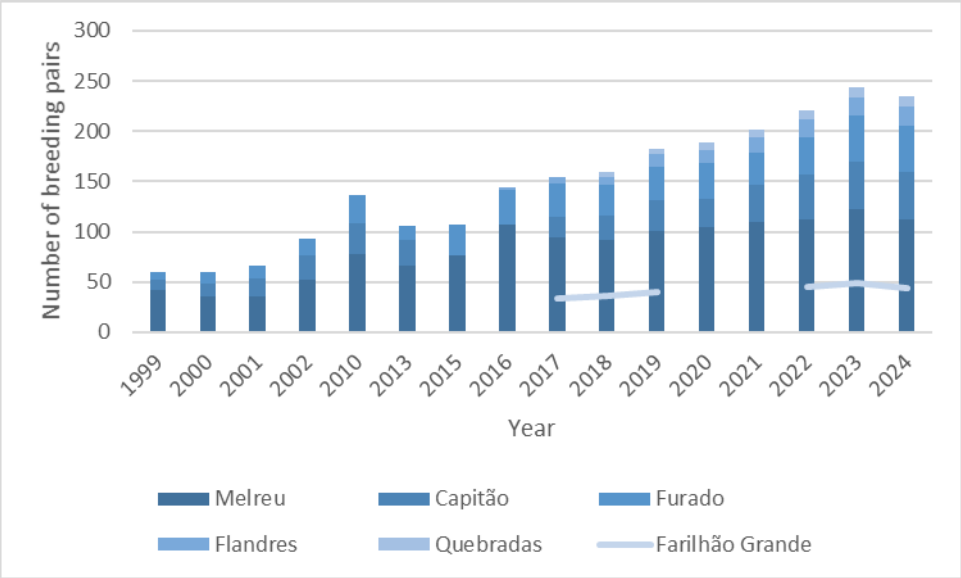

Figure 9 | Number of Cory's Shearwater (pairs) breeding in subcolonies of Berlenga Island and a subsample area of Farilhão Grande, 1999-2024.

Breeding productivity (0.79 and 0.52 chicks fledged per active nest on Berlenga Island and Farilhão Grande Islet, respectively) in 2024 was slightly below the values estimated for the previous years (Figure 10).

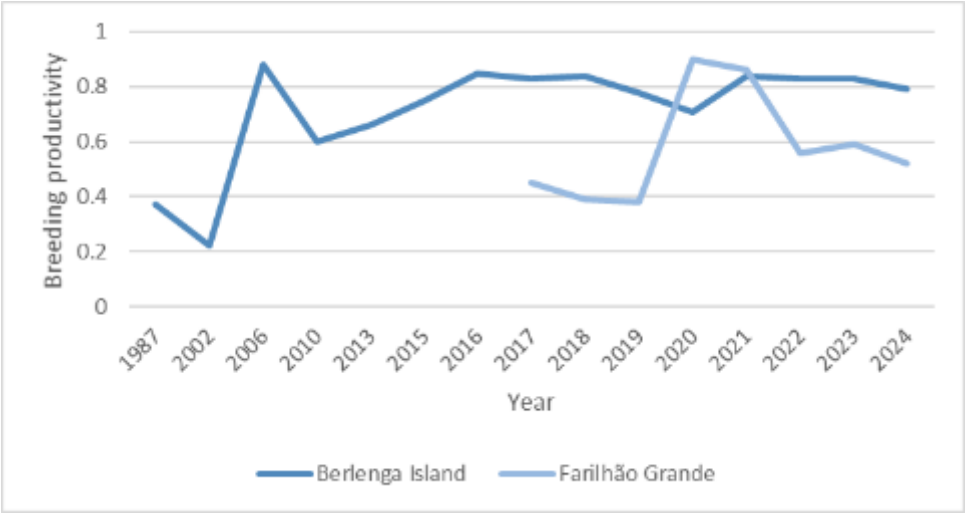

Figure 10 | Breeding productivity (number of chicks near fledging per number of active nests monitored) of Cory's Shearwater, Berlengas Archipelago, 1987-2024.

The adult survival for 2023 (0.76) was below average (time-series average considering homogenous survival and capture probabilities was 0.86±0.01; Figure 11). Not every adult alive was seen each year and thus adult survival (return rates) for 2023 need to be understand as minimum estimates.

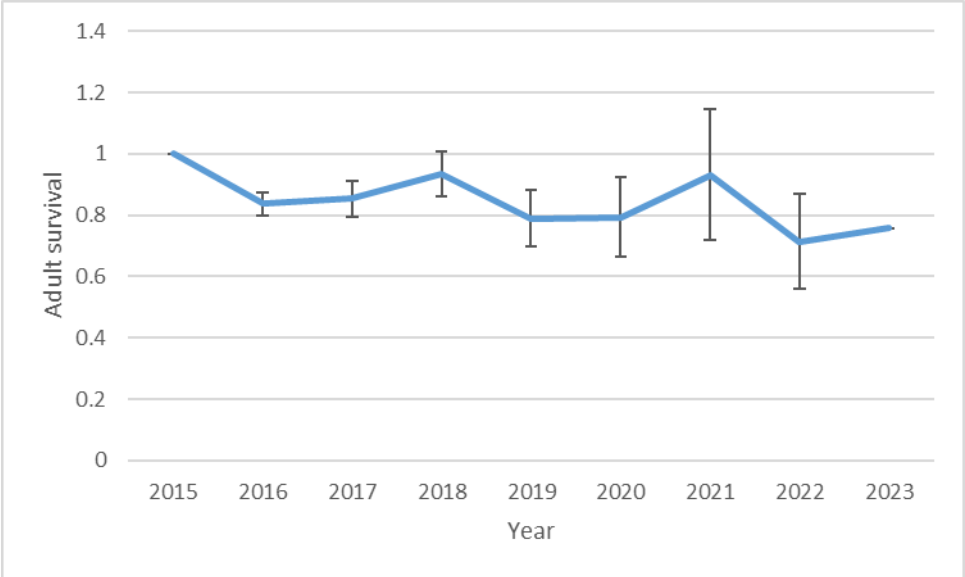

Figure 11 | Annual adult survival (return rates) of Cory's Shearwater, Berlenga Island, 2015-2023. Standard error of each estimate is also given.

Occupancy of artificial nests at both Berlenga Island and Farilhão Grande have shown a near linear increasing since the installation of the first nests in 1999 and 2018, respectively (Figure 12). In fact, artificial nests hold more than 70% of the population of Berlenga Island. 2024 showed a new maximum with 28 nests occupied in Farilhão Grande, but a slight reduction on Berlenga Island (182 nests) when compared with the previous year (188 nests). This year, 232 and 30 artificial nests built for Cory's Sheawater were available on Berlenga Island and Farilhão Grande, respectively.

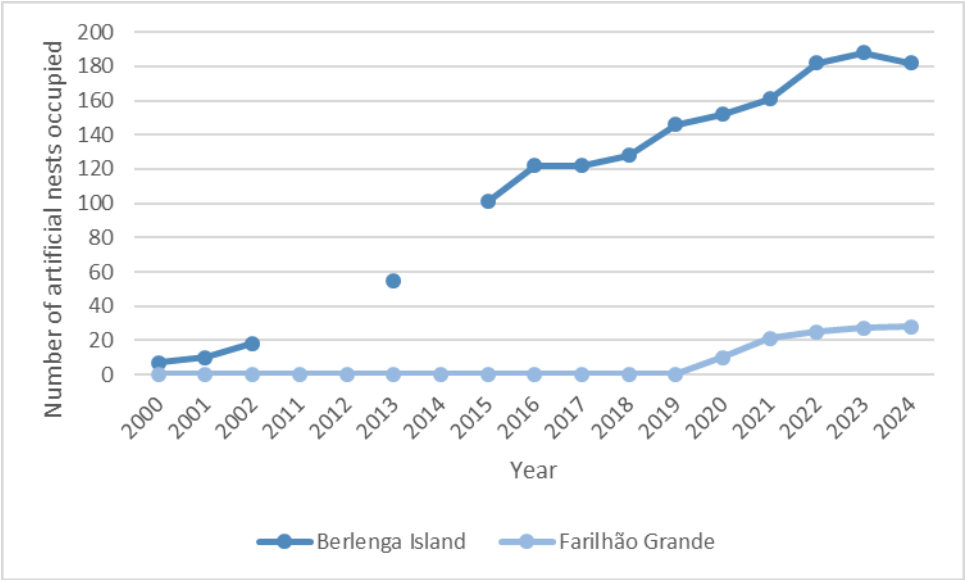

Figure 12 | Occupancy of artificial nests built for Cory's Shearwater, Berlengas Archipelago, 2000-2024.

2.3.3 European Shag *Gulosus aristotelis*

The number of pairs of European Shag breeding on Berlenga Island has shown several oscillations along the time series (Figure 13). However, the lowest ever count was made in 2024, when only 28 pairs were observed on the island.

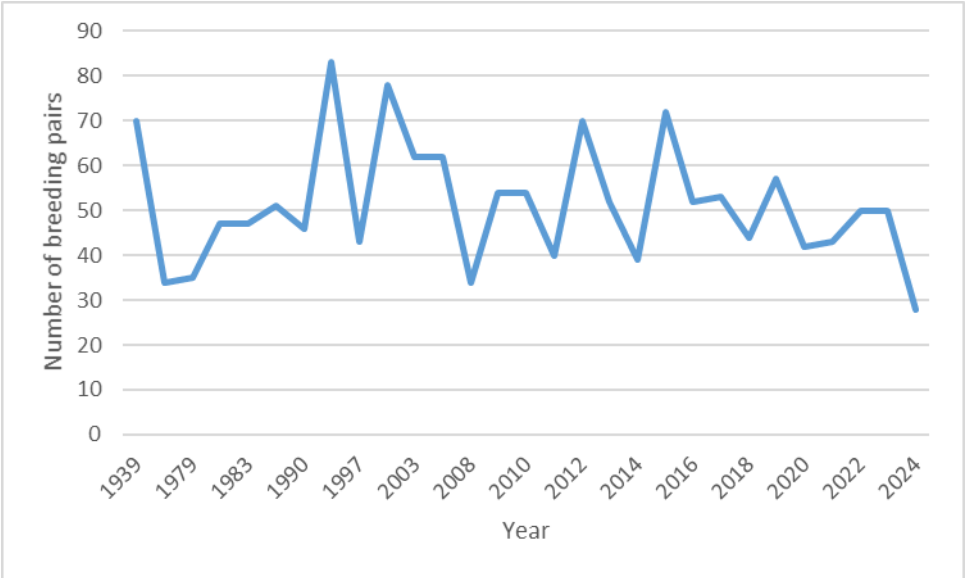

Figure 13 | Number of European Shag (pairs) breeding on Berlenga Island, 1939-2024.

Breeding productivity (0.82 chicks fledged per active nest) in 2024 was also the lowest estimated value ever (Figure 14).

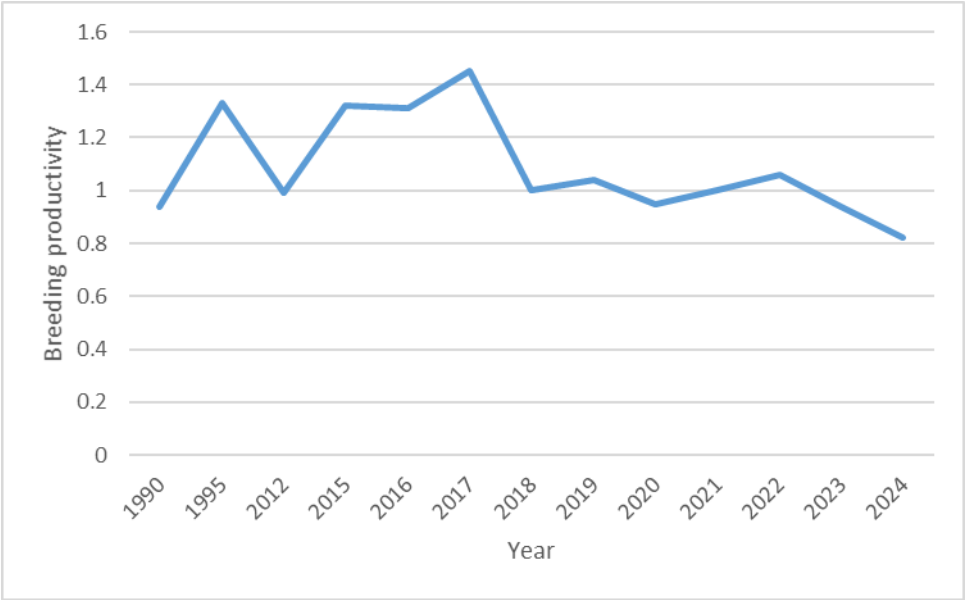

Figure 14 | Breeding productivity (number of chicks near fledging per number of active nests monitored) of European Shag, Berlenga Island, 1983-2024.

Survival rates were estimated for each age class (juvenile, 2 calendar year and adult) at 0.52±0.15, 0.99±0.007, 0.65±0.23, and were above average (time-series average considering homogenous survival and capture probabilities was 0.54±0.11). Not every adult alive was seen each year and thus adult survival (return rates) for 2023 need to be understand as minimum estimates.

2.3.4 Lesser Black-backed Gull *Larus fuscus*

The number of apparently occupied sites (AOS) of Lesser Black-backed Gull breeding on Berlenga Island has shown an increase along the time series (Figure 15). The numbers are still low though, with the most recent count at 10 AOS. No nests were found in other islets or rocks of Berlengas Archipelago.

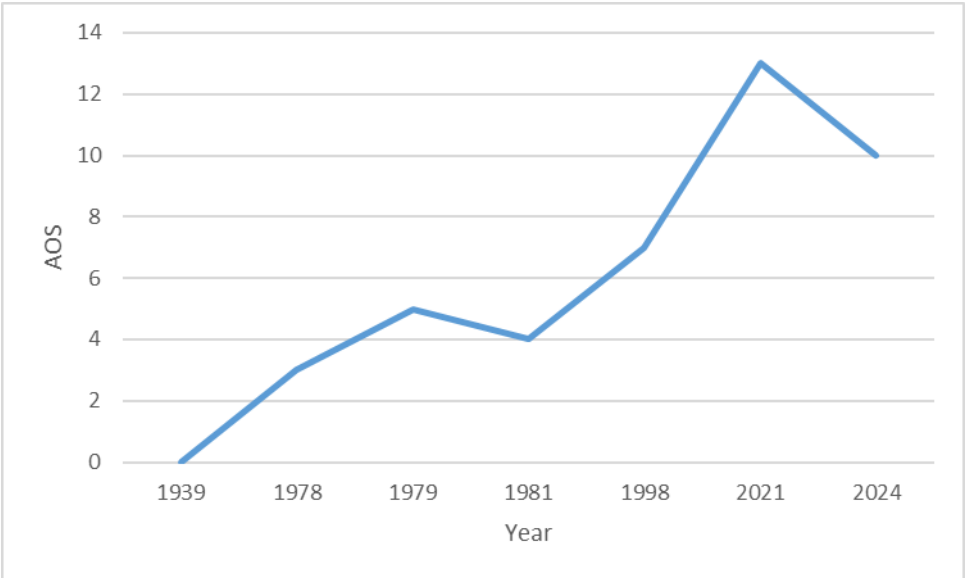

Figure 15 | Number of Lesser Black-backed Gull (AOS - apparently occupied sites) breeding on Berlenga Island, 1939-2024.

2.3.5 Yellow-legged Gull *Larus michahellis*

The number of Yellow-legged Gull adult breeders on Berlenga Island decreased along the time series (Figure 16). The lowest count was made in 2024, resulting in 3340 adult breeders.

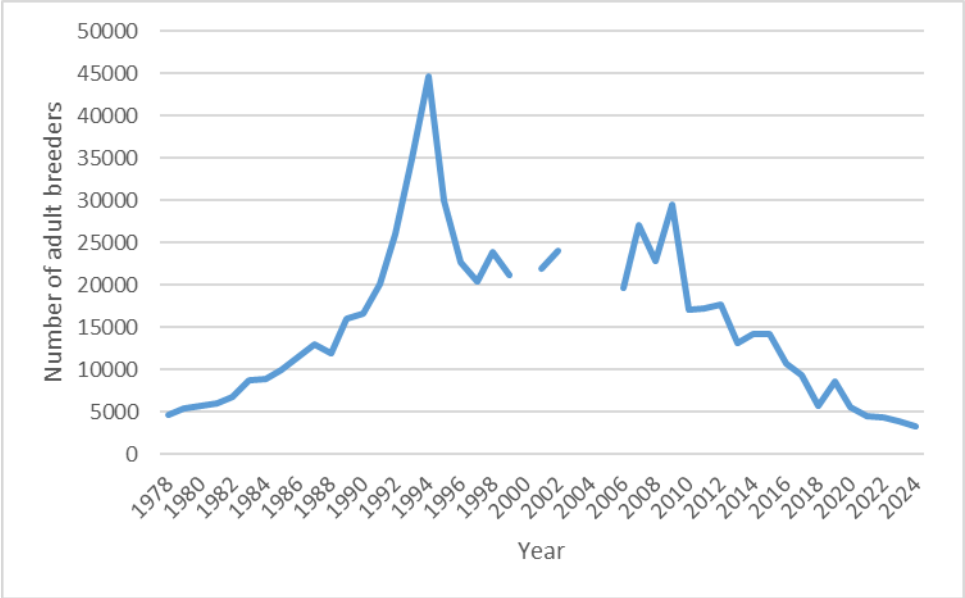

Figure 16 | Number of Yellow-legged Gull adult breeders counted on Berlenga Island, 1978-2024.

Regarding Farilhões Islets, the maximum number of adults was observed in November 2024, when 385 Yellow-legged Gulls were counted (Figure 17).

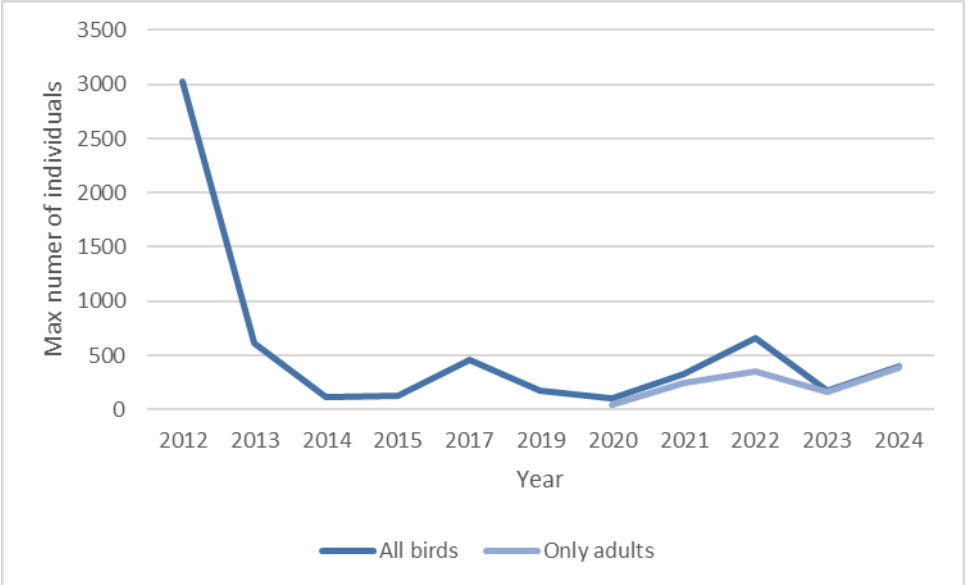

Figure 17 | Maximum number of Yellow-legged Gulls counted in Farilhões islets each year, 2012-2024.

In 2024, breeding productivity (0.91±0.13 nests with hatchlings per active nest) on Berlenga Island was the highest value of the time series (Figure 18).

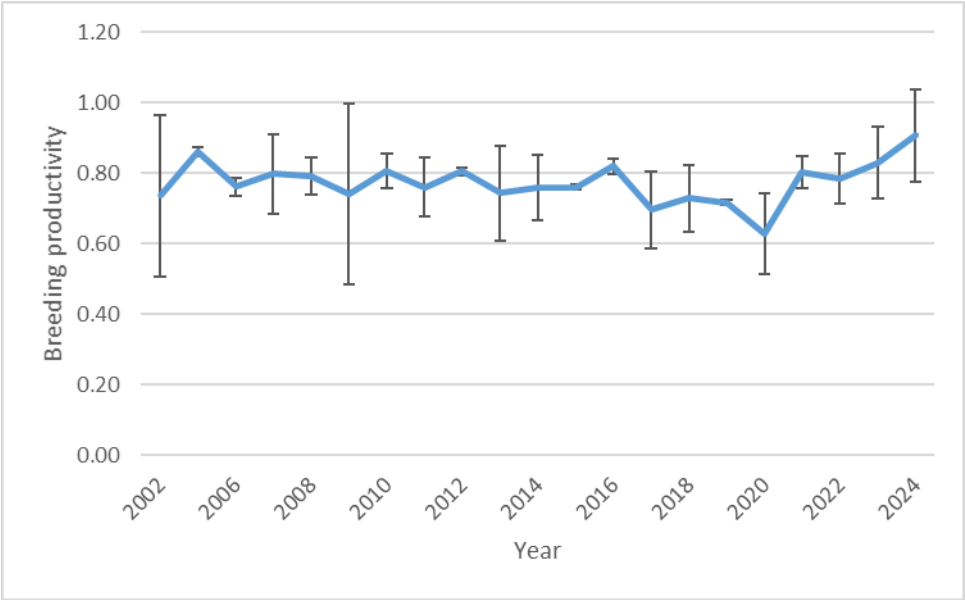

Figure 18 | Breeding productivity (number of nests with hatchlings per number of active nests monitored) of Yellow-legged Gull, Berlenga Island, 2002-2024. Error bars depicted the standard deviation of the estimates.

The juvenile survival for 2023 (0.18±0.10) was below average (time-series average considering homogenous survival and capture probabilities within age classes was 0.52±0.02; Figure 19). Survival rates of birds with two, three and more (considered as adults) years old were estimated at 0.75±0.04, 0.75±0.04 and 0.82±0.03, respectively. Not every adult alive was seen each year and thus juvenile survival for 2023 need to be understand as minimum estimates.

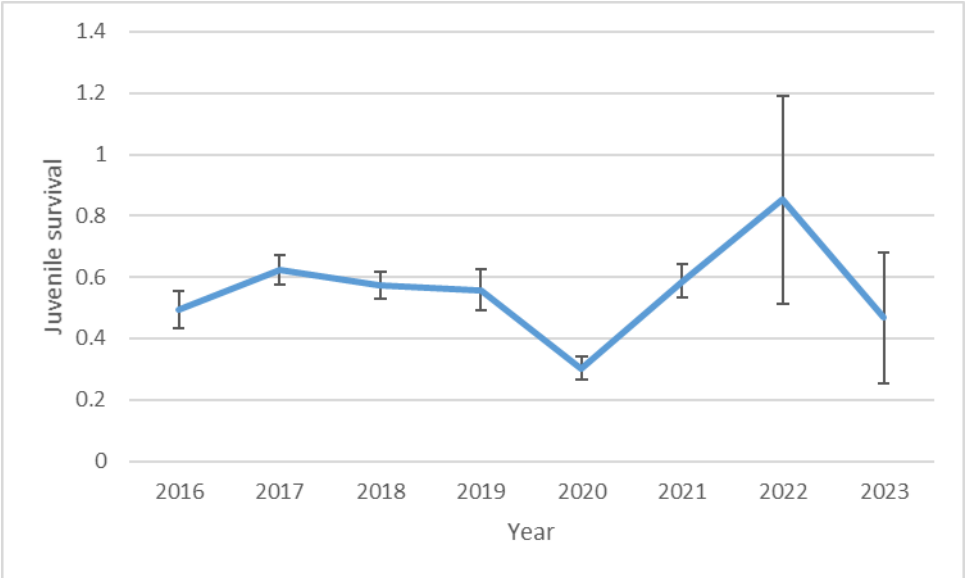

Figure 19 | Annual juvenile survival of Yellow-legged Gull born on Berlenga Island, 2016-2023. Standard error of each estimate is also given.

2.3.6 Common Murre *Uria aalge*

No attempts of breeding by the Common Murre have been observed during the last 10 years. However, observations of a single bird occurred almost every year. A bird was often seen among European Shag nests, in Ponta Norte do Carreiro dos Cações and Cerro do Cão.

2.4 Control of Yellow-legged Gulls breeding population

ICNF is in charge of the control of Yellow-legged Gulls breeding population on Berlenga Island. Following the plan to control the population size of Yellow-legged Gulls, which started in 1999, the annual egg culling campaigns took place from 2019 to 2024. The intervention takes place 3 times during the incubation phase, from early May to late June. In 2024, 7578 eggs were destroyed. Although, the linear decreasing of the population size, reaching recently the figures found back in the 1970', the breeding parameters in non-intervened areas are less variable.

2.5 Seabird bycatch and interactions with fisheries

2.5.1 Testing mitigation measures

SPEA was in charge of testing the mitigation measures. During 2019-2021, two mitigation measures to reduce seabird bycatch in commercial gillnets were tested. LED lights were tested during 72 fishing days by onboard observers, while a scary bird device was tested during 82 fishing days.
Regarding set longline targeting demersal species, a scary bird device was tested using onboard observers or logbooks during 75 fishing days.

2.5.2 Individual tracking of Cory's Shearwater

Individual tracking was led by MARE-University of Coimbra. From 2019 to 2024, 2185 foraging trips were obtained from the 273 GPS deployments on breeding Cory's Shearwater from Berlenga Island (Table 1).

Year	Period	Number of individuals	Number of trips
2019	May	17	
	August/September	35	400
2021	May	32	
	August/September	20	380
2022	May	21	
	August/September	10	320
2023	May	22	
	August/September	80	795
2024	May	23	
	August/September	13	290

Table 1 | Individual tracking of breeding Cory's Shearwater on Berlenga Island from 2019 to 2024.

2.6 Breeding and migrant land birds

2.6.1 Ringing surveys

SPEA was in charge of the ringing surveys with the support of ICNF. The results of the breeding and migrant land birds during 2017-2024 are shown in Table A.11 of Annex A. Overall, 20 different species were ringed. All Peregrine Falcons were ringed as chicks in the nest on Berlenga Island, except one nestling ringed in Farilhão do Nordeste in 2023. Two Zitting Cisticola juveniles during the first flights were ringed on Berlenga Island in 2021. All other species were caught in mist-nets during October-February on Berlenga Island.

2.6.2 Observations of non-breeding species

The full list of non-breeding species observed each year on Berlenga Island by SPEA team, 2016-2024, can be consulted in Annex B. Overall, 72 different species were observed. In 2024, 15 species were observed, representing the year with lower number of species mostly due to the low observation effort during autumn and winter.

2.7 Monitoring of biosecurity measures

SPEA was in charge of the biosecurity measures monitoring with the support of ICNF. After the removal of Black-rats and European Rabbits from Berlenga Island, two biosecurity measures were implemented in order to prevent and early detect the entrance of rodents on the island. Eight A24 ©GoodNature traps were set in the potential entries for rodents (the main pier at the Bairro dos Pescadores, the Fortaleza and the lighthouse; Figure 20). Plus 46 rat-boxes baited with peanut butter wax-blocks were set in the same areas. Monitoring of A24 traps was done 7 times per year, while the rat-boxes were monitored from April to October, when the field team was on Berlenga.

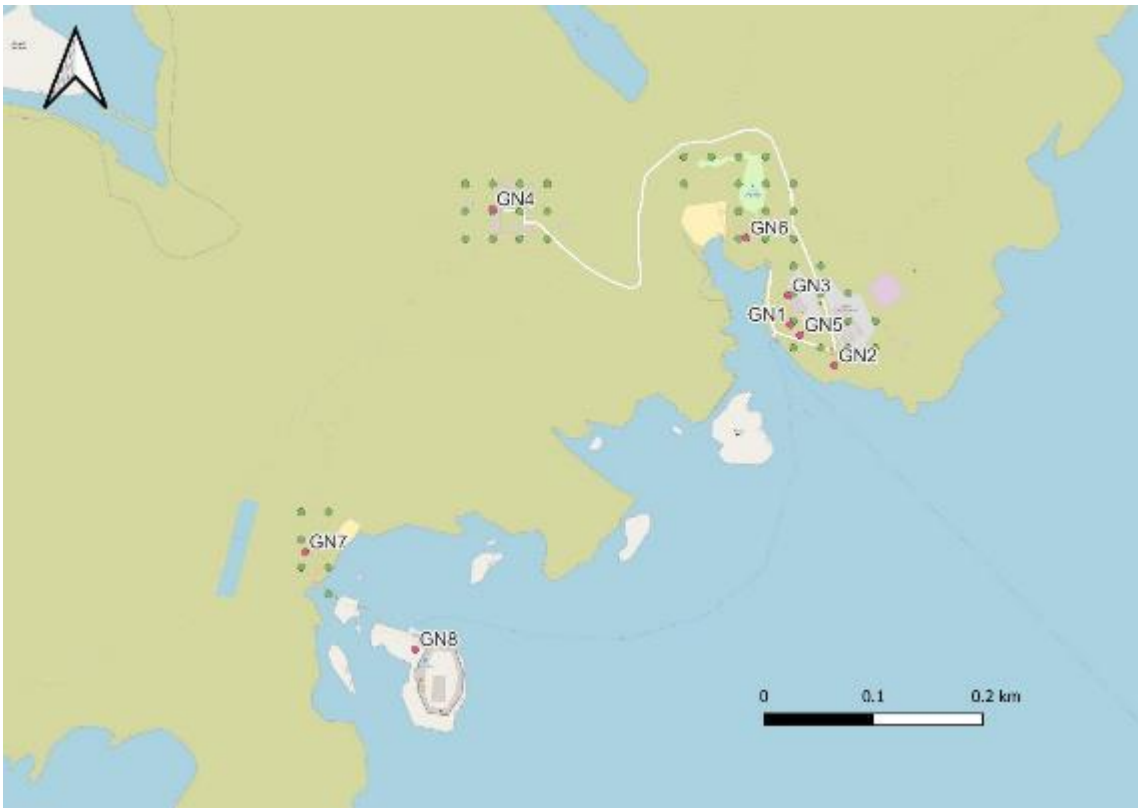

Figure 20 | Location of the A24 ©GoodNature traps (red dots) and rat-boxes (green dots) on Berlenga Island. GN1 - Casa do Cais, GN2 - Castelinho, GN3 - Restaurante, GN4 - Farol, GN5 - Abrigo dos Pescadores, GN6 - Escadas para a Praia, GN7 - Gruta na descida para o Forte, GN8 - Forte.

2.8 Results of biosecurity measures

2.8.1 Black-rat *Rattus rattus*

Overall, the A24 ©GoodNature traps were monitored 49 times in 2018-2024 (Table A.12 of Annex A). The traps were triggered 63 times but no signs of rodents were found in the traps and surroundings. All triggers were assigned to people, gulls and Berlengas Wall Lizard *Podarcis carbonelli berlengensis*. The rat-boxes were monitored 4-6 times each year, resulting in a total of 28 surveys during 2019-2024. No signs of rodents (baits) were observed in the wax-blocks, neither faeces or other signs of the presence of rodents inside the rat-boxes or surroundings. Apart from that, five alerts for the presence of rodents were made:

- July/2018 at the camping area and Ponta de França;
- May/2019 at Melreu;
- April/2021 at Bairro dos Pescadores;
- April/2024 at Melreu.

All alerts were given by local people or volunteers with little experience on rodent identification. In April 2024, a couple of mummified black-rats were found by the field team inside a Cory's Shearwater nest, but interpreted as remainings of the eradication. After each post-alert monitoring, no signs of rodents were recorded and alerts had been called out.

2.8.2 European Rabbit *Oryctolagus cuniculus*

An observation of relatively fresh faeces of European Rabbit was made in May 2024 by a ranger of ICNF. The sighting was made at the top of the cliff of Cerro do Cão. The biosecurity protocol was promptly activated. The site was baited with fresh vegetables and fruit and an automatic camera was set in place until November. No images of the rabbit were recorded. The survey will be kept in 2025, mostly after the spring, when wild plants would be dry and less available food would be present.

2.9 Monitoring of vegetation

2.9.1 To assess the removal of alien species

SPEA was in charge of the vegetation monitoring to assess the removal of alien species, with the support of ICNF. The main aim of this monitoring was to follow the evolution of the plant communities after the removal of Black-rats, European Rabbits and Hotentot Fig *Carpobrotus edulis*, that took place on Berlenga Island during LIFE Berlengas timeframe. Vegetation was monitored on Berlenga Island once a year (2016, 2018-2021, 2023, 2024), during April, where most of the plants presented flower structures, allowing the identification of most of the species. The same 75 plots of 2x2m were surveyed each year (Figure 21). 25 plots were set in a site after the removal of Hotentot Fig, 25 were set in site with a previous high density of Black-rats but with no Hotentot Fig and plus 25 plots were set in a site with low densitites of Black-rats and absence of Hotentot Fig. The cover percentage of each species was collected through visual observation at each plot, as well as the coverage of bare soil and rock.

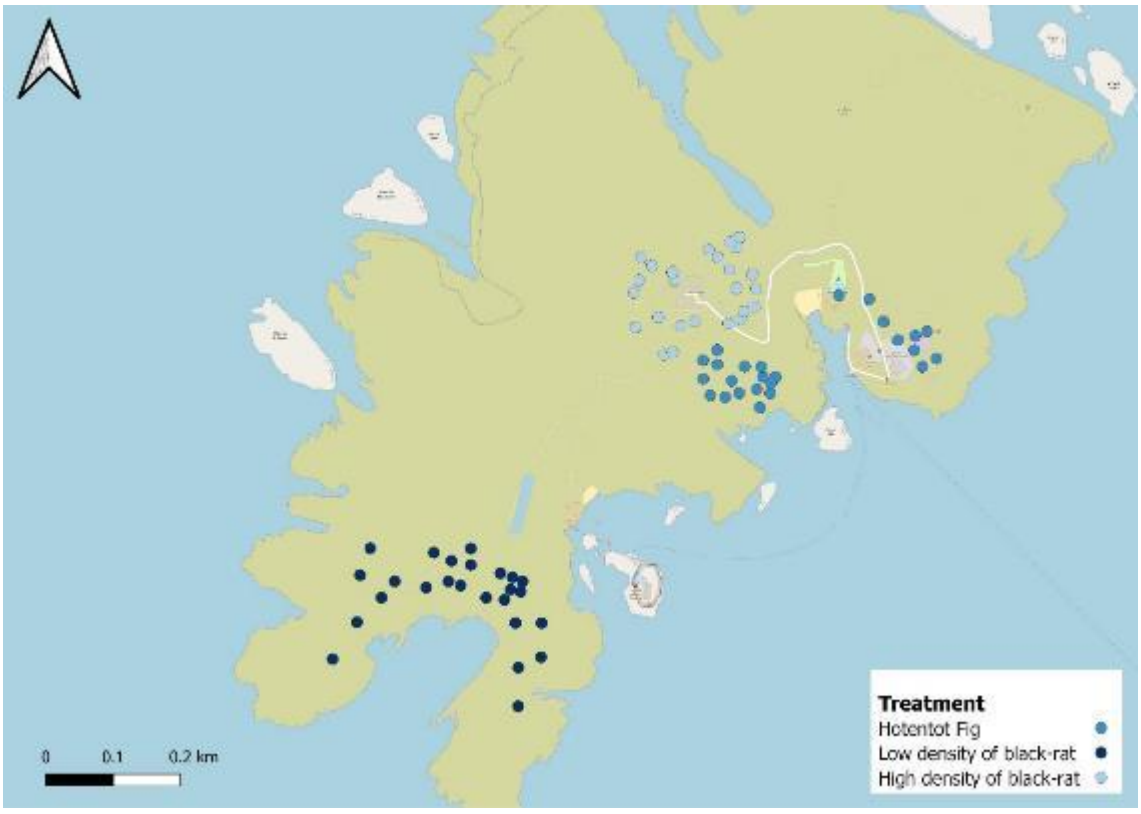

Figure 21 | Location of the plots to monitor native plants on Berlenga Island, 2018-2024.

2.9.2 To assess the exclusion of Yellow-legged Gulls

From 2019 to 2024, the study area was monitored annually in the spring following (Mouga et al. 2021), except in 2023 when the collected data was accidentally lost. This monitoring was led by ICNF with the full support from ESTM.

In 2015, a study area was defined in *Vale das Armérias* on Berlenga Island. The area was divided into 4 subareas, each consisting of three 10 x 10 m squares. In two of these subareas, which we called "exclusion areas", one with individuals of *Armeria berlengensis* (A1, A2 and A3) (**AS**) and the other without any individuals of *Armeria berlengensis* (B1, B2 and B3), (**NAS**) structures were installed consisting of steel poles and a nylon line, set up to prevent the approach of Yellow-legged Gulls (Figure 24). Each pole was placed along the sides of each square, with a uniform spacing of 1 m. The nylon lines were placed parallel to each other, pole by pole, approximately 1 m high. In total, 190 poles were used in the exclusion zones. The remaining subareas, one with growth of *Armeria berlengensis* (A4, A5 and A6) (**ANS**) and another without individuals of *Armeria berlengensis* (B4, B5 and B6) (**NANS**), were used as a control, so no structures were placed, allowing free access for Yellow-legged Gulls. Despite the placement of the structures, some gulls managed to place their nest at the edge of the area, over the largest individuals of *Armeria berlengensis*, within one of the exclusion areas.

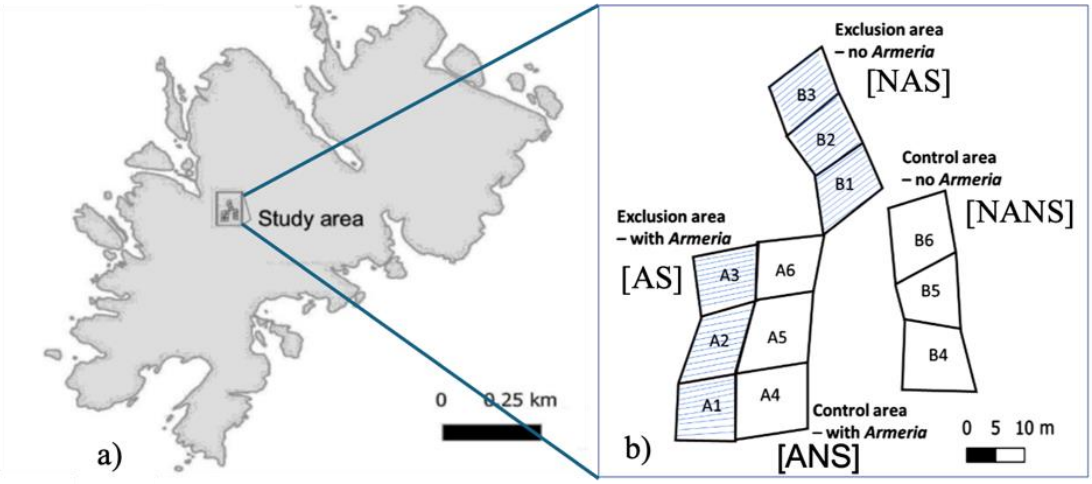

Figure 24 | Location of the area for exclusion of Yellow-legged Gull on Berlenga Island : "structure + Armeria" A(1-3): exclusion area with growth of *Armeria berlengensis*; 'no structure + Armeria' A(4-6): no structures installed with growth of *Armeria berlengensis*; 'structure + no Armeria' B(1-3) exclusion area without any *Armeria berlengensis*; 'no structure + no Armeria' B(4-6): no structures installed in an area without any *Armeria berlengensis*.

Between 2015 and 2024 (except in 2023), species presence and cover were assessed in spring, when most species grow and flower. A 2 x 2 m square was defined, in the centre of each 10 x 10 m square, where each species present was identified, and the total number of species and the percentage of surface covered by species, per square, were recorded. During this period, all *Armeria berlengensis* individuals present in the subareas were also counted and measured, in both diameter and height.

2.10 Results of vegetation

2.10.1 To assess the removal of alien species

The results of the vegetation monitoring during 2016-2024 are shown in Table C.1 of Annex C. Overall, 98 different species or groups of species were observed. In 2024, it was observed the highest plant diversity with 80 species. Also, the percentage of bare soil or rocks was decreasing over the years in those areas where Hotentot Fig was removed and where the density of Blacks-rats was higher before eradication (Figure 22).

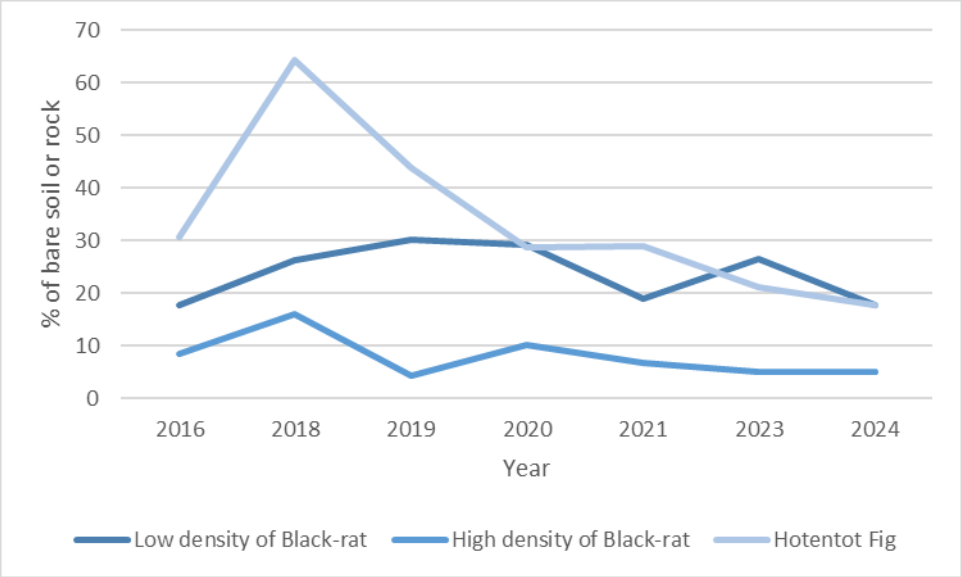

Figure 22 | Evolution of percentage of bare soil or rocks coverage measured in the plots to monitor native plants on Berlenga Island, 2016-2024. Plots were grouped in 3 treatments, area where Hotentot Fig was removed, area with low density of Black-rats before eradication and area with high density of Black-rats before eradication.

Figure 23 | Illustration of the flora development from 2014 (left photo and before Hotentot Fig removal), towards 2019 (in the centre) and 2024 (in the right).

2.10.2 To assess the exclusion of Yellow-legged Gulls

The list of the most abundant species found in the exclusion area are presented in the Table C.2 of Annex C.

The Berlenga plateau is characterized by the dispersion of granite fragments, the result of human activity and natural weathering of the rocks. This environment supports early successional species such as *Plantago coronopus* in areas of thin, compact soil. This environment is characteristic of *Armeria berlengensis*, whose root system is well adapted to the interstitial spaces of the rock, allowing it to grow on rocky outcrops, cliffs and gravel pits. Other rupicolous species, such as

Spergularia rupicola, are also adapted to these habitats, where soil is scarce and salinity is predominant. As soil accumulation increases over time, early successional species are gradually replaced by larger, more generalist species. These include species adapted to dry, sandy habitats, such as *Polycarpon alsinifolium*, *Silene scabriflora* and *Lagurus ovatus*. *Lobularia maritima*, a halophyte, is common in these dry lands, while in areas with sufficient soil accumulation, species such as *Echium rosulatum davaei* and *Calendula suffruticosa algarbiensis* can be found.

The two other endemic (sub)species of Berlengas, *Pulicaria microcephala* and *Herniaria lusitanica berlengiana*, have never been observed in the study area. *Pulicaria microcephala* typically grows in thicker, nitrophilic soils, while *Herniaria lusitanica berlengiana* can only be observed in undisturbed, thinner soils.

Significant differences in species coverage were observed between exclusion zones. As expected, *Armeria berlengensis* was significantly more abundant in AS, and also occurred in the ANS control zone. However, the species remains almost non-existent in areas where it was initially absent, including NAS and NANS (Table C.3 of Annex C). This indicates that exclusion zones played little or no role in the reestablishment of *Armeria berlengensis* in areas where it was previously absent. It is also worth noting (Table C.3 of Annex C) the percentage of bare land - areas where there was no vegetation - due to rocky substrate or insufficient soil. In the AS zone, more than 40% of the area was devoid of vegetation, while the ANS zone had 27%, the NAS 12% and the NANS less than 7%. These values are in accordance with the type of vegetation existing in each zone, with rupicolous species that grow in fissures and thin soils predominating in the AN and ANS zones, while in the NAS and NANS zones nitrophilous species predominate, which require thicker soils rich in nutrients.

The coverage of *Armeria berlengensis*, however, increased, although without statistically significant differences, from 1.50% ± 2.84% in 2016 to 4.67% ± 11.40% in 2024 (Table C.4 of Annex C). Although this growth is slow, it marks the first observable sign of recovery for this species in more than two decades. Conservation efforts, including the removal of invasive herbivores, are crucial to supporting the recruitment of new *Armeria berlengensis* plants, which will hopefully grow into adult shrubs.

The exclusion of invasive herbivores also led to a substantial increase in Poaceae (grass) cover, which rose from approximately 9% to 63% during the study period. This is in line with findings from other island ecosystems, where reduced grazing pressure has resulted in dramatic increases in plant cover, although non-native species are often those that benefit most from these changes. Finally, a significant decline over time was observed in ruderal species such as *Atriplex prostrata*, *Mercurialis ambigua*, *Urtica membranecea* and *Erodium cicutarium*. This decrease in the presence of ruderal species, together with the significant increase in vegetation cover over time - bare land went from 36% to around 9%, even where mainly Poaceae have been present - suggesting that soil conditions might be gradually improving, potentially facilitating the recovery of Berlenga's native rupicolous vegetation.

2.11 Control of Hotentot Fig *Carpobrotus edulis*

SPEA was leading the control of Hotentot Fig with the support of ICNF. The areas from where Hotentot Fig was removed during the LIFE Berlengas (~90% of the area occupied) were periodically prospected for new germinations and resprouts. All Hotentot Fig plants were manually removed. In average, 466 person*hours per year were used along the last 5 years (2020-2024) to keep the intervention areas free of Hotentot Fig (Figure 24).

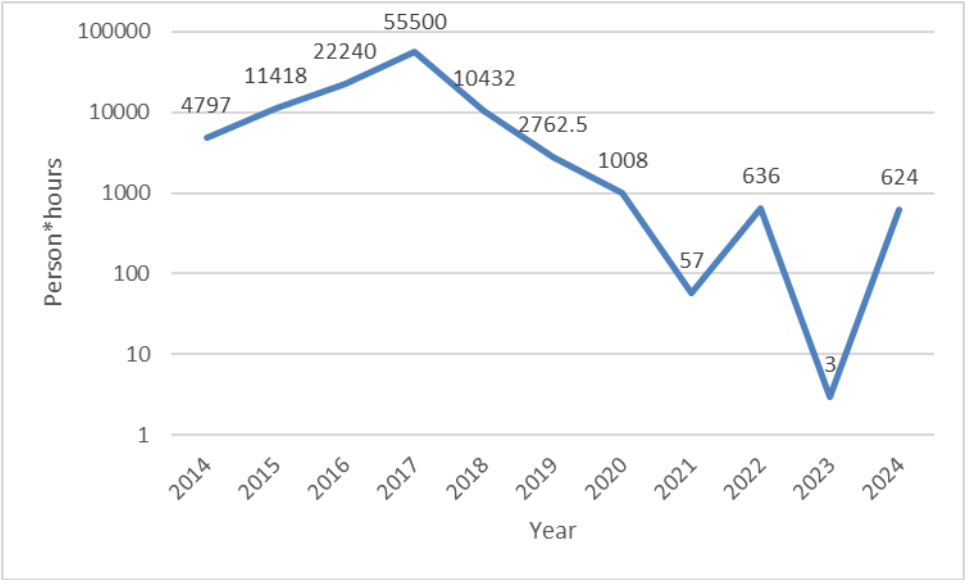

Figure 24 | Effort (as person*hours) applied on Berlenga Island to control Hotentot, 2014-2024. Person*hours is presented in logarithm scale to ease the plot visualization.

3. RESEARCH

3.1. Scientific publications

Nascimento, T., N. Oliveira, A. I. Fagundes, C. T. Baena, A. Luís, 2019. Diet selection of introduced black rats *Rattus rattus* L. in relation to plant availability on Berlenga Island, Portugal. Ecologia mediterranea 45: 15-29.

Homes, N. D., D. R. Spatz, S. Oppel, B. Tershy, D. A. Croll, B. Keitt, P. Genovesi, et al., 2019. Globally important islands where eradicating invasive mammals will benefit highly threatened vertebrates. PLoS One 14(3): e0212128.

Oliveira, N., P. Abreu, J. Bores, A. I. Fagundes, H. Alonso, J. Andrade, 2020. Evaluating the potential of artificial nests as a conservation measure for Cory's Shearwaters *Calonectris borealis* breeding in Berlengas Archipelago, Portugal. Airo 27: 1-19.

Carreiro, A. R., V. H. Paiva, R. Medeiros, K. A. Franklin, N. Oliveira, A. I. Fagundes, J. A. Ramos, 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.

Oliveira, N., A. Almeida, H. Alonso, E. Constantino, A. Ferreira, I. Gutiérrez, A. Santos, E. Silva, J. Andrade, 2021. A contribution to reducing bycatch in a high priority area for seabird conservation in Portugal. Bird Conservation International 31(4): 553-572.

Calado, J. G., J. A. Ramos, A. Almeida, N. Oliveira, V. H. Paiva, 2021. Seabird-fishery interactions and bycatch at multiple gears in the Atlantic Iberian coast. Ocean & Coastal Management 200: 105306

Mouga, T. S. Mendes, I. Franco, A. I. Fagundes, N. Oliveira, P. Crisóstomo, L. Morais, C. Afonso, 2021. Recent Efforts to Recover *Armeria berlengensis*, an Endemic Species from Berlengas Archipelago, Portugal. Plants 10(3): 498.

Nascimento, T., N. Oliveira, A. Luís, 2021. Hey, That's My Fish–Overlap in Prey Composition between European Shag and Local Fisheries in Portugal. Ardea 109 (1): 77-90.

Nunes, S. F., M. Mota-Ferreira, M. Sampaio, J. Andrade, N. Oliveira, R. Rebelo, R. Rocha, 2022. Trophic niche changes associated with the eradication of invasive mammals in an insular lizard: an assessment using isotopes. Current Zoology 68(2): 211-219.

Bastos, R., B. Martins, J.A. Ramos, V.H. Paiva, J. Pereira, F.R. Ceia, C. Gouveia, I. Rodrigues, M. Santos, J.A. Cabral, 2022. Shearwaters' nest attendance patterns throughout the lunar cycle: Are oceanographic conditions decisive for timing of nest arrival? Journal of Experimental Marine Biology and Ecology 549: 151698.

Nascimento, T., N. Oliveira, A. Luis, 2023. Spatial overlap between the European Shag and commercial fisheries in a special protected area: implications for conservation. Fisheries Research 263: 106689.

Oliveira, N., H. Alonso, V. Encarnação, D. Menezes, M. Magalhães, G. Carreira, S. Heber, R. Pimentel, V. Medeiros, J. Bairos, P. Raposo, R. Coelho, R. Rufino, R. Neves, T. Nascimento, E. Silva, J. Andrade, 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., P. Abreu, H. Alonso, A. I. Fagundes, A. Macq, P. L. Geraldes, J. Andrade, 2023. The Effect of Environmental Conditions on Captures, Survival and Breeding Success of a Winter-Breeding Seabird. Ardea 111 (2): 487-500.

Almeida, A., H. Alonso, N. Oliveira, E. Silva, J. Andrade, 2023. Using a visual deterrent to reduce seabird interactions with gillnets. Biological Conservation 285: 110236.

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Mouga, T., P. Crisóstomo, E. Mourato, L. Morais, 2025. Long-term Vegetation Recovery on Berlenga Island Following Conservation Measures. 5th International Conference on Water Energy Food and Sustainability - ICoWEFS 2025: 10pp.

4. VOLUNTEERS AND SUPPORT

Volunteers were mostly helping during field work. Also some undergraduate and Master students were contributing to data analysis and reporting. During 2019-2024, 71 volunteers were involved in Berlengas work. From those, 8 were helping in 2024.

Regarding projects and sources of funding, 4 projects were used to secure the after-LIFE tasks, namely LIFE Volunteer Escapes (LIFE17 ESC/PT/003), MedAves Pesca (MAR-01.04.02-FEAMP-0023), Anzol+ (MAR-01.03.02-FEAMP-0026) and LIFE SeaBiL (LIFE20 GIE/FR/000114). A collaboration was set with University of Barcelona in the framework of the project SEAGHOSTS -

Winged ghosts wandering the oceans: the global spatial ecology and conservation of the world's smallest and elusive seabirds, the storm petrel (Hydrobatidae & Oceanitidae), across the Mediterranean and the NE Atlantic Ocean.

5. VISITATION & AWARENESS ACTIVITIES

5.1 Monitoring annual visitation

From 2019 to 2021, ICNF performed the counting of visitors to Berlenga Island. From 2022 onwards, those counts were not possible to carry. However, the Human Carrying Capacity of the of Berlenga Island came into force in June 2022, implemented through the Berlenga Island access platform – BerlengasPass - in which every visitor must register and obtain an access ticket to the island. Although it is known that not all visitors registered there, the majority did so. In 2023, 77586 access titles were issued. In 2024, until October 9, 70686 access titles were issued.

In 2021 and 2022, FCSH carried out weekly monitoring in August, counting landings and surveys, building a visitor satisfaction barometer (Figures 25 and 26).

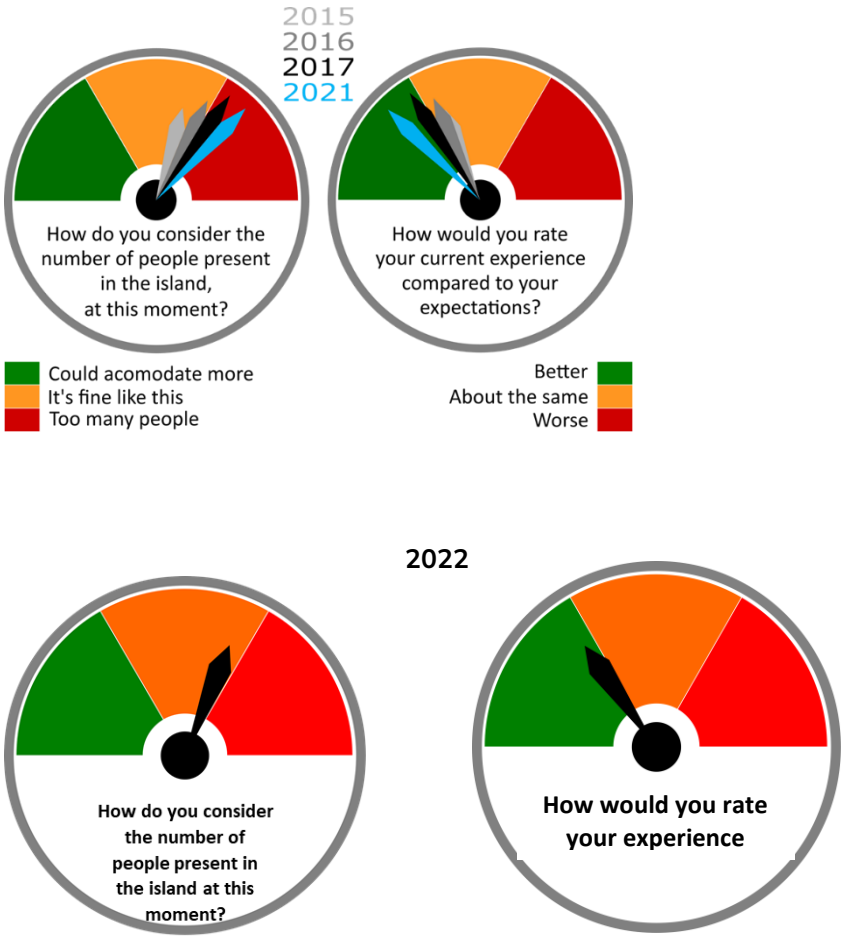

Figure 25 | Results of the application of questionnaires to visitants, visitor satisfaction barometer, during the years of the Life Project and after (2021-2022)

The number of visitors to the island, based on sampling, in 2021 was between 50,000 to 58,000. In 2022 the number increased to 65 000 to 70 000.

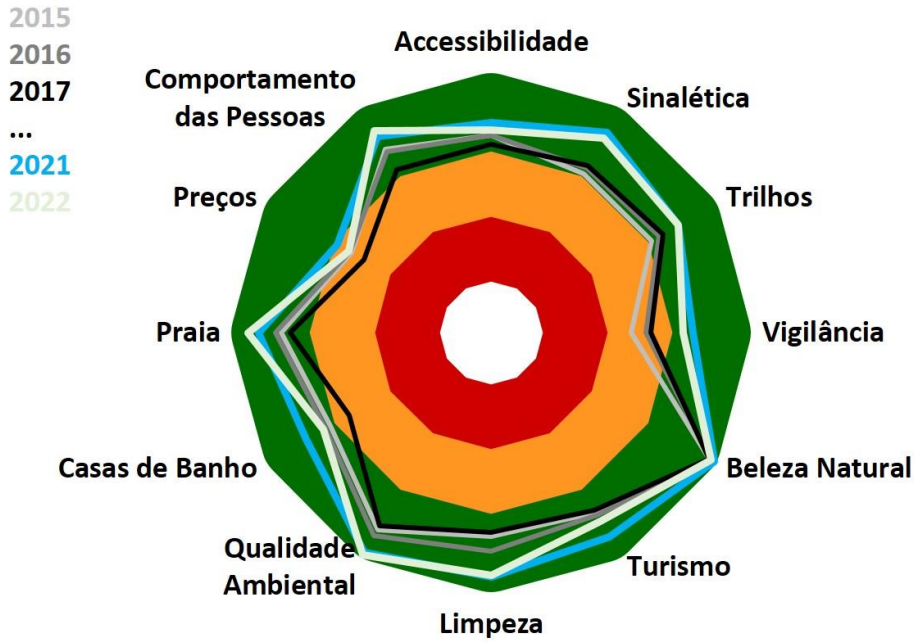

Figure 26 | Visitor satisfaction barometer, during the years of the Life Project and after (2021-2022)

5.2 Awareness activities

The webcam used to broadcast images of nesting seabirds was kept active. Mostly the camera was moved from a Cory's Shearwater artificial nest located in Melreu colony to a Band-rumped Storm-petrel artificial nest located in Capitão colony, on Berlenga Island. The webcam was connected during the entire breeding season, i.e. June to October for Cory's Shearwater and October to February for Band-rumped Storm-petrel.

Several awareness actions were carried out by RNB rangers (ICNF) to visitors in 2019. Later in 2022 and 2023, awareness by rangers was raised for visitors, regarding the Human Carrying Capacity and the need to have access to Berlenga Island.

Awareness activities for fishermen were performed by SPEA. In 2019, two actions took place during the commemorations of the National Maritime Day, with the presence of 160 fishermen. Two interactive kiosks were set at the headquarters of the fishing associations based at the Peniche fishing harbour. In 2021, a photography exhibition “Fishermen and seabirds, allies for a sustainable sea” was opened at the Peniche fish auction market – Docapesca. Also this year, a presentation on the results of the seabird mitigation trials were showed at the closing event of MedAves Pesca in Peniche fishing harbour. Several outputs (factsheets, reports and infographics). were made available on the SPE website.

Other awareness activities included:

- Interview and image recording from WPL innovation to produce a small documentary under the framework of the project "Reservas da Biosfera: territórios sustentáveis, comunidades resilientes" (https://www.rtp.pt/play/p12812/e795846/reservas-da-biosfera-portugal) (2023).
- Interview to the Peniche newspaper "A Voz do Mar" promoted by Francisco Félix (2023).
- Visit of a French delegation to Berlengas. The aim was to observe on the ground the operation of the scaring bird device as a mitigation measure to reduce seabird bycatch by local fisheries. Also the results of conservation measures in land were presented (2024).
- Visit of a group of students from Faculty of Sciences of the University of Lisbon to Berlenga Island (2024).

5.3 Training for tour operators

In 2019, ICNF carried out two sessions for training tour operators in April. Despite no other training sessions were offered after that, the operators in place were mostly the same ones who have received training in 2019.

5.4 Environmental education

In 2019, two training sessions for teachers led by SPEA had 26 participants. Participation in events for the general public and children took also place, namely the Pumpkin Party (May) and the Greenfest (October). In 2021, Children's Day Webinar counted with 40 participants. A training course for teachers was held online (July), under Birds and Environmental Education practival activities of SPEA (30 participants). In 2022, took place the participation in the environment week at Dinoparque, Lourinhã (March). In 2024, an online training session for teachers (December), named “From the islands to the classroom. Berlenga: a living laboratory to explore island biodiversity” was attended by 10 participants.

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ANEXOS

A – Tabular data

Year	Band-Rumped Storm-Petrel (individuals)	Cory's Shearwater (pairs)	European Shag (pairs)	Lesser Black-backed Gull (AOS)	Yellow-legged Gull (adult breeders)		Common Murre (individuals)
	Farilhão Grande	*All Archipelago*	*Berlenga Island*	*All Archipelago*	*Berlenga Island*	*Farilhões***	*All archipelago*
1939	N/C	N/C	70[3]	0[3]	2000[3,*]	N/C	12000[3,*]
1974	N/C	N/C	N/C	N/C	N/C	N/C	1200[14]
1977	N/C	N/C	N/C	N/C	N/C	N/C	320[14]
1978	N/C	N/C	34[4]	3[4]	4640[16]	N/C	365[14]
1979	N/C	N/C	35[4]	5[4]	5500[16]	N/C	231[14]
1981	N/C	N/C	47[5]	4[4]	5750[16]	N/C	196[14]
1983	N/C	N/C	47[5]	N/C	5959[16]	N/C	N/C
1982	N/C	N/C	N/C	N/C	6800[16]	N/C	150[14]
1983	N/C	N/C	N/C	N/C	8780[16]	N/C	142[14]
1984	N/C	N/C	N/C	N/C	8880[16]	N/C	N/C
1985	N/C	N/C	51[6]	N/C	9900[16]	N/C	80[14]
1986	N/C	N/C	N/C	N/C	11450[16]	N/C	140[14]
1987	N/C	N/C	N/C	N/C	13000[16]	N/C	N/C
1988	N/C	N/C	N/C	N/C	12000[16]	N/C	66[14]
1989	N/C	N/C	N/C	N/C	16000[16]	N/C	45[14]
1990	N/C	N/C	46[7]	N/C	16700[16]	N/C	41[14]
1991	N/C	N/C	N/C	N/C	20100[16]	N/C	36[14]
1992	N/C	N/C	N/C	N/C	26000[16]	N/C	33[14]
1993	N/C	N/C	N/C	N/C	35000[16]	N/C	30[14]
1994	N/C	N/C	N/C	N/C	44698[16]	N/C	38[14]
1995	N/C	N/C	83[8]	N/C	30011[16]	N/C	46[14]
1996	N/C	N/C	N/C	N/C	22681[16]	N/C	41[14]
1997	N/C	N/C	43[9]	N/C	20405[16]	N/C	52[14]
1998	N/C	N/C	N/C	7[15]	23954[16]	N/C	31[14]
1999	N/C	N/C	N/C	N/C	21126[16]	N/C	16[14]
2001	N/C	N/C	N/C	N/C	21905[16]	N/C	N/C
2002	N/C	N/C	78[5]	N/C	24085[16]	N/C	27[14]
2003	N/C	N/C	62[9]	N/C	N/C	N/C	8[14]
2004	N/C	N/C	62[9]	N/C	23856[16]	N/C	15[14]
2005	N/C	N/C	N/C	N/C	N/C	N/C	N/C
2006	N/C	N/C	N/C	N/C	19623[16]	N/C	N/C
2007	N/C	N/C	N/C	N/C	27050[16]	N/C	8[14]
2008	N/C	N/C	34[9]	N/C	22795[16]	N/C	4[14]
2009	N/C	N/C	54[9]	N/C	29453[16]	N/C	4[14]
2010	N/C	980-1070[1]	54[10]	N/C	17088[16]	N/C	4[14]
2011	N/C	N/C	40[11]	N/C	17208[16]	N/C	1[14]
2012	1547±247	N/C	70[12]	N/C	17628[16]	(3025)**	1[14]
2013	1188±275	N/C	52[13]	N/C	13150[16]	(611)**	1[14]
2014	1829±242	N/C	39[14]	N/C	14188[16]	(115)**	0[14]
2015	1101±177	800-975[2]	72	N/C	14168[16]	(132)**	0

2016	N/C	N/C	52	N/C	10693[16]	N/C	0
2017	1863±327	N/C	53	N/C	9330[16]	(464)**	1
2018	1498±596	N/C	44	N/C	5661[16]	N/C	1
2019	1180±233	N/C	57	N/C	8623[16]	(169)**	1
2020	2115±354	550-800	42	N/C	5591[16]	39 (103)**	1
2021	1904±467	N/C	43	13	4503[16]	249 (332)**	1
2022	N/C	N/C	50	N/C	4363[16]	349 (663)**	1
2023		N/C	50	N/C	3865[16]	159 (175)**	1
2024		N/C	28	10	3340[16]	385 (398)**	1

Table A.1 | Population estimates of breeding seabirds in Berlengas Archipelago, 1939-2024. Historical data was collated from several sources: [1]Lecoq et al. (2011), [2]Oliveira et al. (2020), [3]Lockley (1952), [4]Araújo and Luís (1982), [5]Lecoq (2003), [6]Núñez (1991), [7]Morais (1995), [8]Neto (1997), [9]ICNF (Unpublished data), [10]Morais et al. (2010), [11]Morais et al. (2011), [12]Morais et al. (2012), [13]Morais et al. (2013), [14]Morais et al. (2014) nad [15]Morais (2007). AOS - apparently occupied sites.
*Converted from the number of pairs estimated by Lockley (1952).
** total number of individuals (from all ages) are given within brackets.

	Band-Rumped Storm-Petrel (Estimated individuals) Farilhão Grande	Cory's Shearwater (Estimated pairs)	European Shag (Pairs) Berlenga Island	Lesser Black-backed Gull (AOS)	Yellow-legged Gull (adults) *Berlenga Island*	Common Murre (Individuals)
2024	1904±467*	550-800**	28	10	3340	1
2014	1829±242	800-975***	39	N/C	14188	0
Change 2014-2024	75	-213	-11		-10848	1
% change 2014-2024	+4%	-25%	-28%		-76%	=

Table A.2 | Population change of breeding seabirds in Berlengas Archipelago at the year 1 of LIFE Berlengas (2014) and at the end of the After-LIFE (2024). *The most recent estimate (2021) is used for Band-rumped Storm-petrel. **The most recent estimate (2020) is used for Cory's Shearwater. ***Cory's Shearwater was counted in 2015.

Year	Melreu	Capitão	Furado	Flandres	Quebradas	Farilhão Grande
1999*	42	10	8	N/C	N/C	N/C
2000*	36	12	12	N/C	N/C	N/C
2001*	36	18	12	N/C	N/C	N/C
2002*	52	24	17	N/C	N/C	N/C
2010**	78	30	29	N/C	N/C	N/C
2013	66	26	14	N/C	N/C	N/C
2015	76	N/C	31	N/C	N/C	N/C
2016	107	N/C	34	3	N/C	N/C
2017	94	21	33	6	N/C	33
2018	92	24	31	7	6	36
2019	101	30	33	13	6	40
2020	105	28	35	13	8	N/C
2021	110	36	33	15	8	N/C
2022	112	45	37	18	9	45

2023	122	48	45	19	10	49
2024	112	48	46	18	11	44

Table A.3 | Number of breeding pairs of Cory's Shearwater counted at each subcolony of Berlenga Island and a subarea of Farilhão Grande, 1999-2024. *Data from Lecoq (2003). ** Data from Lecoq (2010).

ID	Sub-colony	1995[1]	2002[2]	2003[3]	2008[3]	2009[3]	2010[4]	2011[5]	2012[6]	2013[7]	2014[8]	2015	2016	2017
1	**Forninho**	N/C	N/C	3	4	3	3	3	4	4	3	5	3	1
2	**Rio da Poveira**	30	25	21	0	3	3	N/C	4	N/C	N/C	11	5	5
3	**Gruta do Nicho**	N/C	1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	0	0	0
4	**Carreiro Maldito**	N/C	N/C	N/C	14	14	13	9	16	11	6	2	1	3
5	**Cerro do Cão**	1	N/C	6	2	5	5	3	2	1	0	3	1	0
6	**Ponta N do Carreiro dos Cações**	7	7	5	4	6	6	7	7	7	6	5	6	6
7	**Carreiro dos Cações**	10	7	2	4	3	5	5	7	9	9	17	15	12
8	**Quebrada**		N/C	N/C	N/C	N/C	N/C	N/C	1	1	0	1	0	1
9	**Zona da Gruta das Pombas**	4	6	3	3	0	N/C	N/C	1	N/C	N/C	0	0	0
10	**Ilhéu dos Soldados**	N/C	1	N/C	N/C	N/C	N/C	N/C	N/C	1	0	0	0	0
11	**Carreiro da Carolina do Sul**	2	4	3	1	2	N/C	N/C	4	1	2	2	5	1
12	**Carreiro do Zé da Carolina**	6	5	1	2	8	6	7	10	8	6	12	9	10
13	**Gruta dos Olhos**	3	4	3	N/C	2	2	0	4	2	0	0	0	0
14	**Cova do Sono**	7	3	8	N/C	3	3	0	4	5	3	6	0	5
15	**Ouvido do Furado**		N/C	2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	0	0	0
16	**Gruta dos Mosquitos/Relaxe**		1	1	N/C	1	2	1	1	N/C	N/C	0	0	0
17	**Furado Grande**	1	1	1	N/C	N/C	N/C	N/C	1	N/C	N/C	2	0	N/C
18	**Carreiro da Fortaleza**		N/C	N/C	N/C	N/C	3	1	2	1	N/C	2	3	4
19	**Flandres**	3	1	2	N/C	4	1	4	2	1	2	2	4	0
20	**Ilhéu Maldito**	6	2	1	N/C	N/C	1	N/C	0	N/C	N/C	0	0	N/C
21	**Furado do cão**	1	7	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	0	0	0
22	**Ilhéu da Velha**	3	1	2	N/C	N/C	1	N/C	0	N/C	N/C	0	N/C	0
23	**Estela Grande**	3	1	N/C	N/C	N/C	0	N/C	0	N/C	N/C	0	N/C	0
24	**Farilhão Grande**	4	N/C	N/C	N/C	N/C	5	N/C	6	N/C	N/C	3	N/C	4
	Total Berlenga		78	62	34	54	54	40	70	52	39	72	N/C	54
	Total Archipelago		79	N/C	N/C	N/C	59	N/C	76	N/C	N/C	75	N/C	58

Table A.4 | Number of breeding pairs of European Shag counted at each subcolony of Berlenga Island, 1995-2018. Historical data was collated from several sources: [1]Neto (1997), [2]Lecoq (2003), [3]ICNF (Unpublished data), [4]Morais et al. (2010), [5]Morais et al. (2011), [6]Morais et al. (2012), [7]Morais et al. (2013) and [8]Morais et al. (2014).

Id	Sub-colony	2018	2019	2020	2021	2022	2023	2024
1	**Forninho**	0	0	0	0	0	0	0
2	**Rio da Poveira**	3	12	8	14	16	17	8
3	**Gruta do Nicho**	N/C	N/C	N/C	N/C	N/C	N/C	N/C
4	**Carreiro Maldito**	1	1	0	0	0	0	0
5	**Cerro do Cão**	3	3	5	1	0	0	0

6	**Ponta N do Carreiro dos Cações**	7	9	8	10	10	12	9
7	**Carreiro dos Cações**	10	15	11	6	7	7	2
8	**Quebrada**	1	1	1	0	0	0	0
9	**Zona da Gruta das Pombas**	0	0	0	0	0	1	0
10	**Ilhéu dos Soldados**	0	0	0	0	3	0	0
11	**Carreiro do Carolina do Sul**	0	1	1	1	1	1	1
12	**Carreiro do Zé da Carolina**	4	6	2	3	5	4	3
13	**Gruta dos Olhos**	N/C	N/C	N/C	N/C	N/C	N/C	2
14	**Cova do Sono**	11	6	4	8	8	5	1
15	**Ouvido do Furado**	N/C	N/C	N/C	N/C	N/C	N/C	N/C
16	**Gruta dos Mosquitos-Relaxe**	0	0	0	0	0	1	0
17	**Furado Grande**	N/C	N/C	N/C	N/C	N/C	N/C	N/C
18	**Carreiro da Fortaleza**	2	1	0	0	0	0	0
19	**Flandres**	2	4	2	0	0	2	0
20	**Ilhéu Maldito**	N/C	N/C	N/C	N/C	N/C	N/C	N/C
21	**Furado do cão**	N/C	N/C	N/C	N/C	N/C	N/C	N/C
22	**Ilhéu da Velha**	N/C	N/C	N/C	N/C	N/C	N/C	N/C
23	**Estela Grande**	N/C	N/C	N/C	N/C	N/C	N/C	N/C
24	**Farilhão Grande**	N/C	N/C	N/C	N/C	N/C	N/C	N/C
	Total Berlenga	N/C	N/C	N/C	N/C	N/C	N/C	N/C
	Total Archipelago	N/C	N/C	N/C	N/C	N/C	N/C	N/C

Table A.5 | Number of breeding pairs of European Shag counted at each subcolony of Berlenga Island, 2019-2024.

Year	Band-Rumped Storm-Petrel (Farilhão Grande)	Cory's Shearwater (Berlenga Island)	Cory's Shearwater (Farilhão Grande)	European Shag (Berlenga Island)	Yellow-legged Gull (Berlenga Island)
1987	N/C	0.37[1]	N/C	N/C	
1990	N/C	N/C	N/C	0.94[5]	
1995	N/C	N/C	N/C	1.33[6]	
2002	N/C	0.22[2]	N/C	N/C	0.74±0.23[8]
2004					0.86±0.01[8]
2006	N/C	0.88[3]	N/C	N/C	0.76±0.02[8]
2007					0.80±0.11[8]
2008					0.79±0.05[8]
2009					0.74±0.26[8]
2010	N/C	0.60[4]	N/C	N/C	0.81±0.05[8]
2011	0.46	N/C	N/C	N/C	0.76±0.08[8]
2012	N/C	N/C	N/C	0.99[7]	0.81±0.01[8]
2013	0.62	0.66	N/C	N/C	0.74±0.13[8]
2014	0.67	N/C	N/C	N/C	0.76±0.09[8]
2015	0.54	0.75	N/C	1.32	0.76±0.01[8]
2016	0.65	0.85	N/C	1.31	0.82±0.02[8]
2017	0.74	0.83	0.45	1.45	0.70±0.11[8]
2018	0.44	0.84	0.39	1.00	0.73±0.10[8]
2019	0.48	0.78	0.38	1.04	0.72±0.01[8]

2020	0.38	0.71	0.90	0.95	0.63±0.11[8]
2021	0.61	0.84	0.86	1.00	0.80±0.05[8]
2022	0.57	0.83	0.56	1.06	0.78±0.07[8]
2023	0.77	0.83	0.59	0.94	0.83±0.10[8]
2024	N/C	0.79	0.52	0.82	0.91±0.13[8]

Table A.6 | Breeding productivity of monitored seabirds, 1983-2024. Values are given as the ratio between the number of fledglings and the number of active nests, except in the case of Yellow-lagged Gull, for which productivity is reflecting the hatching success, i.e. the ratio between the number of nests with at least one hatchling and the number of active nests. Historical data was collated from several sources: [1]Granadeiro (1991), [2]Lecoq (2003), [3]Alonso et al. (2008), [4]Lecoq (2010), [5]Morais (1995), [6]Neto (1997), [7]Morais et al. (2012) and [8]Morais et al. (2024).

Year	Band-Rumped Storm-Petrel (Farilhão Grande)	Cory's Shearwater (Melreu - Berlenga Island)	European Shag (Berlenga Island)	Yellow-legged Gull (Berlenga Island)
2011	Ad:0.99±0.00 (3)			
2012	Ad:1.00±0.00 (12)			
2013	Ad:0.95±0.14 (27)			
2014	Ad:0.85±0.15 (21)			
2015	Ad:1.00±0.00 (29)	Ad:1.00±0.00 (142)		
2016	Ad:0.52±0.08 (28)	Ad:0.84±0.04 (48)	Juv:0.88±0.37 (5)	Juv:0.49±0.06 (101)
2017	Ad:0.71±0.09 (44)	Ad:0.85±0.06 (220)	Juv:1.00±0.00 (5)	Juv:0.62±0.05 (239)
2018	Ad:0.98±0.09 (19)	Ad:0.93±0.07 (77)	Juv:0.42±0.46 (6)	Juv:0.57±0.04 (351)
2019	Ad:0.86±0.08 (30)	Ad:0.79±0.09 (205)	Juv:0.29±0.19 (12)	Juv:0.56±0.07 (356)
2020	Ad:1.00±0.00 (47)	Ad:0.79±0.13 (88)	Juv:1.00±0.00 (9)	Juv:0.30±0.04 (313)
2021	Ad:0.83±0.08 (22)	Ad:0.93±0.21 (62)	Juv:0.33±0.28 (15)	Juv:0.59±0.06 (328)
2022	Ad:1.00±0.00 (31)	Ad:0.71±0.15 (34)	Juv:0.14±0.15 (15)	(177)
2023	Ad:0.80±0.00 (19)	Ad:0.76±0.00 (77)	(10)	(238)

Table A.7 | Annual individual survival of breeding seabirds, Berlengas Archipelago, 2011-2023. Number of ringed birds seen each year within brackets. Ad: Adult survival. Juv: Juvenil survival.

Year	Band-Rumped Storm-Petrel (Farilhão Grande)	Cory's Shearwater (Melreu - Berlenga Island)	European Shag (Berlenga Island)	Yellow-legged Gull (Berlenga Island)
2011	1 (34)			
2012	24 (180)			
2013	36 (164)			
2014	47 (228)			
2015	104 (246)	102 (61)		
2016	223 (386)	27 (65)	1 (5)	7 (101)
2017	195 (490)	201 (58)	2 (7)	14 (213)
2018	38 (34)	2 (49)	6 (2)	12 (269)
2019	67 (99)	132 (52)	6 (11)	14 (208)
2020	90 (204)	81 (155)	2 (11)	30 (189)
2021	103 (254)	77 (100)	5 (10)	134 (181)
2022	35 (15)	42 (161)	10 (12)	61 (0)

2023	67 (138)	37 (161)	5 (9)	50 (132)
2024	**124 (200)**	156 (43)	1 (2)	47 (113)

Table A.8 | Number of resighted individuals in Berlengas Archipelago, 2011-2023. Number of birds ringed each year are given within brackets.

Year	Band-Rumped Storm-Petrel		Cory's Shearwater	
	(Berlenga Island)	(Farilhão Grande)	(Berlenga Island)	(Farilhão Grande)
2000	0 (0)	0 (0)	7 (60)*	0 (0)
2001	0 (0)	0 (0)	10 (60)*	0 (0)
2002	0 (0)	0 (0)	18 (60)*	0 (0)
2011	0 (0)	0 (29)	N/C	0 (0)
2012	0 (0)	0 (29)	N/C	0 (0)
2013	0 (0)	2 (29)	55 (121)	0 (0)
2014	0 (0)	3 (68)	N/C	0 (0)
2015	0 (0)	5 (72)	101 (155)	0 (0)
2016	0 (0)	8 (71)	122 (180)	0 (0)
2017	0 (0)	13 (78)	122 (220)	0 (0)
2018	2 (21)	14 (78)	128 (232)	0 (0)
2019	2 (21)	17 (78)	146 (231)	0 (0)
2020	2 (21)	21 (78)	152 (232)	10 (29)
2021	2 (21)	27 (79)	161 (232)	21 (30)
2022	2 (21)	23 (79)	182 (232)	25 (30)
2023	1 (21)	28 (79)	188 (231)	27 (30)
2024	1 (21)	35 (80)	182 (232)	28 (30)

Table A.9 | Occupancy of artificial nests built for breeding seabirds, Berlengas Archipelago, 2000-2024. *Data from Lecoq (2003).

Year	Melreu	Capitão	Furado	Flandres	Quebradas
2000*	2 (42)	1 (10)	4 (8)	(0)	(0)
2001*	3 (42)	3 (10)	4 (8)	(0)	(0)
2002*	7 (42)	4 (10)	7 (8)	(0)	(0)
2013	40 (93)	2 (10)	13 (18)	(0)	(0)
2015	66 (102)	5 (9)	30 (44)	(0)	(0)
2016	76 (103)	10 (22)	33 (43)	3 (12)	(0)
2017	70 (100)	17 (49)	29 (43)	6 (12)	0 (16)
2018	71 (104)	19 (48)	26 (42)	6 (22)	6 (16)
2019	76 (103)	22 (49)	29 (41)	13 (22)	6 (16)
2020	77 (104)	20 (48)	34 (42)	13 (22)	8 (16)
2021	81 (103)	26 (49)	31 (41)	15 (23)	8 (16)
2022	86 (103)	35 (49)	34 (41)	18 (23)	9 (16)
2023	86 (102)	38 (49)	36 (41)	18 (23)	10 (16)
2024	81 (102)	36 (49)	36 (41)	18 (23)	11 (16)

Table A.10 | Occupancy of artificial nests built for Cory's Shearwater at each subcolony on Berlenga Island, 2000-2023. *Data from Lecoq (2003).

Name	Latin name	2017	2018	2019	2020	2021	2022	2023	2024
Purple Sandpiper	Calidris maritima	0	0	0	1	0	0	0	0
Northern Long-eared Owl	Asio otus	1	0	0	0	0	0	0	0
Peregrine Falcon*	Falco peregrinus	0	2	0	0	1	2	1	1
Zitting Cisticola*	Cisticola juncidis	0	0	0	0	2	0	0	0
Sedge Warbler	Acrocephalus schoenobaenus	0	0	1	0	0	0	0	0
Common Reed-warbler	Acrocephalus scirpaceus	0	0	0	3	0	0	0	0
Common Grasshopper-warbler	Locustella naevia	0	0	1	0	0	0	0	0
Willow Warbler	Phylloscopus trochilus	0	0	12	3	0	0	0	0
Common Chiffchaff	Phylloscopus collybita	0	0	0	2	1	0	2	0
Garden Warbler	Sylvia borin	0	0	1	0	0	0	0	0
Common Whitethroat	Curruca communis	0	0	12	0	0	0	0	0
European Robin	Erithacus rubecula	0	0	2	1	0	0	0	0
European Pied Flycatcher	Ficedula hypoleuca	0	0	7	0	0	0	0	0
Spotted Flycatcher	Muscicapa striata	0	0	6	1	0	0	0	0
Common Nightingale	Luscinia megarhynchos	0	0	2	0	0	0	0	0
Black Redstart*	Phoenicurus ochruros	0	0	0	1	0	0	1	0
Common Redstart	Phoenicurus phoenicurus	0	0	1	0	0	0	0	0
Whinchat	Saxicola rubetra	0	0	2	0	0	0	0	0
Common Stonechat	Saxicola torquatus	0	0	0	0	0	0	1	0
Meadow Pipit	Anthus pratensis	0	0	0	9	0	0	28	0

Table A.11 | Number of ringed breeding and migrant land birds during 2017-2024, Berlengas Archipelago. * breeding species.

Year	Number of surveys	GN1	GN2	GN3	GN4	GN5	GN6	GN7	GN8
2018	7	6	0	6	0	0	7	1	1
2019	7	1	0	2	0	0	7	0	0
2020	7	0	1	0	2	0	0	0	1
2021	7	1	1	0	1	0	0	0	0
2022	8	1	4	0	2	0	1	1	2
2023	7	1	0	0	0	4	0	0	0
2024	6	1	0	11	3	0	2	1	1
Total	49	10	6	17	8	4	10	3	5

Table A.12 | Triggers of A24 GoodNature traps set on Berlenga Island 2018-2024. GN1 - Casa do Cais, GN2 - Castelinho, GN3 - Restaurante, GN4 - Farol, GN5 - Abrigo dos Pescadores, GN6 - Escadas para a Praia, GN7 - Gruta na descida para o Forte, GN8 - Forte.

B – List of migrant species observed on Berlenga Island, 2016-2024

Name	Latin name	2016	2017	2018	2019	2020	2021	2022	2023	2024
Common Reed-warbler	*Acrocephalus scirpaceus*	x		x		x			x	
Common Sandpiper	*Actitis hypoleucos*	x	x		x	x	x		x	
Eurasian Skylark	*Alauda arvensis*	x		x		x	x	x		x
Kentish Plover	*Charadrius alexandrinus*					x				
Tawny Pipit	*Anthus campestris*				x					
Meadow Pipit	*Anthus pratensis*	x	x	x	x	x	x	x	x	x
Pallid Swift	*Apus pallidus*	x	x	x	x	x	x	x	x	
Great White Egret	*Ardea alba*	x				x				
Grey Heron	*Ardea cinerea*	x	x	x	x	x	x	x	x	x
Ruddy Turnstone	*Arenaria interpres*	x	x	x		x			x	
Short-eared Owl	*Asio flammeus*	x				x				
Brent Goose	*Branta bernicla*								x	
Eurasian Buzzard	*Buteo buteo*		x	x						
Purple Sandpiper	*Calidris maritima*						x			
European Goldfinch	*Carduelis carduelis*			x	x	x		x	x	
Red-rumped Swallow	*Cecropis daurica*		x							
European Greenfinch	*Chloris chloris*					x				
Domestic Dove	*Columba livia (domest.)*	x	x	x	x	x	x	x	x	x
Common Woodpigeon	*Columba palumbus*	x								
Common Cuckoo	*Cuculus canorus*			x						
Common Whitethroat	*Curruca communis*	x		x	x					
Northern House Martin	*Delichon urbicum*	x	x		x		x	x		
Corn Bunting	*Emberiza calandra*						x			
Cirl Bunting	*Emberiza cirlus*						x			
European Robin	*Erithacus rubecula*	x		x	x	x	x	x	x	
Common Waxbill	*Estrilda astrild*					x				
Eurasian Dotterel	*Eudromias morinellus*				x					
European Pied Flycatcher	*Ficedula hypoleuca*	x	x	x	x	x		x		x
Common Chaffinch	*Fringilla coelebs*	x		x						
Crested Lark	*Galerida cristata*	x								
Eurasian Oystercatcher	*Haematopus ostralegus*	x								
Booted Eagle	*Hieraaetus pennatus*	x		x						x
Barn Swallow	*Hirundo rustica*	x	x		x		x	x		
Eurasian Wryneck	*Jynx torquilla*			x				x		
Woodchat Shrike	*Lanius senator*								x	
Common Linnet	*Linaria cannabina*			x			x			
Common Nightingale	*Luscinia megarhynchos*	x								
Bluethroat	*Luscinia svecica*	x								
Black Kite	*Milvus migrans*						x			
White Wagtail	*Motacilla alba*	x		x	x	x	x	x	x	x
Grey Wagtail	*Motacilla cinerea*		x	x						
Western Yellow Wagtail	*Motacilla flava*	x						x	x	x
Spotted Flycatcher	*Muscicapa striata*	x		x	x	x	x			
Whimbrel	*Numenius phaeopus*	x	x	x	x	x	x	x	x	x
Black-eared Wheatear	*Oenanthe hispanica*							x		

Northern Wheatear	*Oenanthe oenanthe*	x	x	x	x	x	x	x	x	
Eurasian Golden Oriole	*Oriolus oriolus*	x								x
House Sparrow	*Passer domesticus*						x	x		
Spanish Sparrow	*Passer hispaniolensis*						x			
Great Cormorant	*Phalacrocorax carbo*	x	x	x		x				
Common Redstart	*Phoenicurus phoenicurus*	x				x	x	x		
Common Chiffchaff	*Phylloscopus collybita*	x	x	x		x	x	x	x	
Willow Warbler	*Phylloscopus trochilus*	x	x	x	x	x	x	x	x	
Snow Bunting	*Plectrophenax nivalis*	x								
Eurasian Golden Plover	*Pluvialis apricaria*	x		x		x		x	x	
Red-billed Chough	*Pyrrhocorax pyrrhocorax*		x	x	x					
Collared Sand Martin	*Riparia riparia*	x								
Whinchat	*Saxicola rubetra*		x	x		x	x	x		
Common Stonechat	*Saxicola torquatus*								x	
Eurasian Woodcock	*Scolopax rusticola*			x						
European Serin	*Serinus serinus*					x				
Eurasian Collared-dove	*Streptopelia decaocto*	x			x	x	x	x	x	
European Turtle-dove	*Streptopelia turtur*		x		x		x		x	x
Spotless Starling	*Sturnus unicolor*	x			x					
Common Starling	*Sturnus vulgaris*	x		x	x			x		x
Brown Booby*	*Sula leucogaster*		x					x		
Eurasian Blackcap	*Sylvia atricapilla*	x				x	x	x		
Redwing	*Turdus iliacus*			x	x					x
Eurasian Blackbird	*Turdus merula*	x					x	x		
Song Thrush	*Turdus philomelos*	x			x	x	x	x	x	x
Fieldfare	*Turdus pilaris*	x		x	x					x
Ring Ouzel	*Turdus torquatus*	x								
Total number of species		43	21	32	26	30	29	28	22	15

C – Results of the vegetation monitoring

Latin name	2016	2018	2019	2020	2021	2023	2024
Agave americana	0.07 ± 0.58	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Allium ampeloprasum	0.44 ± 2.45	0.13 ± 1.15	0.12 ± 0.84	0.03 ± 0.23	0.17 ± 1.2	0.25 ± 1.81	0.24 ± 1.76
Anagallis arvensis	0.04 ± 0.26	0.05 ± 0.23	0.08 ± 0.51	0.21 ± 0.84	0.33 ± 2.89	0.23 ± 1.34	0 ± 0
Anagallis monelli	0.24 ± 1.3	0.36 ± 1.87	0.13 ± 1.15	0.41 ± 2.02	0.33 ± 1.79	0 ± 0	0.28 ± 1.02
Anchusa undulata	0.2 ± 1.21	0.03 ± 0.23	0.04 ± 0.35	0.13 ± 1.15	0 ± 0	0.03 ± 0.24	0 ± 0
Andryala integrifolia	0 ± 0	0.01 ± 0.12	1.48 ± 4.42	4.89 ± 11.26	2.83 ± 5.59	1.43 ± 3.05	2.61 ± 4.85
Angelica pachycarpa	0.03 ± 0.16	0.44 ± 2.57	1.69 ± 5.67	2.64 ± 8.6	1.76 ± 6.01	2.52 ± 12.73	1.27 ± 8.56
Arisarum simorrhinum	0.32 ± 1.09	0.19 ± 0.83	0 ± 0	0 ± 0	0 ± 0	0.01 ± 0.12	0.15 ± 0.69
Armeria berlengensis	0 ± 0	0.07 ± 0.58	0 ± 0	0 ± 0	0.28 ± 2.31	0 ± 0	0.04 ± 0.26
Astragalus pelecinus	0 ± 0	0.03 ± 0.23	0 ± 0	0 ± 0	0.55 ± 2.84	0 ± 0	0.2 ± 0.79
Atriplex prostrata	0 ± 0	0.43 ± 1.14	0.2 ± 1.1	0.03 ± 0.16	0.04 ± 0.26	0.06 ± 0.24	0.04 ± 0.2
Avena barbata	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.88 ± 2.6	8.3 ± 17.48	4.61 ± 9.81
Bellardia trixago	0 ± 0	0 ± 0	0.05 ± 0.36	0.07 ± 0.58	0.21 ± 1.21	0.01 ± 0.12	0.15 ± 0.67
Beta maritima	0.05 ± 0.23	0 ± 0	0.04 ± 0.35	0.03 ± 0.23	0 ± 0	0.03 ± 0.24	0.09 ± 0.62
Bromus hordeaceus	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.07 ± 0.6	0 ± 0
Bromus rigidus	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	8.35 ± 14.27
Bryophyta	0 ± 0	0.21 ± 0.98	0.04 ± 0.35	0 ± 0	0 ± 0	0.09 ± 0.72	0 ± 0
Calendula suffruticosa algarbiensis	20.8 ± 24.71	12.16 ± 15.22	12.69 ± 15.33	15.87 ± 17.41	11.85 ± 13.19	14.99 ± 18.98	15.24 ± 18.31
Carduus tenuiflorus	0.65 ± 5.31	0.09 ± 0.52	0.36 ± 2.38	0.53 ± 1.95	0.03 ± 0.23	0 ± 0	0 ± 0
Carlina corymbosa	0 ± 0	0.07 ± 0.58	0.29 ± 1.49	0 ± 0	0.2 ± 1.73	0.2 ± 0.78	0.43 ± 2.1
Carpobrotus edulis	15.6 ± 33.3	1 ± 4.61	1.16 ± 5.47	0.39 ± 1.31	0.57 ± 2.88	0.16 ± 0.7	1.21 ± 5.38
Cerastium glomeratum	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.01 ± 0.12	0 ± 0
Chenopodium murale	0 ± 0	0.37 ± 2.08	0.05 ± 0.46	0.4 ± 2.14	0 ± 0	0 ± 0	0.01 ± 0.12
Conyza canadensis	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.04 ± 0.26
Coronopus didymus	0.09 ± 0.52	0.01 ± 0.12	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Crassula tillaea	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.04 ± 0.2
Crepis capillaris	0 ± 0	0.03 ± 0.23	0.13 ± 0.5	0.15 ± 0.71	0.05 ± 0.36	0.12 ± 0.63	0.45 ± 2.37
Cuscuta epthymum	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.03 ± 0.24	0 ± 0
Dactylis marina	0 ± 0	0 ± 0	0 ± 0	0 ± 0	4.39 ± 8.63	4.61 ± 9.2	9.49 ± 14.66
Desmazeria marina	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.31 ± 2.43
Digitalis purpurea	0 ± 0	0.01 ± 0.12	0.09 ± 0.6	0.04 ± 0.35	0.4 ± 1.97	0 ± 0	0.04 ± 0.2
Echium rosulatum davaei	5.41 ± 10.06	3.16 ± 6.56	4.12 ± 8.03	4.76 ± 7.95	6.71 ± 11.01	4.62 ± 9.35	2.45 ± 5.32
Erodium cicutarium	0.67 ± 2.52	0.64 ± 1.22	0.57 ± 1.51	0.53 ± 3.1	0.59 ± 2.95	0.55 ± 1.22	0.56 ± 1.6
Euphorbia exigua	0 ± 0	0 ± 0	0 ± 0	0.01 ± 0.12	0.01 ± 0.12	0 ± 0	0.04 ± 0.26
Euphorbia portlandica	0 ± 0	0.01 ± 0.12	0.01 ± 0.12	0 ± 0	0.07 ± 0.38	0 ± 0	0.23 ± 0.99
Evax pygmae	0 ± 0	0.31 ± 1.57	0 ± 0	0 ± 0	0.01 ± 0.12	0 ± 0	0 ± 0
Frankenia laevis	0 ± 0	0 ± 0	0.03 ± 0.23	0 ± 0	0.11 ± 0.67	0.04 ± 0.36	0.05 ± 0.28
Geranium molle	0.67 ± 1.65	0.27 ± 0.76	0.03 ± 0.16	0.03 ± 0.16	0.57 ± 1.61	0.35 ± 0.95	1.39 ± 2.82
Herniaria lusitanica berlengiana	0 ± 0	0.01 ± 0.12	0 ± 0	0 ± 0	0.01 ± 0.12	0 ± 0	0.03 ± 0.16
Holcus lanatus	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	1.59 ± 5.94
Hordeum leporinum	0 ± 0	0 ± 0	0 ± 0	0 ± 0	1.95 ± 5.69	2.58 ± 6.29	1.31 ± 3.57
Isoetes histrix	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.81 ± 5.12	0.07 ± 0.38
Juncus bufonius	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.2 ± 0.75
Lagurus ovatus	0 ± 0	0 ± 0	0 ± 0	0 ± 0	1.91 ± 5.37	0.48 ± 1.42	0.69 ± 1.93
Lavatera arborea	0.52 ± 1.66	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.3 ± 1.43	0.05 ± 0.32
Lavatera cretica	0 ± 0	0.87 ± 2	0.87 ± 2.06	0.81 ± 2.6	0.79 ± 2.2	0.26 ± 0.78	1.11 ± 2.29

Leontodon taraxacoides	0.04 ± 0.26	0.12 ± 0.64	0.05 ± 0.28	0.04 ± 0.35	0.04 ± 0.26	0.03 ± 0.24	0.05 ± 0.23
Linaria spartea	0 ± 0	0.65 ± 2.78	0.29 ± 0.63	1.31 ± 2.81	1.48 ± 3.34	0.8 ± 1.67	2.93 ± 6.87
Líquens	0 ± 0	0 ± 0	0.03 ± 0.23	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Lobularia maritima	9.08 ± 12.98	13.55 ± 14.85	5.84 ± 6.52	5.91 ± 7.67	5.75 ± 8.87	1.2 ± 2.17	3.67 ± 5.12
Lolium rigidum	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.36 ± 1.14	0.07 ± 0.58
Lophochloa cristata	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.04 ± 0.35	0.1 ± 0.65	0.16 ± 0.9
Lotus subbiflorus	0 ± 0	0 ± 0	0.09 ± 0.81	0.13 ± 1.15	0.48 ± 2.62	0.86 ± 5.88	0.59 ± 3.16
Medicago littoralis	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.31 ± 2.33	0 ± 0	0.07 ± 0.58
Medicago polymorpha	0.13 ± 0.53	0.07 ± 0.58	0 ± 0	0.4 ± 2.9	1.24 ± 6.25	0.06 ± 0.34	1.67 ± 4.95
Melilotus indicus	0 ± 0	0.01 ± 0.12	0 ± 0	0.11 ± 0.92	0.48 ± 3.49	0 ± 0	0 ± 0
Mercurialis ambigua	3.08 ± 6.21	3.85 ± 7.76	0.65 ± 1.53	1.19 ± 3.81	0.41 ± 0.96	0.28 ± 0.76	0.67 ± 1.08
Mesembryanthemum crystallinum	0.2 ± 1.19	0.11 ± 0.67	0.09 ± 0.62	0.28 ± 1.34	0.04 ± 0.26	0.35 ± 1.49	0.11 ± 0.67
Montia fontana	0 ± 0	0.01 ± 0.12	0 ± 0	0 ± 0	0.01 ± 0.12	0 ± 0	0.03 ± 0.23
Narcissus bulbocodium subsp. obesus	0.99 ± 2.53	0.48 ± 1.25	0.03 ± 0.16	0 ± 0	0.29 ± 0.85	0.46 ± 0.9	0.55 ± 2.43
Poaceae	1.05 ± 2.62	9.88 ± 12.37	28.33 ± 27.24	21.25 ± 19.5	13.79 ± 18.34	5.07 ± 11.91	1.55 ± 3.21
Ornithopus pinnatus	0 ± 0	0.03 ± 0.16	0.07 ± 0.47	0.11 ± 0.53	0.07 ± 0.58	0.12 ± 0.63	0.33 ± 1.35
Orobanche amethystea	0 ± 0	0.25 ± 0.72	0.59 ± 1.83	0.31 ± 0.97	0.35 ± 0.81	0.13 ± 0.34	0.49 ± 0.83
Oxalis pes-caprae	0 ± 0	0.01 ± 0.12	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Papaver somniferum	0 ± 0	0.08 ± 0.51	0.03 ± 0.23	0.03 ± 0.23	0.01 ± 0.12	0.04 ± 0.36	0.04 ± 0.26
Parietaria judaica	0 ± 0	0 ± 0	0 ± 0	0.13 ± 1.15	0.03 ± 0.23	0 ± 0	0 ± 0
Plantago coronopus	0.09 ± 0.6	0.31 ± 1.46	0.92 ± 6.3	0.35 ± 1.48	0.87 ± 3.18	0.3 ± 0.91	1.44 ± 7.14
Poa infirma	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.05 ± 0.23
Polycarpon alsinifolium	0.04 ± 0.2	0.28 ± 1.25	0 ± 0	0.08 ± 0.59	0.01 ± 0.12	0.1 ± 0.35	0.44 ± 0.93
Polypogon maritimus	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.15 ± 1.16	0 ± 0	0.28 ± 1.1
Pteridium aquilinium	0 ± 0	0 ± 0	0.01 ± 0.12	0.07 ± 0.58	0.13 ± 0.81	0.62 ± 4.82	0 ± 0
Pulicaria microcephala	0 ± 0	0.83 ± 4.03	0.2 ± 1.28	0.89 ± 4.35	0.27 ± 1.62	0.17 ± 1.21	0.67 ± 3.04
Ranunculus muricatus	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.43 ± 2.11	0.14 ± 0.84	0.04 ± 0.35
Romulea bulbocodium	0.05 ± 0.28	0.03 ± 0.23	0 ± 0	0 ± 0	0 ± 0	0.03 ± 0.24	0.08 ± 0.43
Rumex bucephalophorus	0 ± 0	0.39 ± 1.28	1.45 ± 5.42	2.92 ± 7.69	2.88 ± 7.09	4.12 ± 11.85	1.88 ± 4.85
Sagina maritima	0 ± 0	0 ± 0	0.53 ± 3.14	0 ± 0	0 ± 0	0 ± 0	0.25 ± 0.9
Scrophularia sublyrata	0.2 ± 0.77	0.87 ± 3.17	4.2 ± 8.26	2.57 ± 5.78	6.12 ± 13.05	0.77 ± 2.61	0.76 ± 1.79
Sedum andegavense	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.01 ± 0.12	0 ± 0	0.04 ± 0.26
Senecio gallicus	0.27 ± 2.31	0.49 ± 2.7	0.17 ± 0.78	0.23 ± 0.89	0.28 ± 1.36	1.28 ± 4.57	0.53 ± 1.45
Silene gallica	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.01 ± 0.12	0 ± 0
Silene latifolia	0 ± 0	0 ± 0	0 ± 0	0.25 ± 1.97	0.01 ± 0.12	0 ± 0	0.03 ± 0.23
Silene scabriflora	0.03 ± 0.16	0.6 ± 1.8	0.73 ± 1.68	1.69 ± 3.83	1.23 ± 2.79	1.12 ± 2.13	3.28 ± 6.29
Silene uniflora	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0.22 ± 1.81	0 ± 0
Solanum nigrum	0 ± 0	0.31 ± 1.79	0.05 ± 0.32	0.23 ± 0.81	0.2 ± 1.4	0.1 ± 0.62	0.13 ± 0.53
Sonchus oleraceus	0.08 ± 0.32	0.05 ± 0.23	0.01 ± 0.12	0.15 ± 0.69	0 ± 0	0.07 ± 0.43	1.45 ± 2.78
Sonchus tenerrimus	0 ± 0	0.37 ± 1.83	0.08 ± 0.43	0.19 ± 0.73	0.47 ± 1.13	1.13 ± 2.65	0.09 ± 0.5
Spergularia rupicola	0.05 ± 0.23	1.19 ± 3.95	2.28 ± 4.8	3.19 ± 8.34	3.09 ± 7.04	3.59 ± 10.17	2.35 ± 7.11
Suaeda vera	0 ± 0	0.01 ± 0.12	0.01 ± 0.12	0 ± 0	0 ± 0	0.26 ± 1.82	0.01 ± 0.12
Thapsia villosa	1.07 ± 3.06	0.61 ± 2.99	0.27 ± 2.31	0.85 ± 3.5	1.69 ± 5.5	0.88 ± 2.73	1.29 ± 5.92
Torilis nodosa	0 ± 0	0 ± 0	0 ± 0	0.01 ± 0.12	0.79 ± 4.02	0.41 ± 1.69	0.73 ± 2.18
Trifolium campestre	0 ± 0	0.03 ± 0.23	0.07 ± 0.38	0 ± 0	0.35 ± 2.37	0.03 ± 0.24	0.15 ± 0.71
Trifolium glomeratum	0 ± 0	0 ± 0	0 ± 0	0.04 ± 0.35	0.04 ± 0.35	0 ± 0	0 ± 0
Trifolium scabrum	0 ± 0	0 ± 0	0 ± 0	0.07 ± 0.34	0.09 ± 0.62	0.17 ± 1.21	0.04 ± 0.26

Trifolium suffocatum	0 ± 0	0 ± 0	0.01 ± 0.12	0 ± 0	0 ± 0	0 ± 0	0.16 ± 0.52
Umbilicus rupestris	0.04 ± 0.26	0.15 ± 0.54	0.11 ± 0.63	0.01 ± 0.12	0.12 ± 0.37	0.19 ± 0.69	0.24 ± 0.71
Urtica membranacea	8.39 ± 12.84	2.68 ± 7.29	0.57 ± 1.88	0.27 ± 1.09	0.32 ± 0.84	1.38 ± 5.64	1.4 ± 4.15
Vicia angustifolia	0 ± 0	0.01 ± 0.12	0.01 ± 0.12	0 ± 0	0.01 ± 0.12	0 ± 0	0.2 ± 1.73
Vulpia bromoides	0 ± 0	0 ± 0	0 ± 0	0 ± 0	2.48 ± 6.09	12.96 ± 19.57	0.04 ± 0.35
Rock	7.48 ± 17.17	10.43 ± 17.65	12.57 ± 18.84	8.53 ± 16.8	7.48 ± 15.62	9.01 ± 16.41	9.8 ± 19.09
Bare soil	11.52 ± 20.37	25.11 ± 29.76	13.53 ± 19.87	14.13 ± 14.58	10.72 ± 17.85	7.8 ± 13.6	3.67 ± 8.56
Total number of species	34	58	54	52	69	66	80

Table C.1 | Results of the vegetation monitoring on Berlenga Island, 2016-2024, to assess the removal of alien species. Mean coverage ± standard deviation for each species of the 75 2x2m plots is presented for each year of monitoring.

Latin name	Geographic distribution	Conservation status*	Habitat
Armeria berlengensis	endemic for Berlengas	Endangered	Coastal cliffs, on granitic rocky soils
Echium rosulatum davaei	endemic for Berlengas	Near threatened	Coastal cliffs, on nitrified acidic soils
Scrophularia sublyrata	endemic for Portugal mainland	Least concern	Dune areas and coastal cliffs
Calendula suffruticosa algarbiensis	native	Not evaluated	Zones of dunes and coastal cliffs, ornithocoprophilous species
Lobularia maritima maritima	native	Not evaluated	Dunes and coastal cliffs
Polycarpon alsinifolium	native	Not evaluated	Dune thickets, on sandy soils
Silene scabriflora scabriflora	native	Not evaluated	Dry sandy substrates
Spergularia rupicola	native	Not evaluated	Coastal rocks and cliffs
Plantago coronopus	native	Not evaluated	Coastal cliffs and disturbed sites
Atriplex prostrata	native	Not evaluated	In trampled and nitrified places
Urtica membranacea	native	Not evaluated	Ruderal, nitrophilic
Erodium cicutarium	native	Not evaluated	In trampled and nitrified places
Romulea bulbocodium	native	Not evaluated	Meadows, shrublands, any type of soil
Mercurialis ambigua	native	Not evaluated	Ruderal and rich soils
Orobanche calendulae	native	Not evaluated	Plant parasite, mainly Asteraceae
Poaceae:		Not evaluated	
Dactylis smithii marina	native	Not evaluated	Coastal rocks and cliffs
Rostraria cristata	native	Not evaluated	Dry and ruderalized sites
Hordeum murinum	native	Not evaluated	Ruderal and rupicolous
Lagurus ovatus	native	Not evaluated	Sandy soils near the coast
Bromus hordeaceus	native	Not evaluated	Road shoulders

Table C.2 | Most abundant species in the Yellow-legged Gull exclusion areas set on Berleng Island. *Conservation status from Carapeto et al. (2020)

Subarea	*A. berlengensis*	*E. rosulatum*	*S. sublyrata*	*C. suffruticosa*	Poaceae	*L. maritima*	*P. alsinifolium*	*S. scabriflora*
AS	11.00±15.29*	0.33±0.90*	0.00	6.33±6.63*	30,93±17,07*	0.80±1.37*	0.50±0.86	0.60±1.45
ANS	3.07±2.79*	3.20±2.76*	0.00	10.67±8.21*	49.27±22.05*	0.00*	0.33±0.62	0.00
NAS	0.00*	14.33±8.84*	0.47±1.36	27.33±16.24*	23.60±21.64*	15.27±15.22*	0.29±0.61	0.00
NANS	0.07±0.26*	15.47±10.82*	0.00	29.40±20.72*	31,60±28,45*	6.20±8.79*	0.00	2.20±5.20

Subarea	*S. rupicola*	*P. coronopus*	*A. prostrata*	*U. membranacea*	*E. cicutarium*	*R. bulbocodium*	*M. ambigua*	*O. calendulae*	Bare soil
AS	5.33±2.02*	8.13±11.51*	0.47±0.99	0.60±1.24	0.07±0.26	0.60±1.45	0.00*	0.73±1.03	44.57
ANS	1.60±1.72*	2,40±2.95*	0.33±0.72	1.00±1.65	0.27±0.80	0.00	0.00*	0.87±1.23	27.00
NAS	0.07±0.26*	0.00*	0.33±0.90	2.67±3.72	0.33±0.62	0.00	1.00±1.41*	2.07±2.19	12.25
NANS	0.00*	0.80±1.57*	0.07±0.26	4.60±12.72	0.27±1.03	0.00	0.53±1.36*	2.07±2.25	6.73

Table C.3 | Relative abundance of the most abundant species in the exclusion (AS - with individuals of *Armeria berlengensis*; ANS - without any individuals of *Armeria berlengensis*) and control areas (ANS - with growth of *Armeria berlengensis*; NANS - without individuals of *Armeria berlengensis*). *statistical differences found among subareas.

Subarea	*A. berlengensis*	*E. rosulatum*	*S. sublyrata*	*C. suffruticosa*	Poaceae	*L. maritima*	*P. alsinifolium*	*S. scabriflora*
2016	1.50±2.84	14.25±14.60	0.17±0.58	25.17±16.55	8.92±7.18 d	2.50±7.23	1.00±0.82*	0.58±1.38
2018	3.50±9.95	6.25±4.65	0.00	22.92±18.40	26.67±17.90*	9.17±15.20	0,50±0,80*	0.17±0.39
2020	4.50±10.06	5.25±5.46	0.00	25.42±23.88	29.58±22.00*	6.00±8.09	0.00*	1.67±5.74
2022	3.50±8.49	8.83±8.93	0.42±1.44	10.42±5.82	41.25±16.11*	9.33±13.51	0.00*	0.00
2024	4.67±11.40	7.08±10.05	0.00	8.25±7.30	62.83±16.00*	0.83±1.40	0.00*	1.08±2.02

Subarea	*S. rupicola*	*P. coronopus*	*A. prostrata*	*U. membranacea*	*E. cicutarium*	*R. bulbocodium*	*M. ambigua*	*O. calendulae*	Bare soil
2016	1.58±1.83	0.83±1.19	1.50±1.09*	4.92±2.50	0.83±1.40*	0.00	0.67±1.23*	0.00*	35.58
2018	1.92±3.18	5.75±11.50	0.00*	6.17±13.98	0.25±0.45*	0.00	1.25±1.71*	0.67±1.44*	14.83
2020	2.08±3.18	4.83±8.48	0.00*	0.00	0.08±0.29*	0.08±0.29	0.00*	3.00±2.26*	17.50
2022	1.67±2.46	1.58±2.39	0.00*	0.00	0.00*	0.00	0.00*	1.00±1.47*	22.00
2024	1.50±2.20	1.1±1.997	0.00*	0.00	0.00*	0.67±1.61	0.00*	2.50±1.19*	9.42

Table C.4 | Relative abundance of the most abundant species in the exclusion and control areas along the years. *statistical differences found among subareas.