Impact of light pollution on seabirds in Macaronesia and the role of systematic rescue campaigns in mitigation

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Introduction

Light pollution is a growing threat that disrupts natural rhythms in ecosystems, with both short and medium-term effects, ranging from hormonal alterations to disorientation. The group of Procellariiformes is specially affected by light pollution; they are attracted to artificial lights, becoming disoriented and can fallout, getting exposed to risks of injury or mortality.

Since the 1990s, rescue campaigns have been implemented as a mitigation measure, focusing on reducing mortality caused by light pollution during the time when juvenile Cory's Shearwaters *Calonectris borealis*, the most abundant seabird in Macaronesia, leave their nests. These campaigns have been successful in mitigating light-induced mortality, saving thousands of seabirds, and providing valuable information on the biology and ecology of these species. However, challenges persist regarding the lack of systematic monitoring of all grounded birds and the accuracy of numbers recorded by volunteers. Factors such as the distribution of breeding colonies, distance between light sources and colonies and difficulties in maintaining a consistent sampling effort, present obstacles in accurately estimating the real number of affected birds. A systematic survey and correct quantification of grounded birds are crucial to understand the magnitude of the fallout events and light-induced mortality, and in planning the efforts to minimize the effects of light pollution.

Methods

To address these challenges, the LIFE Natura@night project (years 2021-2025) is implementing systematic campaigns to standardize rescue methodologies and data collection from rescued birds, aiming to enhance knowledge for future mitigation measures. Systematic campaigns have been crucial to understand the magnitude of the light-induced mortality problem so that better mitigation measures can be implemented in the future.

With this objective, systematic transects were carried out in the Azores, Canary Islands and Madeira. Since 2022, for 14 days (23rd October – 5th November) during the peak fledging period for Cory's Shearwater, and twice a night, volunteers are performing 20 transects to save birds, collect information about their body condition and data on light features in coastal areas (Figure 1). From these transects, one is in Graciosa (Azores), 17 in Madeira and two in Canary Islands. A protocol, common to the three archipelagos, has been established, all rescued birds are being ringed and some preliminary studies on juvenile tracking is being performed in Madeira island (Figure 2).

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Figure 1. Systematic transect in Graciosa Island (Azores).

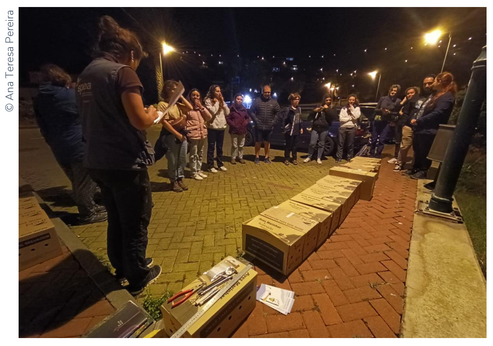

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Figure 2. Ringing session in Madeira.

Results

A total of 2,500 km of systematic transects have been conducted across Macaronesia every year.

On the first year of the project in Graciosa 25 Cory's shearwaters were rescued, 47 Cory's shearwaters in Madeira and 7 were rescued in the Canary Islands. In 2023, on the transect from Graciosa no bird was rescued, in Madeira we found 20 birds (two of them dead) and in Canary Islands 4 birds were found (see Figure 3). The number of birds found in 2023 was notoriously lower than in 2022.

In both years, the total of volunteers was 103, but with some differences between the archipelagos. In Madeira and Canary Islands more volunteers participated in 2023 but in Azores the campaigns were assured by the Natural Park staff (Figure 4).

In Madeira, some staff from the five partner municipalities had training about the methodology and seabirds and participated on the systematic transects, with the aim of participate on the campaigns in the future. All the volunteers had specific training about the methodology used.

The Figures 5 and 6 show the locations where the birds were rescued on the transects in the three archipelagos. In areas with more seabird activity and with bright lights was where a greater number of fallouts was observed. In the Figure 7 is shown an example of one of the locations where the number of birds rescued was the highest, in Madeira.

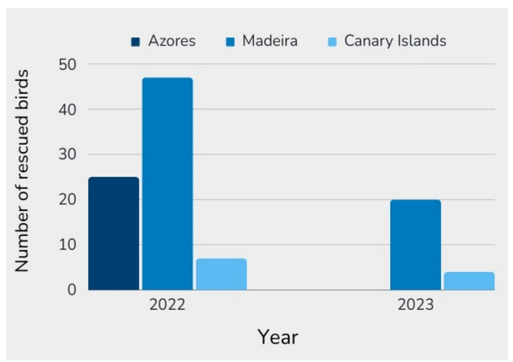

Figure 3. Number of birds rescued during the systematic campaigns per year.

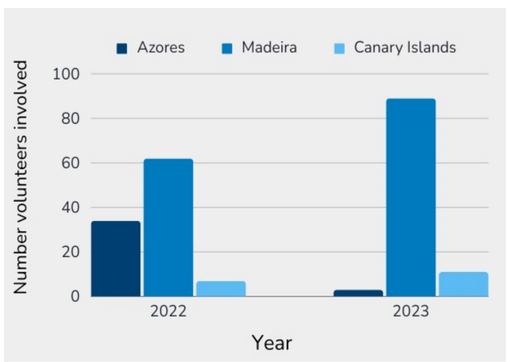

Figure 4. Number of volunteers that participated in the systematic campaigns per year.

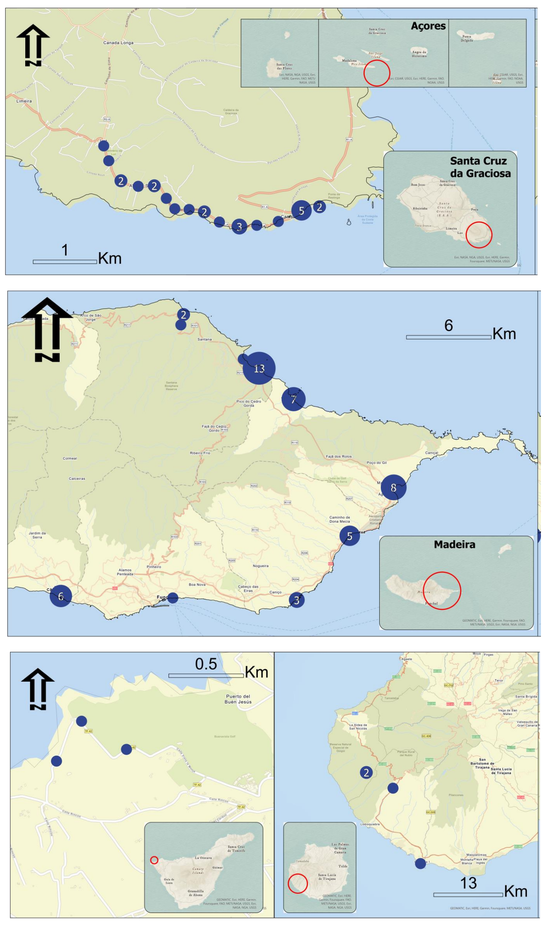

Figure 5. Seabird fallouts during the systematic campaigns of 2022, for Azores, (Graciosa) Madeira and Canary Islands (Gran Canaria and Tenerife).

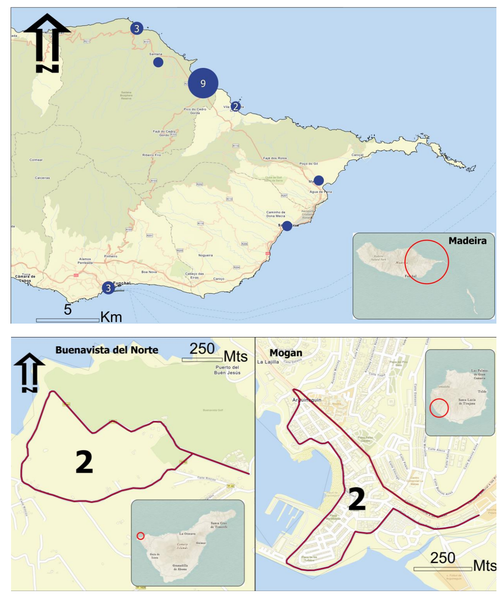

Figure 6. Seabird fallouts during the systematic campaigns of 2023, for Madeira and Canary Islands (Gran Canaria and Tenerife),

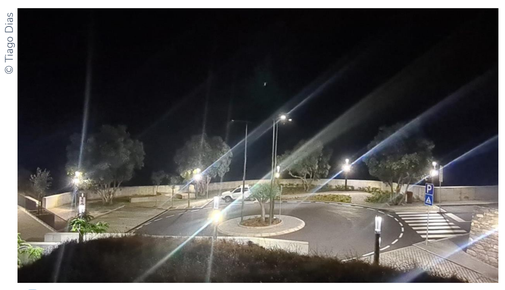

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Figure 7. One of the locations with the highest number of fallout of Cory's Shearwater in Madeira.

Discussion

The systematic transects have been conducted across Macaronesia allowed the identification of areas with higher incidence of bird falls, which can be linked to the proximity to breeding colonies and artificial and intense lighting with white colour. The impact of bright artificial light was very clear and that should be used as a guideline to mitigation measures and public light management.

Since the human effort was similar in both year, the differences between the number of birds found in 2022 and 2023 might be related to the moon phase and brightness. A higher number of fallouts is linked to darker nights, as occurred in 2022, and as an opposite to what was observed in 2023, when the full moon peak occurred during the systematic campaigns. This results can be explained by the fledglings being less disoriented and less attracted to the artificial light, when the moon is bright.

Systematic campaigns will continue in the coming years, alongside with public lighting modifications, which will allow an evaluation of the efficacy of this mitigation measure. We expect to have a clearer view of the variation of bird fallout and how does environmental variables (moon phase, moonlight, wind, etc) influence this phenomenon.

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