Zoologia Caboverdiana 8, 3, 58–65
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Artigo original | Original article

Translocation test of Cabo Verde shearwater *Calonectris edwardsii* on Raso Islet

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RESUMO

A translocação de crias de aves é uma metodologia utilizada para aumentar a probabilidade de recolonização de uma área onde outrora uma espécie nidificava, como é o caso da cagarra endémica de Cabo Verde *Calonectris edwardsii* que ocorria na ilha de Santa Luzia. Para que esta translocação seja exitosa, é importante primeiro verificar a aplicabilidade da mesma. Assim, este estudo teve como objectivo verificar o efeito de ninhos artificiais no crescimento das crias e no sucesso do abandono do ninho. Em Outubro de 2017, no ilhéu Raso foram translocadas 10 crias bem desenvolvidas (com dois meses) de ninhos naturais para ninhos artificiais. As crias foram alimentadas durante a noite e o desenvolvimento destas comparado com 10 crias de ninhos naturais. Não houve diferenças entre os grupos nas curvas de crescimento das crias nem no sucesso de voo, que foi de 100% para ambos. Os resultados demostraram que o peso diminuiu e o comprimento da asa aumentou em ambos os grupos, para que pudessem atingir a medida ideal para voar. Os resultados deste estudo contribuirão para a restauração da vida selvagem que antes existia em Santa Luzia de forma a melhorar o estatuto de conservação desta espécie.

Palavras-chave: crias de cagarra, dieta, ilhas, ninhos artificiais, sucesso de voo

ABSTRACT

The translocation of chicks is a methodology used to increase the probability of recolonization of an area where a species once nested, as is the case of the endemic Cabo Verde shearwater *Calonectris edwardsii* that occurred on the island of Santa Luzia. For this translocation to be successful, it is important to first verify its applicability. Thus, this study aimed to verify the effect of artificial nests on the growth of the young and their fledging success. In October 2017, 10 well-developed chicks (two months old) were translated from natural nests to artificial nests on Raso Islet. The chicks were fed during the night and their development compared with 10 natural nestlings. There were no differences between groups in the growth curves of the offspring or in the flight success, which was 100% for both. The results showed that the weight decreased and the wing length increased in both groups, so that they could reach the ideal measurement for flying. In this way, the results of this study will contribute to the restoration of wildlife that previously existed on Santa Luzia, in order to improve the conservation status of this species.

Keywords: artificial nests, diet, islands, fledging success, shearwater chicks

INTRODUCTION

Seabird populations are declining worldwide and, in part, due to threats they face on land (Hazevoet 1994). Predation by invasive animals introduced by humans and human capture are the main threats to seabirds in their nesting areas (Semedo *et al.* 2020). These threats have already caused local extinctions of some species of seabirds (Lopes *et al*. 2015). Once the threats that caused the decline or local extinction of a seabird population have been eliminated or reduced to negligible levels, methodologies can be used to help in the re-colonization of these areas (Geraldes *et al.* 2016). One of these methodologies is the translocation of seabird hatchlings from a reproduction area to the site where they were extinct. This procedure, defined by the movement of living organisms from one area to another mediated by humans, is complex and delicate. Knowledge of the biology of the species to be translated is essential, as well as its ecology.

Translocation, as a method of conservation, is undoubtedly an important tool, provided that certain aspects are taken into account, such as the intended objectives, choice of the adequate site, adequate transport of animals, efficiency in monitoring, feeding, possible threats that the species may face, among others. In other words, very careful planning is required for a successful translocation. Some studies have shown that the provision of artificial nests can increase knowledge about the reproductive biology of species that nest in cavities and may become a tool for their conservation (Robertson & Rendell 1990).

The Nature Reserve of Santa Luzia is the largest natural reserve in the country and comprises the uninhabited island of Santa Luzia (35 Km^2) and Branco (2.78 Km^2) and Raso (5.76 Km^2) islets (Freitas *et al.* 2015). After Cabo Verde colonization, whalers used the islands regularly, introducing mice and rats (Lopes *et al*. 2015). Later the establishment of shepherds with their domestic animals (goats and cats) would lead to the introduction of more mammal species on the island of Santa Luzia (Lopes *et al*. 2015). This has caused the disappearance of the shearwater, as a result of predation on chicks and adults, and other seabirds, such as *Pelagodroma marina* (Hazevoet 1994). At present, no seabirds are known to breed on Santa Luzia, although the presence of feathers found in crevices and of a possible nesting bird strongly point to the possibility of Cabo Verde storm petrels *Hydrobates jabejabe* attempting to breed at the cliffs (Oliveira *et al*. 2013, Geraldes *et al*. 2016, Semedo *et al.* 2020).

Santa Luzia has significant potential for seabird restoration by translocations once predators are removed because it is uninhabited, still has suitable habitats for their nesting and there are large colonies in the nearby islets (Hazevoet 2015). One of the main objectives of the local NGO Biosfera 1 is to restore the endemic species that existed on Santa Luzia, some of these dangerously isolated in the two islets (e. g. Raso lark *Alauda razae*), to improve their conservation status through their reintroduction (Geraldes *et al.* 2016). So, an extradition program of introduced predators has been carried out.

The Cabo Verde shearwater, *Calonectris edwardsii* (Oustalet, 1883) is an endemic species of Cabo Verde, classified as Near Threatened in the International Union for Conservation of Nature (IUCN) Red List (Birdlife International 2018), which uses different areas of the Atlantic Ocean during the non-breeding period (Hazevoet 1995). The species is classified as Endangered at the national level and also on Raso and Branco islets (Hazevoet 1996). Adults reach the breeding colonies during March (Hazevoet 2015). The laying of the single egg occurs in May and hatching occurs in July (Hazevoet 2015). The chicks are fed by both progenitors, leaving before sunrise, for the sea in search of food, returning to the nest after sunset (Navarro 2007). The chick remains in the nest, alone or in the company of a parent until the fledging time, between late October and early November (Murphy 1924, Hazevoet 1995). Similarly to other Procellariiformes, Cabo Verde shearwater has a high reproductive output, however, they are unable to replace an egg in case of losing it or the chick, resulting in failure of that reproductive season. Usually, the species nests in holes on the ground or rock cavities that can be very shallow in accessible or inaccessible coastal areas, such as cliffs (Hazevoet 2015). Cabo Verde shearwaters on Raso islet feed on the most abundant commercial fish species, such as *Sardinella maderensis*, bigeye scad *Selar crumenophthalmus* or scad *Decapterus sp* species, and non-commercial prey, like keelted needlefish *Platybelone argalus lovii* or squid *Loligo* sp. (Rodrigues 2014). Knowledge of the diet of the species is important for a successful translocation of the offspring, since translocated chicks need to be artificially fed. The main objective of this study was to verify the effect of the artificial nests on the growth of chicks during their development and abandonment of the nests.

MATERIAL AND METHODS

The Raso Islet (16°36’40.63”N, 24°35’15.81”W) is part of the Marine Reserve of Santa Luzia (Fig. 1) and it was declared as an Integral Reserve (Decreto-Lei Nº3/2003). It has an arid climate with a highly notable biological diversity (Freitas *et al.* 2015). Home to one of the largest populations of the Cabo Verde shearwater, Raso Islet is of great importance for the species. In 2018, a census was conducted on Raso Islet, and 6544 breeding pairs of Cabo Verde shearwaters were estimated (Paiva *et al.* 2015). The presence of important populations of other species, such as brown booby *Sula leucogaster*, red-billed tropicbird *Phaethon aethereus* and the endemic Raso lark *Alauda razae* increases the biological importance of the islet even more (Hazevoet 1995).

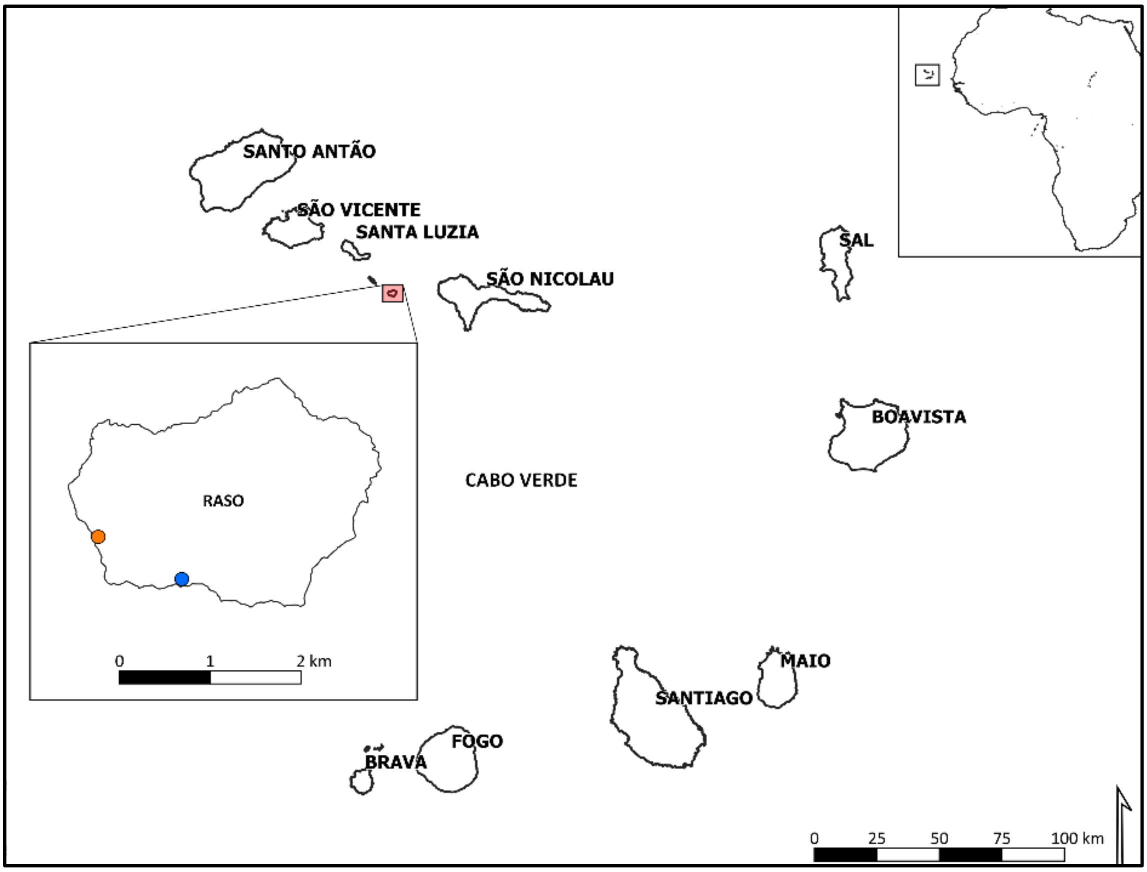

Fig. 1. Study site. Geographic location of Cabo Verde, Raso Islet in the Cabo Verde Archipelago, and the sites from where the seabirds were translocated (blue dot), and the artificial nets were set (orange dot).

In October 2017, 10 artificial nests were built on the southwest of Raso islet (Fig. 2). The nests were constructed with Bioflex cement and large stones, finishing with pebbles in front of the nest, to look as natural as possible. The site for the artificial nests was chosen and located in an area that is frequently used by shearwaters during the night. Subsequently, the nests were occupied by 10 chicks from the south of Raso. The translocated chicks were approximately two months old and from parents with successful reproduction in the past. The chicks, with indeterminate sexes, were randomly selected and were all well developed to facilitate the work (check raw data here: https://figshare.com/s/32624e8c376522cb629e), since during this period they are less frequently fed as they need to lose weight in preparation for fledging (Hazevoet 1995). The chicks were transported in October 04 in dark bags to avoid stress. Chicks, with initial weight between 470 to 710 grams, were hand-fed every day at night 100 g portions of fresh white seabream *Diplodus lineatus*, mackerel scad *Decapturus macarellus*, bigeye scad *Selar crumenophthalmus*, Cabo Verde mullet *Chelon bispinosus*, and one species of mollusc, the Atlantic white-spotted octopus *Callistoctopus macropus*.

Fig. 2. Construction of artificial nests for Cabo Verde shearwaters *Calonectris edwardsii* in the southwest of Raso Islet, Cabo Verde (photos by K. Delgado).

Additionally, ten chicks were randomly selected from a southwest population on Raso Islet to serve as controls. Both translocated and control chicks were monitored three times per week in the mornings. During this monitoring, biometric data was collected – length of wings, and weight. The wing measurement was taken using a ruler (± 0.5 mm) and weight using a spring scale (± 10 g). The chicks were always measured and weighed by the same person. These data were collected until the chicks were able to fly (mid of November). The information gathered was compiled into a database made available on Figshare (https://figshare.com/s/32624e8c376522cb629e). Dynamic tables were built to allow data analysis of the mean values per week of both variables. To compare the values of the chicks from artificial and control nests, 5 t-tests were performed between (1) the mean wing length and (2) mean weights in the translocation day, so we may say that the later differences will be due to translocation; (3) the mean maximum weights; and (4) the mean wing length and (5) weights before fledging of the two groups.

RESULTS

Of the 10 translocated shearwater chicks, all survived and fledged. The first juveniles of shearwater began to fly on the fourth week of monitoring. Regarding the mean wing lengths of the initial and final of the test between translocated and control juveniles, they did not present very different values (initial t_9= -2.19; p= 0.20; final t_9= 0.23; p= 0.40; Fig. 3). In the first few weeks, the mean wing length of the juveniles of translocated shearwater was slightly higher those of the control. However, from the fourth monitoring week, there was a slight reduction in the average wing length of translocated shearwater juveniles, which remained practically constant until the fledge of the chicks. The values of the initial and final weight (t_9= 2.39; *p*= 0.02; t_9= 2.39; *p*= 0.02) were significantly different between groups, but not the mean maximum weight before the fledge of juveniles (t_9= 0.84; *p*= 0.20; Fig. 3).

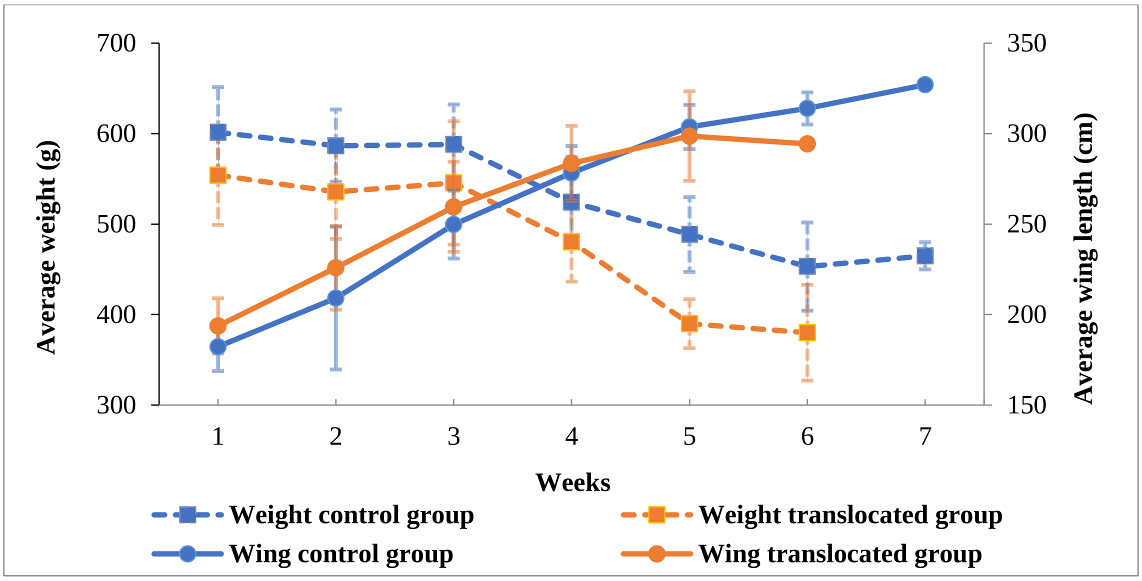

Fig. 3. Results of the artificial nest experiment. Weekly variation of the average (± standard deviation) of the weight (dashed lines) and wing length (full lines) of the 10 translocated (in orange) and the 10 control (in blue) shearwater *Calonectris edwardsii* offsprings of Raso Islet, from translocation until fledging.

DISCUSSION

The translocation test proved to be viable for future translocations of Cabo Verde shearwaters, as all 10 translocated chicks survived and fledged. The fact that the chicks were removed from their original nests and translocated to artificial nests did not affect their wing growth in comparison to the control chicks, similarly to translocations performed in other seabird island populations (Miskelly *et al.* 2009). In fact, according to Rodrigues (2014) the average wing length of the actual translocated shearwater juveniles (250.1 mm) does not differ much from the average wing length of the juveniles of the 2014 campaign (310.0 mm), also conducted on Raso Islet. However, even if the translocation is successful and all chicks fledge, it does not mean that they will nest there (Oro *et al.* 2011). Monitoring of demographic, behavioural and ecological parameters after reintroduction several years after translocation is essential to measure its success and make strategic adjustments, if necessary (Bambirra & Ribeiro 2009).

The diet based on selected prey were sufficient to guarantee the body growth of the translocated chicks, since they did not present significant differences in maximum body mass in relation to the other chicks. However, translocated chicks were significantly lighter than the controls and previously monitored chicks before fledging (Rodrigues 2014). This may be due to differences in the sex ratios of the two groups, which were unable to be determined. This observation does not diminish the adequacy of the tested diet for translocation, as this issue may be resolved in future translocations increasing the proportions of food given to the translocated individuals or the frequency they are fed.

Both the translocated and control chick started to lose weight in the third week of monitoring. Weight loss is due to the fact that shearwaters, when still underdeveloped, present a much larger weight, but over time, they begin to lose weight in order to be able to fly to the sea (Lack 1968). Most translocated chick flew in the 6th week of monitoring, while control chick flew between the 6th and 8th week of monitoring. This may indicate that the translocated chicks could be older than the control ones, even though their wing length was similar. Therefore, weight should be also used to estimate age in the following studies.

CONCLUDING REMARKS

The juveniles of translocated shearwater all survived and flew, which leads us to believe that the method was effective, taking into account the result obtained. However, the success of this method can only be evaluated after the natural occupation of the nests by adults in the following years, as this was only a test. If occupied, we can build more nests on Santa Luzia and reintroduce this important Cabo Verde endemic species.

ACKNOWLEDGEMENTS

This work was undertaken in the scope of the GEF-SGP Project, with the support of the Sociedade Caboverdiana de Zoologia Desertas Fund supported by GEF-SGP (CPV/SGP/OP5Y1/CORE/BD/11/13). Special thanks to all the team that was on Raso during data collection, especially K. Chantre and S. Antunes for their support. To J. Ramos and V. Paiva of the University of Coimbra for the support in writing the project.

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Received 10 November 2020
Accepted 29 December 2020