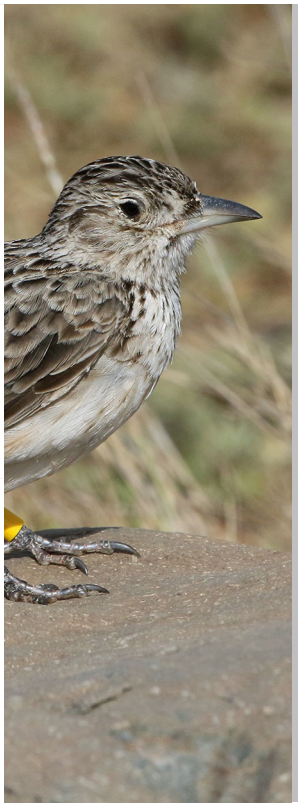

LESSONS AND SURPRISES FROM AN INTER-ISLAND RE-INTRODUCTION OF THE CRITICALLY ENDANGERED RASO LARK *ALAUDA RAZAE* OF CAPE VERDE

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ABSTRACT

Confined to a single island where its small population fluctuates in response to rainfall, the Raso lark is likely to remain Critically Endangered unless a second population becomes established. This paper reports translocations of larks, 37 in 2018 and 33 in 2019, to the nearby island of Santa Luzia where the species existed until about 500 years ago. Both islands lie within the Reserva Natural Integral de Santa Luzia. While the hard release protocol proceeded without mishap, problems with radio-tagging the released birds were encountered. However early indications are encouraging; the released birds have bred, and their annual survival is not substantially worse than that of larks on the source island, Raso. Unexpectedly, the study documented several natural, unassisted movements of larks from Raso to Santa Luzia (and, less unexpectedly, of translocated birds returning to Raso). The ultimate outcome of the project remains uncertain since eradication of Santa Luzia's introduced cats, possible predators of the larks, was interrupted when the island was evacuated because of the Covid-19 pandemic.

Key words: island restoration, threatened species, population growth, immigration, hard release, radio tagging, Reserva Natural Integral

INTRODUCTION

Since its scientific description (Alexander, 1898), the Raso lark *Alauda razae* has been confined to the 7 km² islet of Raso, the largest island in the Cape Verde archipelago that has never been permanently inhabited by people. Although smaller than its sister species, the Eurasian skylark *A. arvensis* (Dierickx, 2018), the Raso lark, typically 18–22 g, shows dietary similarities; while invertebrates are delivered to nestlings, the diet of non-breeding birds is principally plant material, including seeds, gleaned from the barren plains of Raso (Donald & Brooke, 2006). There the species' population fluctuated between about 20 and 130 pairs during the second half of the 20th century (Donald et al., 2003). From 2001–2019, annual monitoring has continued to document fluctuation from a low of 57 individuals in 2004 to between 900 and 1,550 individuals from 2011–2019 (Brooke, 2019, pers. obs.). These fluctuations have been driven largely or entirely by rainfall; after rain birds breed and the population increases rapidly, but periodic long droughts can cause the population to sink to very low levels (Brooke et al., 2012; Brooke, 2018 Dierickx et al., 2019). Confined to a single island and with a population that fluctuates greatly and is often below 100 individuals, the species is classified as Critically Endangered and, given its single island status and small population, will almost certainly remain so in the absence of active conservation intervention. Translocating a portion of a threatened population to a new locality is a common conservation action (Fischer & Lindenmayer, 2000) and is the most obvious candidate intervention in the case of the Raso lark. With annual

survival exceeding 80% (Dierickx et al., 2019), which is high for a small passerine, the lark has a life history that is associated with successful translocations (Ducatez & Shine, 2019).

Subfossil studies have revealed that the lark previously occurred on three other Cape Verde islands, São Vicente, Santo Antão and Santa Luzia (Figure 1; Mateo et al., 2009). The species' disappearance from those islands occurred at roughly the time the archipelago was permanently settled by people in the mid-fifteenth century, and was presumably caused by the habitat changes and introduction of alien species arising from settlement. Of the three islands, São Vicente and Santo Antão retain substantial human populations and have never been seriously considered for a lark re-introduction. The focus has been on 35-km² Santa Luzia, 16 km at the nearest from Raso. Both islands lie within the Reserva Natural Integral de Santa Luzia and have similar habitat. Whilst Raso has never been inhabited and has no mammals, Santa Luzia was inhabited in the past and is occupied by two species of non-native mammal, cats *Felis catus* and mice *Mus musculus*. Today neither island supports permanent human habitation but both receive frequent overnight visits from fishermen.

The possibility of a lark re-introduction to Santa Luzia was first considered around 2008 when the Raso population had increased from its 2004 low point to around 200 birds. A serious worry was the possibility that the cats on Santa Luzia would kill the larks soon after their release there. This triggered discussion about whether a reintroduction at this time would be contrary to the IUCN (2013) guidelines which stipulate that "There should be confidence that these past causes [of local population extinction] would not again be threats to any prospective translocated populations". However, it was evidently impossible to establish that cats were actually responsible for the larks' disappearance 500 years in the past, especially as another lark species, the bar-tailed lark *Ammomanes cinctura*, has persisted alongside cats on Santa Luzia, albeit in small numbers. On the other hand, the alternative argument was made that any such project would, at the worst, likely provide methodological lessons that could prove useful in the

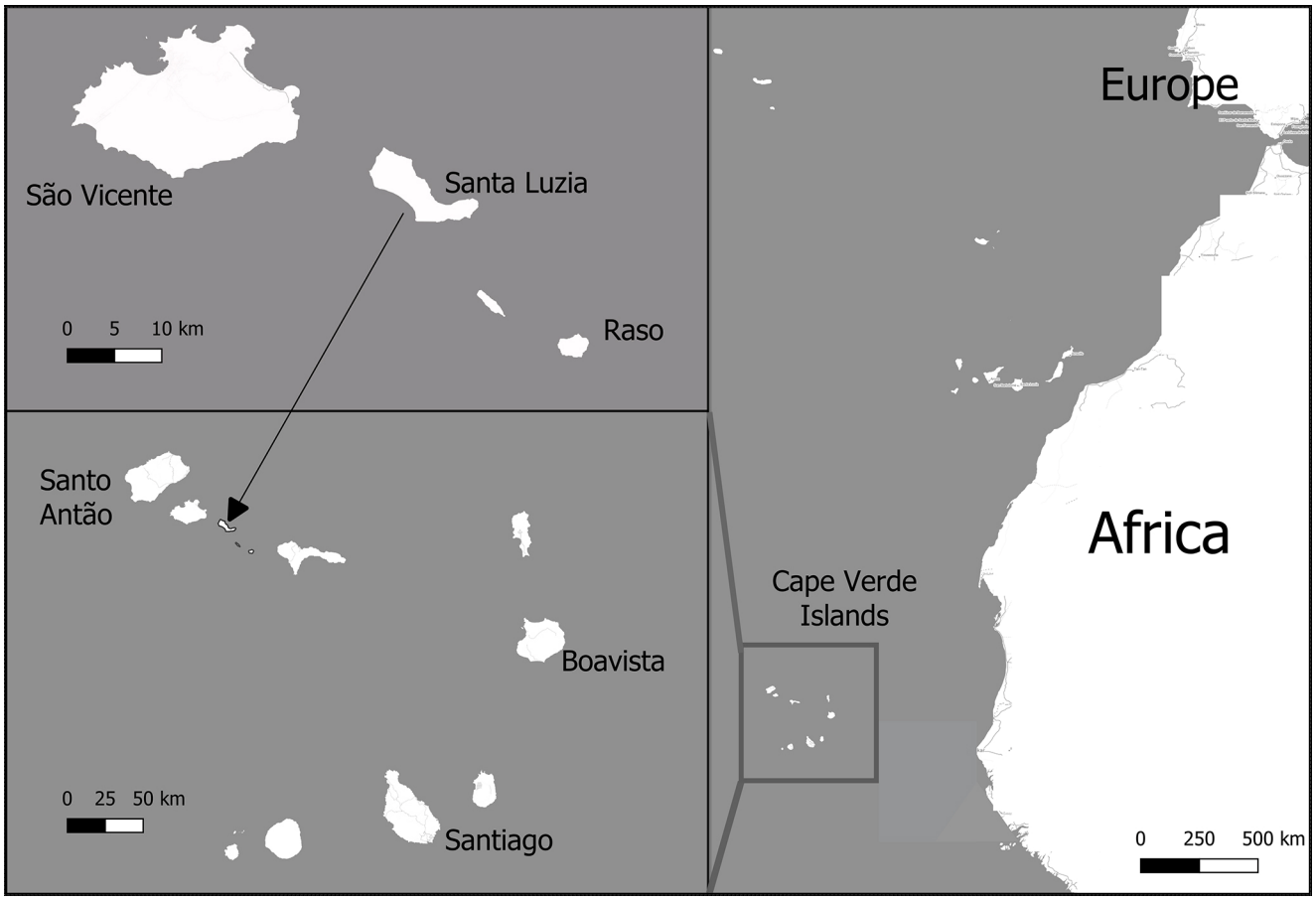

Figure 1. The geographical position of the Cape Verde archipelago, including the islands of Raso and Santa Luzia

A recently-released colour-ringed Raso lark on Santa Luzia, showing the protruding radio antenna ©Paul Donald

future. This would be within the spirit of the IUCN guidelines "where significant uncertainty exists, an experimental approach within the translocation programme can provide guidance for implementation". Moreover, the Raso population, at that time around 200 and with a strongly male-skewed sex ratio (Brooke et al., 2012), could arguably 'spare' males to provide the lessons.

There matters rested until the Raso lark population frequently exceeded 1,000 post-2011, and a grant was awarded in 2017 to SPEA (Sociedade Portuguesa para o Estudo das Aves or Portuguese Society for the Study of Birds, the BirdLife Partner in Portugal) by the MAVA Foundation for ecological restoration of Santa Luzia. Key components of this wide-ranging restoration project would be the eradication of cats from Santa Luzia and translocation there of larks from Raso. The question then was whether to embark on translocation while cat eradication was still in progress, albeit with cat numbers much reduced, or to delay until total eradication. A decision in favour of the former was made and plans drawn up for the first translocation in April 2018, when cat numbers were reduced by approximately 50%, to a density under two per square kilometre (Geraldes et al., 2016). The proposed lark translocation therefore followed in the footsteps of other passerine translocations undertaken elsewhere, for example in New Zealand (Armstrong & Craig, 1995; Armstrong & Ewen, 2001), the Seychelles (Wright et al., 2014) and the Hawaiian Islands[1]. In all cases, the aim was to establish additional populations of island species existing in limited numbers on one or a few small islands (Taylor et al., 2017).

PLANNING THE TRANSLOCATION

April was chosen as the translocation month, partly because of the availability of key personnel but also for biological reasons. It was a time of year when Raso larks were unlikely to be breeding (the main breeding season is between September and December; Donald & Brooke, 2006). Thus there was minimal risk that birds would inadvertently be removed from parental duties, with fatal consequences for eggs or chicks. Furthermore, it was assumed they would be minimally motivated to return from Santa Luzia to breeding territories. In fact such motivation may be lowest in newly-independent juveniles, but catching such juveniles in reasonable numbers after a period of successful breeding, a period that could not be predicted in advance, was unrealistic. Furthermore, the distinctive juvenile plumage is soon moulted out, after which young birds become indistinguishable from adults even in the hand.

For the first translocation, in 2018, the intention was to move 30–40 birds from Raso to Santa Luzia, a total at the lower end of the range suggested by Tracy et al. (2011) if the aim was to ensure the genetic diversity of the donor population was retained in the newly-established population. However, this total was partly determined by the likely number of birds that could be caught each day, and the number of days that a boat could remain on station to effect the transfers to Santa Luzia. The total number of birds removed from the Raso population was therefore unlikely to impact the long-term trajectory of the population since it was currently quite large (Bain & French, 2009), exceeding 1,500 birds.

Birds would be caught from 15:30 (local time) onwards, a timing that would deprive each bird of at most 2.5 hours of late afternoon feeding. They would be retained individually overnight in large cloth bird bags, transferred by boat overnight or early the following morning to Santa Luzia, and then released as soon as possible after dawn. This would be a 'hard' release with no pre-release familiarisation to the novel Santa Luzia environment, no anti-predator training, and no provision of supplementary food and water. In the absence of any contra-indications, this release protocol was chosen simply because it was logistically the easiest and also the least costly; in the event (see below), it proved entirely satisfactory.

PROGRESS IN THE FIELD

Translocation in 2018

As anticipated, Raso was dry when we arrived on 11 April 2018, and there were no signs of lark breeding activity. Most birds were in heavy wing moult, indicating

that breeding had ceased since larks in this genus have only a single post-breeding annual moult. Furthermore, most birds were gathered in roving flocks of 30–200 individuals, a further indication that little or no breeding was taking place. These flocks are difficult to approach closely, and larks correspondingly difficult to catch. It quickly became evident that the best prospects for catching birds were offered by the area close to the camp (and principal landing) where feeding birds dig into the ground (Donald et al., 2007), especially in the late afternoon which, conveniently, was the designated catching period.

During the course of the first catching session (14 April), we learnt that the birds in the digging area were mostly male (7 males and 1 female caught). On subsequent evenings, we deliberately attempted to target the smaller-billed females but the catch remained male-biased (Table 1). Each bird captured was measured, blood-sampled and given both a metal ring and a unique colour-ring combination. Every combination included a colour, pale blue, that was never used on Raso among the approximately 1,000 colour ring combinations used there since 2002 (Dierickx et al., 2019), meaning that it would be possible, at a glance, to identify any bird returning from Santa Luzia to Raso.

Each day's batch of birds was taken aboard the Biosfera vessel, *Jairo Mora Sandoval,* at dusk without incident. The birds were then roosted overnight in suspended bird bags in a quiet dark room aboard the vessel which set forth to Santa Luzia at dawn the following morning. No food or water was provided.

On arrival at Santa Luzia, birds were taken ashore immediately, and ferried in their bags to the release point (Figure 2). On the first two days, radio tags (Biotrack PicoPip 392) were glued to a patch of skin on the back of all 12 birds immediately prior to release to facilitate tracking the birds and assessment of their habitat use. Then the day's batch of birds was released simultaneously.

Four and a half hours after the first release on 15 April, a headless lark and another tag with many feathers plucked were found near the release point where a neglected kestrel *Falco (tinnunculus) neglectus* was in residence. On the second release day, birds were released in a different area (Figure 2) but again some birds were predated. It was thought that a single pair of kestrels, nesting on a cliff less than 1 km from the initial release site, was responsible for all these predations. Although predation by kestrels of larks was not seen, there was plenty of evidence that kestrels were responsible for the rapid disappearance of tagged larks. On one occasion, researchers spent several hours tracking a tag before realising that the signals were coming from a kestrel, which had presumably ingested the tag. Tag signals were also detected coming from the kestrel nest, indicating that larks had been taken there. In due course, evidence emerged from whole or partial corpses that kestrels killed at least six of the 12 birds released on the first two days. Although kestrels also occur on Raso, the fact that the Santa Luzia kestrels had chicks in the nest and the larks' lack of familiarity with their new environment may have contributed to the predation. Furthermore, although the tags themselves were hidden under the larks' back feathers, the black protruding antennae often glinted in the sunlight and may have attracted the kestrels, as researchers following the birds could clearly see the reflections from a distance.

On subsequent days, the remaining 25 birds were released without radio tags, due to concerns that the

Table 1. Details of Raso larks caught on Raso and taken to Santa Luzia where they were released as specified

Date caught on Raso	No. males	No. females	Time of release on Santa Luzia next morning	Release square (see Fig. 2)	Release comments
14	7	1	08:35	F5	Radio-tagged
15	2	2	11:06	F4	Radio-tagged
16	6	2	10:40	D1	Not radio-tagged
17	5	2	10:00	D1	Not radio-tagged
18	4	3	10:30	E2	Not radio-tagged
19	1	2	10:40	E2	Not radio-tagged
Totals	25	12			

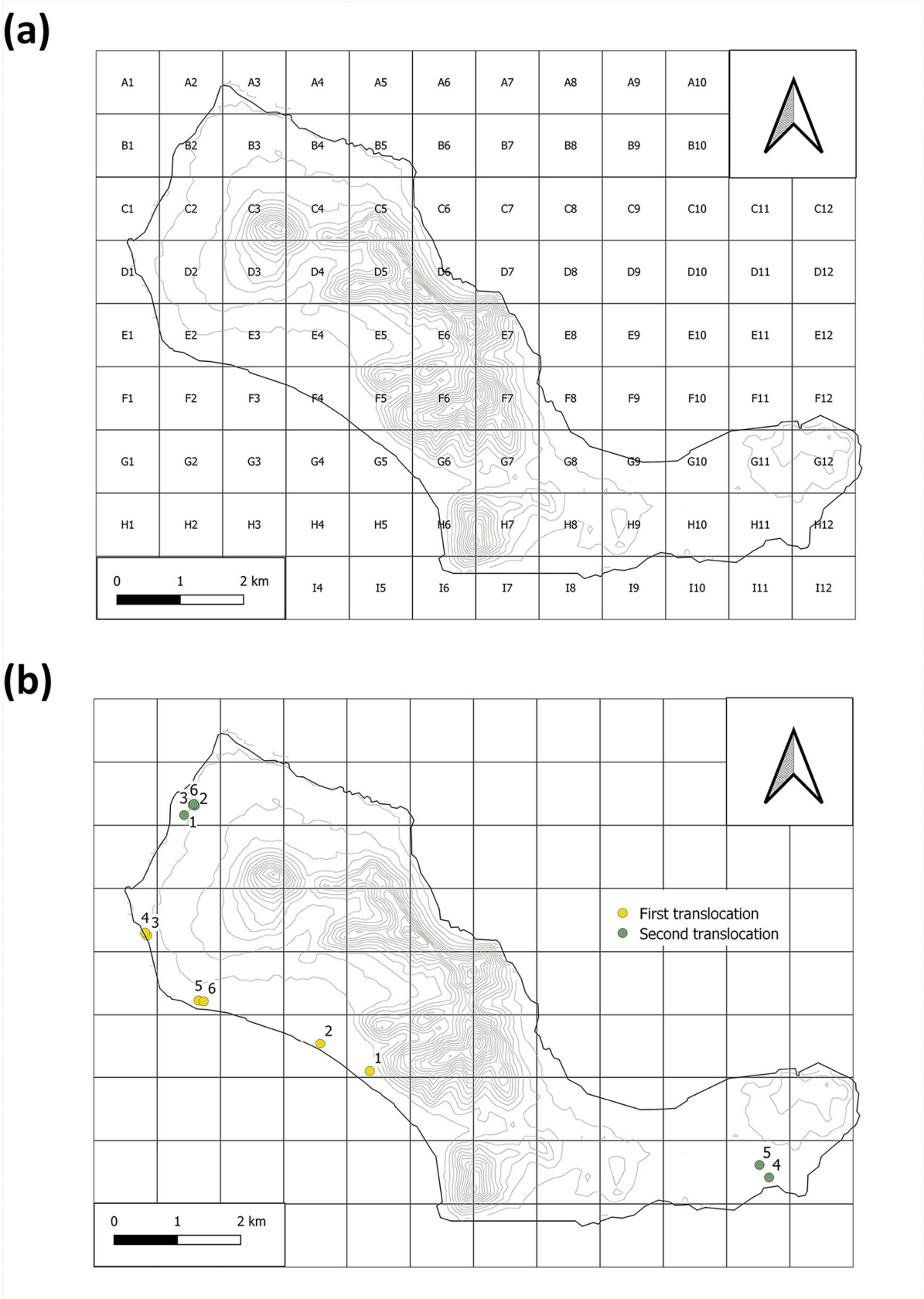

Figure 2. (a) Base map showing 1-km grid squares referred to in text and tables and (b) points where Raso larks were released over six days (1–6) in 2018 (yellow) and 2019 (green)

antennae were contributing to predation. The events associated with radio-tagging exemplify how translocation projects can be disrupted by events wholly unanticipated during planning.

Following the problems with radio tags, it was possible to use the tags to follow only two birds on Santa Luzia into May beyond the initial post-release days. Both moved 2–3 km from the release sites (F4 and F5; Figure 2) to the north-west (E2), with no indication of excursions to other parts of the island.

Observations made over the following seven months indicated that the birds remaining on Santa Luzia were mostly seen in the north-west (B2 and C2) and south-east (H11), with one bird known to have visited both areas. The decline in the number of translocated birds on Santa Luzia (Figure 3) was faster than would have occurred if Santa Luzia birds experienced an annual survival of 82 percent, the average rate on Raso (Dierickx et al., 2019).

In addition to death, numbers may have diminished due to emigration; one bird, a male, released on Santa Luzia on 16 April and last seen on that island on 21 September, was sighted back on Raso in mid-November in the exact area where it had been caught. Conversely, the Santa Luzia population was supplemented by natural unassisted immigration; a female, colour-ringed on Raso in November 2017, was sighted on Santa Luzia in October 2018.

The translocated birds that survived had apparently adapted to the Santa Luzia environment as evidenced by breeding; a young fledgling was seen in the north-west (Square E2) in July, well before the first signs of breeding activity on Raso, in September. In addition, the natural immigrant female mentioned in the previous paragraph bred with a translocated male in the south-east of the island (Square H11). Although no nest was found, three recently fledged young were seen.

The overall population trajectory resulting from the first translocation, the combination of translocated birds, immigration and successful breeding, is shown in Figure 3. Total numbers could be somewhat underestimated since Santa Luzia is sufficiently large that some Raso larks present could easily escape detection.

A supplementary translocation?

At the start of 2019, at least 12 Raso larks remained on Santa Luzia, prompting the question: Would it be wise to top-up the population in the near future? Arguments for and against such a course of action were as follows:

In favour of an early second top-up translocation

- The small population on Santa Luzia was demographically vulnerable and possibly genetically impoverished,

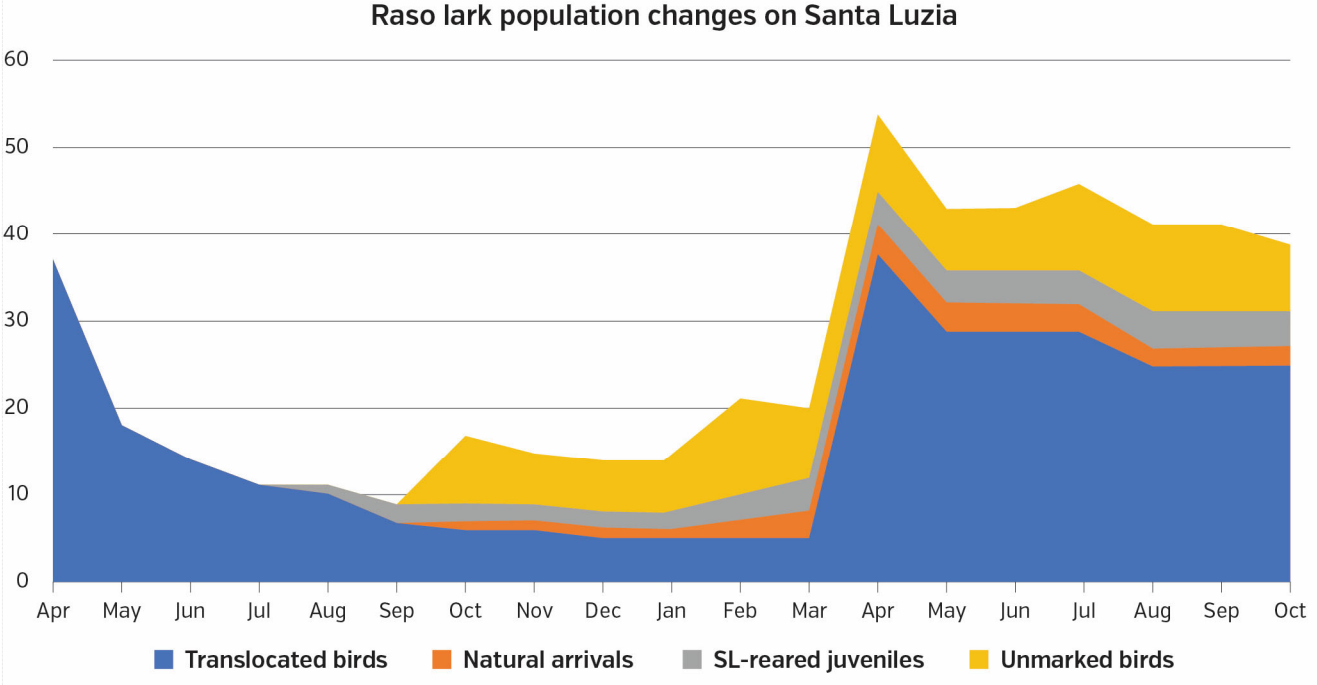

Figure 3. Minimum numbers of Raso larks on Santa Luzia from April 2018 until October 2019

- The distribution of the larks already present on Santa Luzia indicated the best habitats and safest release locations for newly-translocated birds, possibly reducing short-term post-translocation mortality,
- The Raso population, which at the time was high (ca. 1,500 birds), could withstand removal of further birds.

In favour of delaying a second top-up translocation

- A further top-up translocation would involve time, effort and expense
- Knowing now that larks can fly between islands in both directions, further colonists could arrive on Santa Luzia and naturally boost the population,
- The Raso population can multiply 5-fold following a couple of rainy years (Brooke et al., 2012). A similar increase by Santa Luzia's population would render a further translocation unnecessary,
- Given the unexpectedly high genome-wide variation among Raso larks (Dierickx et al., 2020), the birds on Santa Luzia were likely to be genetically variable,
- Cats (< 10) were still present on Santa Luzia. It would make sense to delay any top-up translocation until they had been totally eradicated.

These arguments were presented in January 2019 to approximately 20 conservation practitioners working at the David Attenborough Building, University of Cambridge. Noting especially the small size of the Santa Luzia population, approximately 80 per cent of the group favoured an early second translocation, plans for which were duly instigated. At this stage two more

Transporting the larks, suspended in bird bags in water-resistant blue plastic bin, from Raso to the dinghy and thence the larger inter-island vessel ©Laura Castello

colour-ringed females from Raso, also ringed there in 2017, were sighted on Santa Luzia, one in February and one in April 2019. Thus three colour-ringed females are known to have moved naturally from Raso to Santa Luzia. This hint of female-biased natural dispersal in the Raso lark matches the widespread pattern of female -biased dispersal observed among birds (Greenwood, 1980). Since the proportion of all birds on Raso that were colour-ringed was about one-third, it may be that the total number of natural movements to Santa Luzia in the year to April 2019 was 8–10.

Translocation in 2019

Once again Raso was dry when the catching team arrived in late March 2019, and there were no signs of lark breeding activity. With most birds in unapproachable flocks, we again largely caught birds in the area close to the camp where birds dig into the ground for food, especially in the late afternoon. Some birds were attracted to the net by water and/or biscuit crumbs, a ploy which helped us assess a bird's sex before it was caught, and so avoid catching a large excess of males which, as in 2018, were the more numerous in the camp area (Table 2). Birds were measured, blood-sampled and given both a metal ring and a unique colour-ring combination. As in 2018, every combination included a pale blue ring, never used on Raso.

The transport and release protocol was identical to that pioneered in 2018. No food or water was provided, and no birds were radio-tagged. As indicated in Table 2, 22 birds were released in the north-west of Santa Luzia near the Agua Doce lighthouse (B2: Figure 2) and 11 in the Francisca area in the south-east (H11: Figure 2). These two areas were selected since they were the focus of activity of the roughly 20 birds already present on Santa Luzia, and therefore presumably offered the most suitable habitat.

By the end of April 2019, 18 of the 33 released birds had been seen at least once between one and 13 days after release. All detected birds were seen either in the release square or one square away. Monitoring was intermittent in May–September but more intensive in October–November when 20 of the 33 birds released in 2019 were sighted on Santa Luzia. Since a further three (see below) are known to have returned to Raso, survival of the larks translocated in 2019 was clearly higher than in 2018, because immediate kestrel predation was largely or wholly avoided and perhaps also because birds were released in the areas known to be preferred where they joined other birds already present.

Table 2. Details of Raso larks caught on Raso in 2019 and taken to Santa Luzia where they were released in the area specified, in all cases no later than 10:00 on the day after capture

Date caught on Raso	No. males	No. females	Release square (see Fig. 2)
28 March	5	1	B2
29 March	3	4	B2
30 March	3	3	B2
31 March	5	1	H11
1 April	2	3	H11
2 April	1	2	B2
Totals	19	14	

In October 2019, the minimum Santa Luzia population was about 40–50 individuals, comprising five and 20 from the 2018 and 2019 translocations respectively, two colour-ringed natural immigrants and about 15 unringed birds. This latter group probably included both birds raised on Santa Luzia (a minimum of four: Figure 3) and unringed unassisted immigrants from Raso.

Although recently-fledged juveniles seen in 2018 had provided conclusive evidence of successful breeding on Santa Luzia, it was not until November 2019 that two nests were found, both in square B2. One nest had a single egg that did not hatch, the other had a single egg that did not hatch plus a chick that successfully fledged.

Birds returning to Raso

Following the single bird known to have returned to Raso from the 2018 releases, three birds translocated to Santa Luzia in March/April 2019 had returned to Raso by the time of the annual November monitoring visit. These included two males caught near our camp. This was exactly the area to which they returned, and both were actively breeding in November (nests found). The third was a female which was caught about 800 m north of the camp. She too returned from Santa Luzia to her capture area, but we obtained no evidence she was breeding.

More remarkable was a non-translocated female ringed on Raso in November 2017. She was then observed in square H11 in the south-east of Santa Luzia on several dates between 25 October 2018 and 13 February 2019 during which period she bred successfully (see above), before returning to Raso. There she was observed in

Releasing Raso larks on Santa Luzia ©Jesús Martinez

November 2019 in Cha da Castelo around 500 m east of the original ringing location.

2020 UPDATE AND CONCLUDING OBSERVATIONS

The Raso lark has shown itself tolerant of a hard release protocol. However, the project outcome remains uncertain since the 2020 coronavirus crisis led to the evacuation of all project personnel in late March. Intermittent work began again on the island in late May. This chain of events has reduced the chance that the remaining cats, believed to number at most six, will be eradicated in 2020. Since there is every likelihood that those remaining cats include both males and females, the population will probably rebound. Although neither planned nor desired, this chain of events does potentially provide an experimental test of whether Raso larks can persist alongside cats. Since evidence accumulated by the project suggests Santa Luzia is suitable for Raso larks, those larks present in early 2020, supplemented by any further immigrants from Raso, may establish a viable long-term population if the impact of cats proves to be slight. On the other hand, if the lark population disappears, particularly once the cat population grows, the prudent course may be to delay a further translocation until cats have been totally eradicated from Santa Luzia.

While the return of some translocated birds to Raso across 16 km of sea was not unexpected, Raso larks had never been seen on Santa Luzia prior to this project. Therefore the unassisted movements of three colour-ringed birds from Raso to Santa Luzia was not anticipated, even allowing for the single 2009 sighting of a Raso lark on Sao Nicolau some 20 km to the east of Raso (Hazevoet, 2012). Although greater observer effort on Santa Luzia of course increases the chance of seeing visiting larks, it seems probable that larks have been

visiting Santa Luzia for years, but only sighted recently. This could be because the visiting larks were not killed by cats in 2018 and 2019, and therefore survived to be seen, and/or it could be that the presence of translocated larks has provided sufficient social attraction to prompt any arriving immigrants to linger.

To our knowledge, possible social attraction has not been recorded in other passerine translocation projects. For example, the Seychelles warbler *Acrocephalus sechellensis*, now with a global population of about 3,000 birds[2], has been translocated from Ile Cousin to four other islands, in some cases across sea distances under 10 km (Wright et al., 2014). Only six cases of inter-island dispersal have been documented in this large project (Hannah Dugdale, in litt.). On the other hand, the rapidity with which some seabird populations grow after removal of mammals implies visitation by prospecting pre-breeders (Brooke et al., 2018), as does the success of some seabird attraction projects involving model seabirds and/or acoustic cues (Jones & Kress, 2012). If social attraction is a factor influencing the success of other avian re-introduction projects, it argues for reintroductions to be as near to the source population as practical.

ENDNOTES

[1]https://pacificrimconservation.org/conservation/bird-translocations/

[2]http://datazone.birdlife.org/species/factsheet/seychelles-warbler-acrocephalus-sechellensis/text

ACKNOWLEDGEMENTS

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STOP PRESS LATE OCTOBER 2020

Although Covid-19 restrictions will preclude the detailed annual monitoring on Raso in November 2020, the news from Santa Luzia is positive. Regular monitoring throughout the island has detected no further sign of cats since mid-July. Seven pairs of Raso larks were known to be actively breeding (five nests plus two pairs feeding juveniles) in October 2020. Furthermore, early indications suggest that populations of native reptiles and other landbirds have increased.

ABOUT THE AUTHORS

Michael Brooke, a member of Cambridge University's Zoology Department, has maintained the long-term Raso lark study with annual visits from 2002 to the present. He also has a long-standing interest in seabirds and island restoration, particularly via the removal of alien mammals.

Lee Gregory has had a lifelong obsession with Western Palearctic birds. An accomplished rare bird finder with four national firsts to his name in the Canary Islands, Cape Verde, Gambia and Kuwait, Lee was formerly Assistant Warden at Fair Isle and Dungeness Bird Observatories. A qualified British Trust for Ornithology bird ringer, he is currently working in Primary School Education in South Wales as a site manager.

Pedro Geraldes is a biologist and certified ringer who has dedicated his career to the recovery of threatened species and habitats, mainly with seabirds and invasive species. Working for SPEA since 2004 he has participated in and coordinated several conservation projects with strong public visibility and local stakeholders' involvement. Since 2012 he has managed projects on the marine reserve of Santa Luzia, together with the local NGO Biosfera I.

Laura Castelló graduated in Biology at the University of Valencia (Spain). Following an Erasmus exchange visit to the Faculty of Sciences of Lisbon, she did an internship at Madeira Natural Park in the LIFE Ilhéus do Porto Santo project. In March 2012 she started her collaboration with SPEA Madeira as a volunteer within the European Voluntary Service, and from October 2013, as a conservation officer in several projects. In 2018 she collaborated for seven months on the conservation project in the Santa Luzia Reserve, Cape Verde.

Paul Donald is Senior Scientist at BirdLife International and Honorary Research Fellow at the University of Cambridge. He has a particular interest in larks and has worked on all the world's rarest species.

Tommy Melo is a biologist, dedicated to the conservation of species and habitats, especially the creation and sustainable management of marine protected areas in Cape Verde. He is a co-founder of the Cape Verdean NGO Biosfera 1 for the conservation of nature, and its President since 2014.

Joana Bores developed a passion for island conservation in 2011 when she built a Cory's shearwater

artificial nest on Berlengas Island (Portugal). She then decided to study Marine Biology and dedicate herself to the recovery of species and islands. She has been working in SPEA since 2016 on different island restoration projects, and since 2018 has been responsible for Raso lark monitoring on Santa Luzia.

REFERENCES

Alexander, B. (1898). An ornithological expedition to the Cape Verde Islands. *Ibis* 4: 74– 118.

Armstrong, D.P. and Craig, J.L. (1995). Effects of familiarity on the outcome of translocations. 1. A test using saddlebacks *Philesturnus carunculatus rufusater*. *Biological Conservation* 71: 133–141. doi: 10.1016/0006-3207(94)00027-N

Armstrong, D.P. and Ewen, J.G. (2001). Testing for food limitation in reintroduced Hihi populations: Contrasting results for two islands. *Pacific Conservation Biology* 7: 87–92.

Bain, D. and French, K. (2009). Impacts on a threatened bird population of removals for translocation. *Wildlife Research* 36: 516–521. doi:10.1071/WR07186

Brooke, M.de L. (2018). Extreme rainfall-related clutch size variation in the Critically Endangered Raso Lark *Alauda razae* of the arid Cape Verde islands. *Bird Conservation International* 29: 321–326. doi: 10.1017/S0959270918000163

Brooke, M.de L., Bonnaud, E., Dilley, B.J., Flint, E.N., Holmes, N.D., Jones, H.P., Provost, P., Rocamora, G., Ryan, P.G., Surman, C. and Buxton, R.T. (2018). Seabird population changes following mammal eradications on islands. *Animal Conservation* 21: 3–12. doi: 10.1111/acv.12344

Brooke, M.de L., Flower, T.P., Campbell, E.M., Mainwaring, M.C., Davies, S. and Welbergen, J.A. (2012). Rainfall-related population growth and adult sex ratio variation in the Critically Endangered Raso lark *Alauda razae*. *Animal Conservation* 15: 466–471. doi: 10.1111/j.1469-1795.2012.00535.x

Dierickx, E.G.G. (2018). *Population dynamics and population genetics of the Critically Endangered Raso lark: implications for conservation.* PhD thesis, University of Cambridge. doi: 10.17863/CAM.21809

Dierickx, E.G., Robinson, R.A. and Brooke, M.de L. (2019). Survival of a long-lived single island endemic, the Raso lark *Alauda razae*, in relation to fluctuating population and rainfall. *Scientific Reports* 9: 19557. doi: 10.1038/s41598-019-55782-8.

Dierickx, E.G., Sin, S.Y.W., van Veelen, H.P.J., Brooke, M.de L., Liu, Y., Edwards, S.V. and Martin, S.H. (2020). Neo-sex chromosomes and demography shape genetic diversity in the Critically Endangered Raso Lark. *Proceedings of the Royal Society B* 287: 20192613. doi: 10.1098/rspb.2019.2613

Donald, P.F. and Brooke, M.de L. (2006). An unlikely survivor: the peculiar natural history of the Raso Lark. *British Birds* 99: 420 –430.

Donald, P.F., de Ponte, M., Pitta Groz, M.J. and Taylor, R. (2003). Status ecology, behaviour and conservation of Raso Lark *Alauda razae*. *Bird Conservation International* 13: 13–28.

Donald, P.F., Hille, S., Brooke, M.de L., Taylor, R., Wells, C.E., Bolton, M. & Marlow, T. (2007). Sexual dimorphism, niche partitioning and dominance in the feeding ecology of the critically endangered Raso Lark *Alauda razae*. *Ibis* 149: 848–852. doi: 10.1111/j.1474-919X.2007.00701.x

Ducatez, S. and Shine, R. (2019). Life-history traits and the fate of translocated populations. *Conservation Biology* 33: 853–860. doi: 10.1111/cobi.13281

Fischer, J. and Lindenmayer, D.B. (2000). An assessment of the published results of animal relocations. *Biological Conservation* 96: 1–11. doi: 10.1016/S0006-3207(00)00048-3

Geraldes, P., Kelly, J., Melo, T. and Donald, P. (2016). The restoration of Santa Luzia, Republic of Cabo Verde, Feasibility study and restoration action plan 2016–2020. Protecting threatened and endemic species in Cape Verde: A major island restoration project (CEPF). – Sociedade Portuguesa para o Estudo das Aves. (https://www.cepf.net/sites/default/files/finalreport-spea-61459.pdf)

Greenwood, P.J. (1980). Mating systems, philopatry and dispersal in birds and mammals. *Animal Behaviour* 28: 1140–1162.

Hazevoet, C.J. (2012). Seventh report on birds from the Cape Verde Islands, including records of nine taxa new to the archipelago. *Zoologia Caboverdiana* 3: 1–28.

IUCN/SSC. (2013). *Guidelines for Reintroductions and Other Conservation Translocations*. Version 1.0. Gland, Switzerland: IUCN Species Survival Commission.

Jones, H.P. and Kress, S.W. (2012). A review of the world's active seabird restoration projects. *Journal of Wildlife Management* 76: 2–9. doi: 10.1002/jwmg.240

Mateo, J.A., López Jurado, L.F. and Geniez, P. (2009). Historical distribution of the Raso Lark *Alauda razae* in the Cape Verdes. *Alauda* 77: 309–312.

Taylor, G., Canessa, S., Clarke, R.H., Ingwersen, D., Armstrong, D.P., Seddon, P.J. and Ewen, J.G. (2017). Is reintroduction biology an effective applied science? *Trends in Ecology and Evolution* 32: 873–880. doi: 10.1016/j.tree.2017.08.002

Tracy, L.N., Wallis, G.P., Efford, M.G. and Jamieson, I.G. (2011). Preserving genetic diversity in threatened species reintroductions: how many individuals should be released? *Animal Conservation* 14: 439–446. doi: 10.1111/j.1469-1795.2011.00448.x

Wright, D.J., Spurgin, L.G., Collar, N.J., Komdeur, J., Burke, T. and Richardson, D.S. (2014). The impact of translocations on neutral and functional genetic diversity within and among populations of the Seychelles warbler. *Molecular Ecology* 23: 2165–2177. doi: 10.1111/mec.12740

RESUMEN

Confinada a una sola isla donde su pequeña población fluctúa en respuesta a las precipitaciones, es probable que la alondra de Raso permanezca En Peligro Crítico a menos que se establezca una segunda población. Este artículo informa sobre la translocación de alondras, 37 en 2018 y 33 en 2019, a la cercana isla de Santa Luzia donde la especie existió hasta hace unos 500 años. Ambas islas se encuentran dentro de la Reserva Natural Integral de Santa Luzia. Aunque el protocolo de liberación procedió sin contratiempos, surgieron problemas con el marcaje por radiofrecuencia de las aves liberadas. Sin embargo, los primeros indicios son alentadores; las aves liberadas se han reproducido y su supervivencia anual no es sustancialmente peor que la de las alondras en la isla de origen, Raso. De forma inesperada el estudio documentó varios movimientos naturales, no asistidos, de alondras de Raso a Santa Luzia (y, menos inesperadamente, de aves translocadas que regresaban a Raso). El resultado final del proyecto sigue siendo incierto, toda vez que la erradicación de los gatos introducidos de Santa Luzia, posibles depredadores de las alondras, se vio interrumpida cuando la isla fue evacuada a causa de la pandemia de Covid-19.

RÉSUMÉ

Confinée à une seule île où sa faible population fluctue en réponse aux précipitations, l'alouette Raso est susceptible de rester en danger critique d'extinction à moins qu'une deuxième population ne s'établisse. Cet article fait état des translocations d'alouettes, 37 en 2018 et 33 en 2019, vers l'île voisine de Santa Luzia où l'espèce existait jusqu'à il y a environ 500 ans. Les deux îles se trouvent dans la Réserve Naturelle Intégrale de Santa Luzia. Alors que le protocole de libération dure s'est déroulé sans incident, des problèmes de marquage radio des oiseaux relâchés ont été rencontrés. Cependant, les premières indications sont encourageantes; les oiseaux relâchés se sont reproduits et leur survie annuelle n'est pas sensiblement pire que celle des alouettes sur l'île source, Raso. De manière inattendue, l'étude a documenté plusieurs mouvements naturels et non assistés d'alouettes de Raso à Santa Luzia (et, de manière moins inattendue, d'oiseaux transférés retournant à Raso). L'issue finale du projet reste incertaine car l'éradication des chats non-indigènes à Santa Luzia, prédateurs potentiels des alouettes, a été interrompue lorsque l'île a été évacuée en raison de la pandémie de Covid-19.