SHORT COMMUNICATION

Evaluating oribi translocations for conservation: the importance of translocation guidelines

Tamanna Patel[1,2] (iD)[§],
Keenan Stears[1,3,4]* (iD),
Ian T. Little[5] (iD) &
Adrian M. Shrader[1,6] (iD)

[1]*School of Life Sciences, University of KwaZulu-Natal, Scottsville, Pietermaritzburg, 3209 South Africa*

[2]*Threatened Species Unit, South African National Biodiversity Institute, Pretoria, 0184 South Africa*

[3]*Department of Ecology, Evolution, and Marine Biology, University of California, Santa Barbara, California 93106, U.S.A.*

[4]*South African Environmental Observation Network, Ndlovu Node, Phalaborwa, 1390 South Africa*

[5]*Endangered Wildlife Trust, Johannesburg, South Africa*

[6]*Mammal Research Institute, Department of Zoology and Entomology, University of Pretoria, Pretoria, 0028 South Africa*

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INTRODUCTION

At a global scale, anthropogenically-mediated disturbances have resulted in the extirpation of species and declines in both population and range size (Dirzo *et al*., 2014; Young, McCauley, Galetti & Dirzo, 2016). Furthermore, land transformation and habitat fragmentation have limited the ability of species to disperse naturally throughout their ranges (Thuiller *et al*., 2006). To compensate for both this defaunation and disruption of animal movement patterns, rewilding and restoration are becoming increasingly important approaches to conserve and promote biodiversity (Seddon, Griffiths, Soorae & Armstrong, 2014; Du Toit & Pettorelli, 2019). Central to both of these concepts, as well as wildlife management and conservation in general, is the translocation of species (Athreya, 2006; Seddon & Armstrong, 2019).

Despite the prevalence of species translocations, global reviews show that the majority of translocations have been unsuccessful (Fischer & Lindenmayer, 2000; Taylor *et al*., 2017). To address the concern that counter-productive animal translocations were occurring, the IUCN Conservation Translocation Specialist Group was established to develop a framework to guide translocation projects and improve their success before they are implemented (Pérez *et al*., 2012; IUCN/SSC, 2013).

In South Africa, oribi antelope (*Ourebia ourebi ourebi*) occur in small, highly fragmented populations that are vulnerable to local extinction due to changing land use, dog hunting, and poaching (see Shrader, Little, Coverdale & Patel, 2016; Manqele, Selier, Hill & Downs, 2018). Thus, oribi are a species of high conservation concern and translocation programmes have been identified as a valuable management tool to restore populations (Grey-Ross, Downs & Kirkman, 2009). However, the success or failure of oribi translocations have been poorly documented (Grey-Ross *et al*., 2009). Here, we use the hierarchical decision-making framework for translocations developed by Pérez *et al*. (2012) to evaluate previously-conducted oribi translocations to improve the effectiveness of future oribi translocations.

METHODS

We assessed the effectiveness of oribi translocation projects that spanned the province of KwaZulu-Natal, South Africa, between two and ten years prior to conducting this study in 2014 ($n = 10$ discrete translocations at different sites). Detailed information about each oribi translocation project was obtained from private landowners and the Oribi Working Group of South Africa. All projects are conservation translocations with the goal of population restoration (as defined by IUCN/SSC, 2013). For each of these translocations, we determined how many of the ten criteria outlined in Pérez *et al*. (2012) were considered prior to the start of each project. Pérez *et al*. (2012) integrated ten recommendations from translocation guidelines into a three-tiered evaluation tree. The first tier evaluates the necessity of the translocation project, while the second tier evaluates the risk of the project and whether the potential risks have been mitigated. Lastly, the third tier assesses the technical and logistical suitability of the translocation project (see Table 1). Translocations that do not meet the criteria listed in the first tier should not be carried out. If translocations are deemed necessary, but fail to meet criteria from tiers two and three, then the design of the translocation needs to be improved (Pérez *et al*., 2012).

For each translocation, we calculated the finite

*To whom correspondence should be addressed.
E-mail: keenanstears@ucsb.edu

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Table 1. The hierarchical decision-making system of Pérez *et al.* (2012) for assessing translocations projects. The first tier evaluates whether the translocation is necessary for the conservation of a threatened species or population. The second tier evaluates the risks involved in the translocation project, and the third tier assesses the methodological design of the translocation project. Within this framework, each criterion should be addressed successively, such that, if a translocation project does not meet the criteria outlined in the first tier, an alternative conservation strategy should be investigated. The criteria used in this system are existing recommendations and guidelines used in assessing animal translocations.

Tier		Criteria
One: Necessity of the translocation	1	Is the species or population under threat?
	2	Have the threatening factors been removed or controlled, or were they absent in the release area?
	3	Are translocations the best tool to mitigate conservation conflicts?
Two: Risk evaluation	4	Are the risks for the target species acceptable?
	5	Are the risks for the species or the ecosystem acceptable?
	6	Are the possible effects of the translocation acceptable to local people?
Three: Technical and logistical suitability	7	Does the project maximize the likelihood of establishing a viable population?
	8	Does the project include clear goals and monitoring?
	9	Do enough economic and human resources exist?
	10	Do scientific, governmental, and stakeholder groups support the translocation?

population growth rate, lambda (λ), by dividing the total number of oribi at each site at the time of this study by the initial population size after the first oribi translocations occurred at the start of each translocation project. Thus, in this context, lambda does not reflect an annual growth rate, but rather the change between the start and end population size at each site. For each site, population change was calculated over different time periods (Table 2). We included translocations assessed over two years because population declines of 50–75% were observed. Thus, with such drastic declines, we were confident that assessing these populations as declining was accurate. We defined a project as successful if it achieved an increasing or stable growth ($\lambda \geq 1$) and unsuccessful if the population was declining ($\lambda < 1$). Factors that could influence population growth (*i.e.* harvesting and the sale of animals) did not occur at any of the release sites. Moreover, at each site, oribi density was lower than the maximum observed oribi density within the study area (~16 oribi/km^2; Table 2). Thus, it is unlikely that density dependence influenced the observed population change at each site.

We used a Pearson's correlation to relate the success of each translocation project to the number of criteria that were considered by the translocation project. Furthermore, we used a Generalized Linear Model (Gamma distribution and a log link function) to compare the average oribi population growth for translocations that addressed all of the important tier one criteria ($n = 4$) to translocations that did not address all tier

Table 2. Translocation details used to assess oribi translocations at each site. All sites had small oribi populations that occurred at lower densities compared to the maximum observed oribi density within the study area (~16 oribi/km^2). Generally, drastic declines in oribi numbers occurred within a short time frame post-translocation.

Site	Oribi density (oribi/km^2)	Start population size	End population size	Years post-release	Population change (%)	Population trend
1	0.5	4	1	2	–75	Decreasing
2	0.4	3	1	3	–67	Decreasing
3	1.0	12	2	10	–83	Decreasing
4	6.0	14	2	5	–86	Decreasing
5	3.5	12	6	2	–50	Decreasing
6	2.3	5	3	5	–40	Decreasing
7	7.0	10	4	2	–60	Decreasing
8	1.8	14	7	7	–50	Decreasing
9	1.2	39	38	8	–3	Stable
10	0.8	9	13	5	+44	Increasing

one criteria (*i.e.* translocation should not have occurred, $n = 6$). For this analysis, we included oribi density and the time period over which the translocation was assessed as covariates. Model assumptions were assessed using the *performance* package in R (Lüdecke, Ben-Shachar, Patil, Waggoner & Makowski, 2021). All work was approved by the University of KwaZulu-Natal animal ethics committee (058/14/Animal).

RESULTS AND DISCUSSION

Our assessment of past oribi translocations in KwaZulu-Natal, South Africa, revealed that these projects have not been an effective conservation tool for this species, with 80% of these translocations achieving declining populations post-release. Despite this, all translocations justified the need for translocation to occur (criterion 3) and 90% of the translocation projects focused on threatened individuals or populations (criterion 1; Fig. 1a). However, 60% of oribi translocations did not meet all three of the criteria in the first tier and, thus, conservation strategies other than translocation should have been explored. The two translocation criteria from the Pérez *et al.* (2012) framework that were the most poorly addressed by the translocation projects were 1) whether threatening factors to oribi had been removed or controlled at the release site (criterion 2), and 2) whether the projects had long-term monitoring to assess progress towards specific objectives (criterion 8) (Fig. 1a). Furthermore, 50% of projects did not have adequate technical or logistical support, despite 80% of the projects having enough economic and human resources to ensure the success of these translocations (criterion 9). Finally, 90% of translocations received scientific, governmental, and stakeholder support (criterion 10).

Marchant (1996) found that 36 translocated oribi were reduced to seven individuals within two weeks and that unsuitable habitat was the driver of these declines. Habitat may be unsuitable because of illegal hunting with dogs, poor rangeland management (*e.g.* overstocking with livestock; Stears & Shrader, 2020), habitat loss and fragmentation (Carbutt & Martindale, 2014; Stears & Shrader, 2015), and that landowners have little knowledge about oribi and their habitat requirements and do not know what land management practices would benefit oribi conservation (Louw, Pienaar & Shrader, 2021). Without directly addressing these threats, translocation of oribi to a release site is likely to fail. Moreover, without suitable monitoring, it is not possible to determine potential drivers of decline or how translocated individuals may navigate the release site. With oribi populations occurring on private rangelands, citizen-science can be a powerful monitoring tool for translocated oribi but see Patel, Stears, Little & Shrader (2021) for issues relating to citizen science, data quality, and oribi conservation.

All of the translocations addressed six or more of the ten translocation guideline criteria (Fig. 1b). However, we did not find a significant correlation between oribi population growth rates and the number of criteria that were addressed ($r = 0.48$, $P = 0.16$; Fig. 1c). This is likely because only one translocation addressed all ten criteria (Fig. 1b). This translocation was the only one that achieved positive population growth over five years post-translocation. A single translocation achieved a stable population over an eight-year period. This translocation addressed all tier one criteria, had clear goals for monitoring, and ensured that threatening factors had been removed/controlled in the release area. Furthermore, 30% of translocations assessed nine out of the ten criteria, yet these resulted in failed translocations. A unifying factor was that these translocations failed to address important tier one criteria. On average, translocations that addressed all tier one criteria had higher population growth and a greater chance of achieving positive growth compared to translocations that did not address all tier one criteria ($\chi^2 = 3.005$, d.f. = 1, $P = 0.001$; Fig. 1d). This suggests that with better adherence to translocation guidelines, and improved translocation design, oribi translocation projects can be successful.

Ultimately, the low success rate of oribi translocations is a major concern for oribi conservation. Such translocations may be vital because oribi populations are highly fragmented (Shrader *et al.* 2016) and grasslands are experiencing continued anthropogenic disturbances (Carbutt & Martindale, 2014). We understand that under certain circumstances, translocations are done on short notice because of rapid and unexpected changes in land-use practices or imminent persecution threats where oribi are found (*e.g.* conversion of grasslands to urban housing). Furthermore, we acknowledge that not all translocations (*e.g.* ecological replacements) will meet the criteria listed. Nevertheless, we highly recommend that wildlife managers and conservation biologists implement the hierarchical decision-making framework

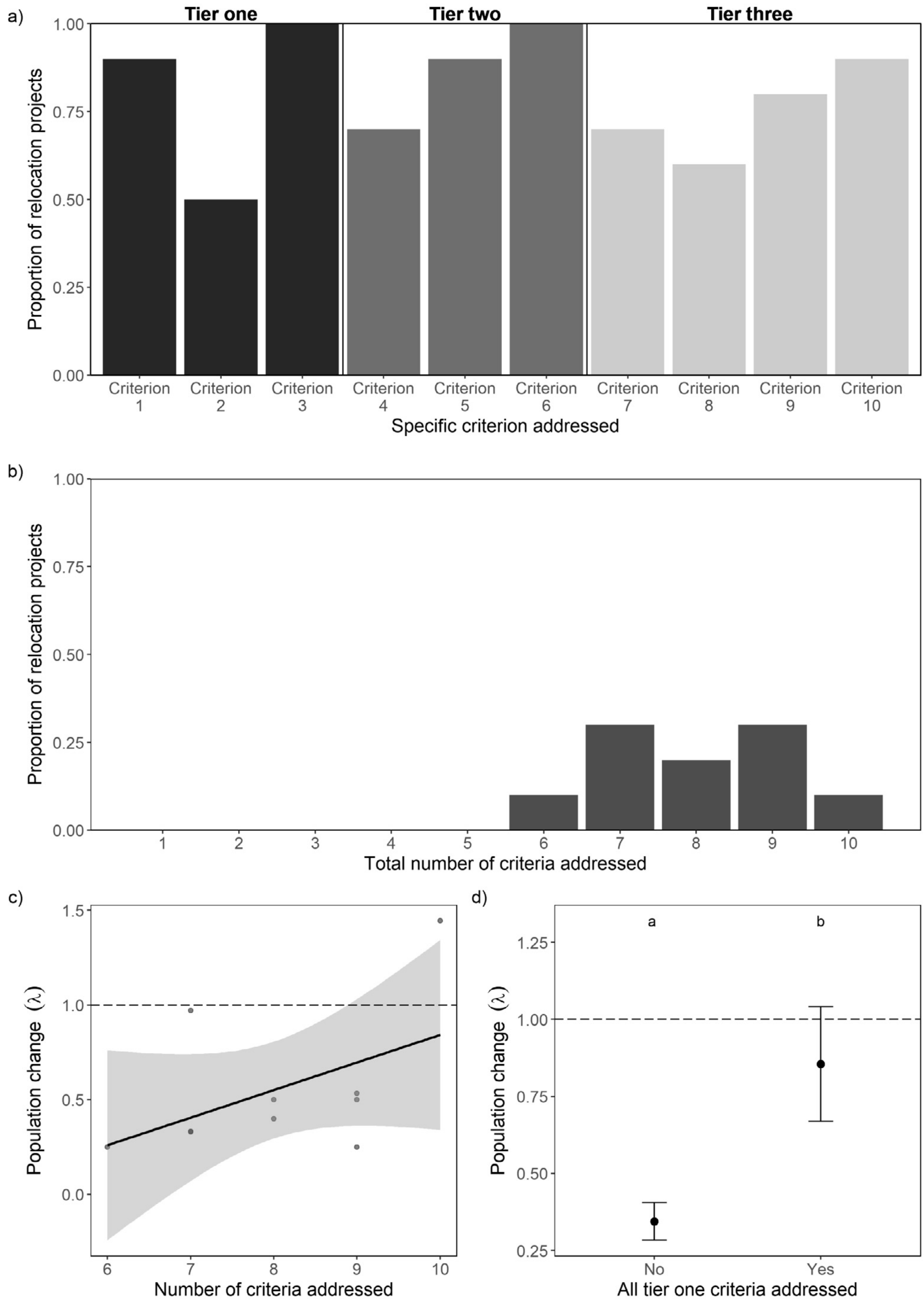

Fig. 1. Assessment of oribi translocations in KwaZulu-Natal, South Africa. The proportion of translocation projects (n = 10) that addressed: (**a**) each specific criterion for translocation, and (**b**) between zero and all ten translocation criteria. Panel (**c**) depicts the relationship between oribi population growth and the number of criteria considered, and panel (**d**) shows that translocations that addressed key tier one criteria are likely to achieve higher oribi population growth (mean ± S.E.) compared to projects that did not address tier one criteria. The dashed lines represent a stable population and letters in the dataspace denote significant differences.

discussed above, or other similar translocation guidelines, to assess the necessity, risk, and the technical and logistical design of each translocation project before they are implemented. Furthermore, oribi-specific research should be integrated with translocation guidelines to assess compliance. Finally, databases that contain information about oribi translocation projects should be kept updated and ensure that accurate reporting of failed translocations are included. Information gleaned from failed translocations are necessary to improve future translocation projects.

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§ORCID iDs

T. Patel: orcid.org/0000-0002-6277-0719
K. Stears: orcid.org/0000-0003-1012-5838
I.T. Little: orcid.org/0000-0002-5586-2332
A.M. Shrader: orcid.org/0000-0002-6451-6132

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