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Original Research Article

Conservation implications of wildlife translocations; The state's ability to act as conservation units for wildebeest populations in South Africa

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A B S T R A C T

Wildlife translocations have historically assisted in re-establishing species in areas of extinction and are currently employed in over 50 countries. Ironically, they may also be responsible for the extinction of pure genetic lineages via hybridization, thereby negatively impacting endangered, indigenous, and rare species. Due to recent evolutionary divergence, black wildebeest (*Connochaetes gnou*) and blue wildebeest (*Connochaetes taurinus*) can mate and produce fertile offspring when sympatric. A total of 6929 translocated black and blue wildebeest from 273 private ranches and 3 provincial protected areas protected (PPAs) were documented over 5 years, across 5 South African provinces. We analyzed dispersal patterns and wildlife ranching economics to identify conservation implications and to infer if translocations are likely to persist in their current form. Findings indicate (1) 58.45% of sampled private ranches manage for both wildebeest populations, (2) blue wildebeest males are primarily translocated, (3) wildebeest are introduced across provincial lines, (4) wildebeest are introduced to within and amongst the private and commercial industry from multiple sources, and (5) wildebeest revenue accounted for 20.8% of revenue generated from all wildlife translocations. Unwanted conservation implications concern ecological integrity, genetic swamping, and regulatory efficiency. We caution against risks posed by the game industry upon the PPA's ability to function as nature conservation units and act as stocking sources and the plausibility that black wildebeest populations incorporate varying degrees of introgressive hybrids. Moreover, wildebeest account for 1/5 of revenue generated from all game translocations. This is indicative of its likelihood to persist in their current form, thereby inducing hybridization and facilitating outbreeding depression. We caution that concerns are likely to worsen if no intervention is taken. Lastly, we coin the concept of Ecological Sustainable Network (ESN); we designed a framework for standardizing procedures to advance effective wildlife translocation practices worldwide.

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1. Introduction

1.1. The extent of the wildlife ranching industry within South Africa

South Africa encompasses more than 11,600 private wildlife ranches, spreading over 21 million hectares (Dry, 2013; Van Hoven, 2015). An additional 15,000 ranches manage both domestic livestock and wildlife (Patterson and Khosa, 2005 as cited in Cousins et al., 2008). During 1991–2000, South Africa experienced an annual increase of 5.6% in land used for wildlife ranching (Cloete et al., 2015). Currently, 16.8% of private ranches and 6.1% of provincial protected areas (PPAs) utilize the privatization of wildlife as their primary source of revenue; in fact, wildlife managed on private ranches is almost threefold of that managed on the provincial land (Bothma, 2002; Cousins et al., 2010).

Wildlife ranching has the higher rate of return per hectare than any agricultural based market (Slabbert, 2013). With an annual return on investment upwards of 80%, wildlife enterprises generate 4.7 billion Rand/year (Oliver, 2015). They are subdivided into the following, often overlapping, market segments: hunting (3.1 billion Rand/year), trophy hunting (510 million Rand/year), game translocation (750 million Rand/year), live auctions (1 billion Rand/year), game meat production (42 million Rand/year), and taxidermy (200 million Rand/year) (Bothma et al., 2009; Du Toit and Van Schalkwyk, 2011; Grobler et al., 2011).

1.2. Wildlife ranching entails the management of enclosed populations and varying objectives for translocations

South African wildlife ranching practices require fences along the perimeter of all game ranches. As such, populations are closed and finite and natural processes do not take place (e.g., dispersal, emigration, and colonization dynamics) (Cousins et al., 2008). Consequently, ranch owners are faced with the need to intensively manage populations on their land while weighting economic profitability with genetic concerns stemming from small and closed populations (e.g., inbreeding, outbreeding depression, and bottlenecks) (Lehmann et al., 2008).

The commercial nature of the wildlife ranching industry has resulted in wildlife translocation practices taking place in over 50 countries worldwide; United States of America and South Africa have the highest utilization (Spear and Chown, 2009a). Various market sectors within its industry (see above) indirectly act as drivers for translocation efforts; primary examples include the need to stock animals for hunting (which is employed in over 23 countries and across 1,394,000 km^2 of private and national land in sub-Saharan Africa) and ecotourism (driven by wildlife viewing) (Bothma, 2002; Child, 2012; Fischer et al., 2015, Lewis and Alper, 1997; Lindsey et al., 2007; Loveridge et al., 2007). IUCN (1988) guidelines define translocation as the “mediated movement of living organisms from any source (privately managed or wild), with release in another”. This oversimplified definition enables local decision makers to determine if a translocation effort is conservation oriented. The conservation-based goal of translocating individuals into an existing population is primarily to increase genetic diversity via outbreeding, whereby genetic diversity is increased through the mating of an unrelated individual and a breeding population (Balding, 2007). However, such management decisions are complex and there is a need to mitigate the risk of unwanted consequences (e.g., outbreeding depression). Conservation-based translocations are conducted with the objectives to counter: genetic bottlenecks, local extinction events, and/or inbreeding processes by re-establishing, recolonizing, replacing, restoring, relocating, and reinforcing the population, in addition to providing biological control (Rhymer and Simberloff, 1996).

Non-conservation related objectives include a substitute for culling, recreation, biological control, aesthetics, religion, wildlife rehabilitation, color variance, and animal rights activism (Pasquini et al., 2010, Seddon et al., 2012). There is a lack of a much-needed standardization in the wildlife translocation practice throughout South Africa (Grobler et al., 2011).

1.3. State's role as conservation units

Regardless of whether or not motivations are conservation-based, wildlife translocations have the capacity to shape ecosystem dynamics. Historically, translocation practices served as an effective conservation tool, bringing various species back from the brink of extinction through the reintroduction of animals (Hayward et al., 2007). We coin the definition of the concept of national parks (i.e., a state) acting as conservation units and define this as the state's ability to act as a source for genetically pure individuals for the purpose of serving as population founders on governmental and/or private land. We emphasize the underlying principle of wildlife management plans concerning the reintroduction of locally extinct populations; it is critical that founders are pure breed (i.e., genetic status) in order to reestablish taxonomy-pure populations. We caution that the risk of translating genetically admixture individuals with the intention to reestablish closed populations is the facilitation of hybridization, divergence and speciation. Primary examples of reintroductions of locally extinct species in the South African context include the southern white rhinoceros (*Ceratotherium simum*), Cape mountain zebra (*Equus zebra*), bontebok (*Damaliscus pygargus phillipsi*), and the black wildebeest (*Connochaetes gnou*) (Fabricious et al., 1988; Robinson et al., 1991; Flack, 2003 Hamman et al., 2003).

Ironically, the genetic integrity of the later three is currently jeopardized by the same management practice that originally enabled them to persist and survive bottlenecks, wildlife translocation. In fact, upwards of 60% of Blesbok (*Damaliscus pygargus phillipsi*) are varying degrees of bontebok X blesbuck hybrids (Van Wyk et al., 2013, 2017).