Reintroducing reintroductions into the conservation arena

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Response: Reintroducing reintroductions into the conservation arena

Alexandre Robert[a], Bruno Colas[b], Isabelle Guigon[a], Christian Kerbiriou[c], Jean-Baptiste Mihoub[c], Michel Saint-Jalme[a], François Sarrazin[c]

[a] Muséum National d'Histoire Naturelle, CESCO, UMR 7204 MNHN-CNRS-UPMC. 55 rue Buffon, 75005 Paris, France.

[b] Université Denis Diderot, ESE, UMR 8079 UPS-CNRS-AgroParisTech, Bat 360, 91405 Orsay, France.

[c] Sorbonne Universités, UPMC Univ Paris 06, Muséum National d'Histoire Naturelle , CNRS, CESCO, UMR 7204. 61 rue Buffon, 75005 Paris, France.

We are grateful for the interesting and constructive comments on our article and largely agree with the points raised by the three commenters. If we intend to improve reintroduction biology, the challenge is to overcome the idiosyncratic trajectory of each reintroduced population to understand the basic processes that favour or reduce the conservation effectiveness of these programmes. We need to reintroduce reintroduction programmes into the conservation arena through the sharing of integrative concepts, language and tools, and we argue that this should start with success criteria at local, regional and global scales.

As noted by the commenters, defining the success of any type of management action raises the question of the benefits and limits of genericity and standardization, which is a general concern in conservation biology. How can we apply the same universal criteria (or proxies like threshold population size) to populations of plants, invertebrates or large vertebrates facing various threats in various environments? This question has caused heated debates among conservation scientists. Some authors have pointed out the difficulties and dangers of using risk-ranking protocols for very different taxa (Cardoso et al. 2011), due to the conceptual and technical pitfalls associated with universal criteria (Flather et al. 2011). Others have rather called attention to the necessity of such generic criteria in the absence of alternatives, highlighting their transparency, their potential for being criticized, refined and improved, and their complementarity with subjective expert judgment (Brook et al. 2011). Most of the criticisms towards the use of universal or standardized criteria are directed to criteria based on state variables (such as population size or range), which are only proxies of viability, and can exhibit different functional links with ecological or evolutionary potentialities across species. In this article (Robert et al. 2015), we advocated, like others before us (Mace et al. 2008), that a viability criterion (i.e., a potentiality, rather than a current state) should be ideally considered to define success.

Conservation statuses make sense only if they are elaborated on the same conceptual basis for all species, thus allowing objective comparisons to be made. We argue that the science of reintroduction biology (Seddon et al. 2007) does not escape this rule. As suggested by Kristin Haskins (Haskins 2015), the removal of the restored and protected Robbin's cinquefoil and Bald eagle from the U.S. Federal List of Endangered and Threatened Wildlife and Plants can be considered as a criterion of success (US listing itself is based on objective factors to include candidate species in the list or remove them). But the utility and pertinence of such criterion partly lies in the fact that these two species can be objectively compared with other species which are still on the list.

Of course, translocations of animals or plants may have various aims and benefits, ranging from empirical knowledge (Sarrazin & Barbault 1996) to technical developments (Ewen et al. 2014) and some may even be purely experimental. However, we focused here on the ultimate aims of conservation translocations (sensu UICN 2013) that should have an actual impact on the conservation status of the focal species or ecological processes through long term viability.

Although relying on an existing and valid protocol (as emphasized by Phil Seddon, Seddon 2015), we acknowledge that the application of criteria designed for remnant populations to translocated ones is not straightforward, and all three commenters appropriately pointed out the specificity of translocated populations in terms of e.g., demographic biases or dynamics. In this regard, we agree with Kristin Haskins that genetic problems (which we did not consider in the article) are another very important issue that needs to be considered and treated specifically in the contexts of remnant versus reintroduced populations, although we believe that reintroduced populations do not necessarily suffer less genetic problems compared to remnant ones. One reason is that in any populations, the nature and intensity of genetic problems (maladaptation, drift load, inbreeding depression, reduced evolutionary potential) are so critically related to the demographic history and ecology of populations (e.g., current spatial distribution and dispersal patterns, past population size and dynamics), as well as to species traits (e.g., breeding system), that it is difficult to draw generalities on the intensity of genetic problems in reintroduced versus remnant populations. Another reason is that reintroduced populations suffer specific genetic problems due to initial disequilibria, demographic bottlenecks, local adaptation (Robert et al. 2007), and programs relying on captive breeding raise additional genetic issues such as selection relaxation (Robert 2009) and adaptation to captivity (Frankham 2008).

Such peculiarities of restored populations indeed encourage us to develop efficient monitoring programs focusing on relevant indices. It is likely that if a potentially exhaustive individual-based monitoring can be achieved during the *establishment* phase, it has to turn to sampling during *growth* phase and may even reach simple time series (e.g., of density) to evaluate the trends of *regulated* populations. Monitoring methods are of course strongly species-dependant but the aims of such monitoring should converge towards shared success criteria.

Finally, as stressed by Debra Shier (Shier 2015), many issues still need to be addressed to make IUCN criteria a suitable standard for measuring the success of reintroductions and other conservation translocations. These issues include the rescaling of red list indices, the investigation of other red list criteria than abundance (such as trends or range area), the consideration of genetic processes, and the extension of the analysis to the meta-population scale. At an even wider spatial scale, species-based assessments should balance the benefit of local reintroduced populations with the impact to the source population (Dimond & Armstrong 2007) and other remnant populations (Le Gouar et al. 2008, Mihoub et al. 2011), and here again, the IUCN status, assessed at the regional or global level, provides a promising framework.

More generally, whatever the spatial scale considered, we need to go beyond demography and address the wider ecological impacts of translocations (especially those not conducted in the species range), the perception of success by people (Ewen et al. 2014) and the global, macro-evolutionary biodiversity benefits of restoring species and populations.

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