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Review

Preventing the development of dogmatic approaches in conservation biology: A review

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ABSTRACT

The application of management practices based on dogmas may lead to unexpected results, and hence to the bad allocation of economic resources. This is an especially relevant subject today given that, in a context of deep economic crisis, conservation has very limited resources. Here, we review e-alerts from 20 of the most important journals in the field of applied conservation ecology to identify topics that are vulnerable to dogma development, and then to suggest strategies to prevent this to happen. After examining 525 pre-selected papers, we identified several major questions within the sphere of some of the main agents of anthropogenic global change based on 129 papers. Specifically we reviewed knowledge accumulated during recent decades on the resilience of wildlife to cope with two of those agents, namely (a) habitat fragmentation, alteration and loss; and (b) the arrival of exotic invasive species. We critically discuss four common conservation questions within those two major areas: the pros and cons of supplementary feeding for conservation purposes, the ubiquity of the detrimental effect of invasive species and the feasibility of its eradication, as well as the efficiency of controlling generalist predators for both game and conservation purposes. We finally provide a list of five good practices to prevent the generation of dogma when applying the science of conservation biology to the abovementioned agents of global change, and as a way of optimizing the effectiveness and efficiency of biodiversity management.

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1. Introduction

As in discussions about sport, many lay people seem to have well-formed ideas about the most complex of conservation topics, opinions that are often in fact based on the creation of dogmas. This problem, which other basic and applied sciences such as physics, chemistry or engineering do not have to confront, seriously affects the realm of biodiversity conservation, since applying management practices based upon dogmatic ideas often leads to unexpected results (Possingham et al., 2002; Kareiva and Marvier, 2003; Martínez-Abraín et al., 2004; Halpern et al., 2006; Martín-López et al., 2009), with undesirable ecological and economic consequences (Cawardine et al., 2008; Floerl and Coutts, 2009; Farley, 2010; Speth, 2011). In conservation, concepts such the existence of

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'bad' alien species, the necessary loss of genetic diversity following habitat fragmentation, and the probity of reintroductions, culling programs, biological corridors and supplementary feeding have some dogmatic component, because they are considered *a priori* to be correct and efficient principles and practices. For example, worldwide many large gull species of the genus *Larus* are tagged as 'bad' species and are subject to culling, often without evidence to justify such actions (e.g. Oro and Martínez-Abraín, 2006). Specifically, in the Balearic Islands, where many endemic animal and plant species occur, ca. 25% of the regional conservation budget during the period 1989–2003 was invested in unsuccessful campaigns to cull local yellow-legged gulls (*Larus michahellis*) (authors, unpublished). Yet, gull populations decrease rapidly as soon as the human causes of their abundance (such as landfills and fishing discards) are properly managed and today some large gull species are even included on IUCN Red Lists (Lynas et al., 2007). As a way of preventing undesirable situations such as the one described above, conservation biologists began in the previous decade to send out clear messages to managers underlining the fact that decision-making should be informed by accumulated scientific evidence rather than based on personal experiences and feelings, which may only serve to reinforce the acceptance of scientific dogma (see e.g. Sutherland et al., 2004; Linquist, 2008). Despite the great uncertainty that exists when dealing with the heterogeneity inherent to biodiversity responses to environmental change and management (Regan et al., 2005), whenever possible it is important to base decision-making on available evidence from the fields of population, community and behavioral ecology, as well as evolution (Soulé, 1985; Simberloff, 1988; Sutherland et al., 2004; Martínez-Abraín and Oro, 2010). We do not claim that creation of dogma is widespread in our times in conservation biology but rather we aim to review counterpoints to well establish management practices as a precautionary exercise. To a large extent the crux of the problem may stem from poor communication and transfer of new knowledge to managers, rather than on lack of willingness of managers to keep pace with scientific advances. However it is also true that applied science is often inconclusive, partly because dogma development not only affects managers but also conservation scientists, and hence it becomes impossible to advise wildlife managers properly.

Stakeholders dealing with global change often tend to take for granted that animal and plant species have little capacity for coping with change and severe perturbations in their environments, without human intervention (see e.g. Conant, 1988; Hoegh-Guldberg et al., 2008; Seddon et al., 2009; Seddon, 2010; but see Ricciardi and Simberloff, 2008). However, change – including long-lasting climate change – and perturbations are common factors in the evolution of organisms; thus, it is to be expected that many such species will have behavioral and/or evolutionary mechanisms that can deal with change (Mace et al., 1998), even at its rapid current pace and severity (Oro et al., 2012). For example, many of the plant species considered to be typical of the Mediterranean Basin scrublands (e.g. *Chamaerops*, *Smilax*, *Arbutus*, *Olea*, *Pistacia* and *Phillyrea*) are actually plants that evolved during the Eocene, Oligocene and Miocene under very different environmental conditions compared to present ones, that have survived several climate changes, in addition to profound historical anthropogenic modifications in their habitats (Herrera, 1995).

Global anthropogenic change has two major components, namely, climate change and the set of human activities that directly affect wildlife at a global scale (MA, 2003). We chose not to assess the ability of fauna and flora to respond to global climate change because we wanted to focus on proximate factors whose management by conservation practitioners (i.e. wildlife managers from the public, private or NGO sectors) is practical in the short term; nevertheless, the overall picture of change is more likely to consist of an interaction between climate change and direct anthropogenic factors (Carroll, 2007; van der Wal et al., 2008; Heller and Zavaleta, 2009). Indeed, the linking of so many negative trends with climate change may in fact mask the role of proximate human-caused factors such as direct persecution or overharvesting (see e.g. Munilla et al., 2007).

Here, we review knowledge accumulated during recent decades on the capacity of wildlife (i.e. its resilience) to cope with (a) habitat fragmentation, alteration and loss; and (b) the arrival of exotic invasive species. We selected within the two above-mentioned subject areas four major topics of interest in applied management for which substantial knowledge has been accumulated in recent decades and for which evidence is lately accumulating in the form of counterpoints to widespread and commonly accepted principles and practices. This procedure echoes the selection of questions of conservation concern carried out by Sutherland et al. (2006, 2009) for both the conservation of biodiversity in the UK and global biological diversity preservation. In this regard, reviews are a necessary approach to the synthesis of knowledge obtained using the ecological tools employed by conservation practitioners (Norris, 2004) and to optimize management actions, especially in an era characterized by large cuts in funding for conservation agencies and the uneven distribution of conservation spending *vis-à-vis* conservation priorities (Hoekstra et al., 2005; Brooks et al., 2006; Halpern et al., 2006).

2. Methods

This is necessarily a traditional qualitative review given that our aim was to provide an overview of four different topics (see below). Specific topics such as the efficacy of removing opportunistic predators have been already subject to quantitative meta-analysis in the literature (see e.g. Smith et al., 2010a, 2010b).

We used some of the main agents of global change, namely (a) habitat fragmentation, alteration and loss and (b) the arrival of invasive exotic species, as major topics to identify questions of conservation interest for which substantial accumulated knowledge is available.

Considering that a direct literature search using conventional search procedures and engines for counterpoints rather than rules in conservation biology was not possible (because exceptions are not typically registered as such in titles, abstracts and keywords), we reviewed on a weekly basis over a 3-year period (March 2008–2011) the e-alerts from the main scientific journals in the fields of ecology, conservation, invasion biology and biogeography. The 20 journals whose e-alerts were reviewed by both authors (with a journal overlap of 88%) are indicated in Appendix A. From the e-alerts of these journals we selected articles embracing either views defending a position against well-established conservation theoretical paradigms (without a predetermined set list) under a framework of global anthropogenic change or applied strategies to cope with this change in an effective and efficient way. From selected articles, we checked the reference lists and selected additional papers, which included journals other than those sending e-alerts and years outside the initial 3-year sampling period. Specifically, articles from 30 additional journals were selected (Appendix A). This combined procedure enabled us to select initially a total of 525 papers and in all cases we read at least the abstracts in search of some exception to what we considered to be an established rule or practice in conservation biology; we used the existence of unexpected exceptions or counterarguments to established rules as a criterion to identify topics that are prone to dogma development