

Letter

Trophy Hunting Does and Will Support Biodiversity: A Reply to Ripple *et al.*Enrico Di Minin,^{1,2,*}
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In our paper [1] we discussed the importance of trophy hunting as a conservation tool provided it can be done in a controlled manner to benefit biodiversity conservation and local people. To address some of the concerns about trophy hunting, we proposed adopting 12 new recommendations that embrace the guiding principles on trophy hunting promoted by the International Union for the Conservation of Nature. Ripple *et al.*'s comment [2] on our paper argues that greater consideration needs to be given to the ecological and evolutionary effects of trophy hunting to evaluate it fully as a conservation tool. Most of the concerns that they raise have already been raised and are not restricted to trophy hunting. In fact, these same concerns also apply to conservation areas where ecotourism is the primary land use. In addition, their reply is limited in scope because their concerns apply mainly to a single country – South Africa – and have been discussed in detail elsewhere [3].

In this reply, we restate the importance of trophy hunting to create incentives for biodiversity conservation, preventing habitat loss, and highlight how improvements in conservation policy can be used to address some of the concerns raised. Ripple *et al.* [2] state that ecotourists account for '... an extremely small fraction of total global greenhouse gas emissions, and these emissions cannot be linked to biodiversity at trophy hunting sites'. However, not only did they neglect to quantify this fraction but they also overlooked the

problem that the contribution of emissions from tourism to climate change sets a potentially major challenge for the sustainability of international tourism. Indeed, tourism transport, accommodation, and associated activities contributed an estimated 5% of global anthropogenic CO₂ emissions in 2005 [4]. Climate change is already threatening the persistence of biodiversity at trophy-hunting sites, as demonstrated by the increasing frequency of extreme El Niño events (e.g., the current drought threatening southern Africa) [5]. Ripple *et al.* [2] also mentioned how maintaining large populations of targeted species, especially large herbivores, can affect biodiversity via overgrazing/browsing, but this issue is not restricted to areas where trophy hunting is the main land use; rather, it is common to most small, fenced conservation areas where ecotourism is the dominant activity [6].

Despite already raising the issue in our paper and providing recommendations to avoid such consequences [1], Ripple *et al.* [2] stated how trophy hunting can disrupt community structure and functioning, with evolutionary-scale consequences when '... less [economically] valuable species are replaced by more [economically] valuable species, or where predators are persecuted to protect [economically] valuable large herbivores'. However, this concern is mainly limited to South Africa where many wildlife populations are artificially managed within fenced reserves. The full range of species needed to create a functional ecosystem might not be available at trophy hunting sites (this is also the case of conservation areas where ecotourism is the main land use and where many species have been historically extirpated). The main weakness of this critique is that unless harvest is intensive and affects a large proportion of the adult population (i.e., decidedly not the case for most trophy-hunted species in Africa), negative evolutionary consequences of harvest are unlikely. Our recommendation for population viability analyses [1] that include the evolutionary consequences of harvest are certainly

advisable in cases where rare or small-population species are trophy-hunted. Additionally, species richness and community structure are higher in these intensively managed sites compared with agricultural and other competing land uses [7]. Predator persecution is indeed an issue in South Africa, although national and local conservation authorities are responding to this problem by implementing evidence-based conservation actions (e.g., [8]). Additionally, a year-long ban on leopard hunting has been imposed in 2016 to gather more evidence on the size of South Africa's leopard population [9].

Even though the problem applies equally to ecotourism, the issue with managed species derived from elsewhere in South Africa can be addressed by improving current policies (e.g., the Biodiversity Act in South Africa) to prevent introductions of such *ex situ* species. However, there is considerable debate globally regarding what constitutes a species' 'previous' range, and whether this should be the dominant consideration when deciding whether to assist migration in light of shifting climates [10]. Furthermore, the South African Hunters and Game Conservation Association have strongly denounced selective and intensive game breeding practices (e.g., enhancing or altering genetic characteristics of game species for commercial purposes, including artificial and unnatural manipulation to achieve unusual coat colors and excessive horn lengths), and they have called upon the South African government to implement conservation strategies in the interest of protecting the country's biodiversity [11].

In conclusion, we reiterate how the lack of incentives generated from trophy hunting will worsen biodiversity loss, but that compared with ecotourism, trophy hunting can provide much greater area-based returns to funding conservation and have fewer negative impacts in terms of emissions and ecosystem functioning. Our recommendations [1] require that resources generated from trophy hunting are used

to monitor targeted (and even non-targeted) species and ecosystems. Without doubt, there is a need to improve and enforce national policies that consider the ecological, social, and economic issues around trophy hunting. Furthermore, we support the notion that the conservation community would benefit from a better understanding of the ethics of trophy hunting [12].

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