

Letter

Does Trophy Hunting Support Biodiversity? A Response to Di Minin *et al.*William J. Ripple,^{1,*}
Thomas M. Newsome,^{1,2,3}
and Graham I.H. Kerley⁴

In their recent article ‘Banning Trophy Hunting Will Exacerbate Biodiversity Loss’ [1], Di Minn *et al.* presented a set of arguments in support of trophy hunting. They suggested that trophy hunting will benefit biodiversity (i.e., the number of plant and animal species in an area) through several main mechanisms, including (i) increased funding for conservation; (ii) a smaller carbon footprint compared with ecotourism; and (iii) the emphasis on maintaining large wildlife populations. Unfortunately, these justifications do not go deep enough into the direct and indirect mechanisms that affect native plant and animal species and ecosystems. In addition to potential social, economic, and ethical issues, we argue that greater consideration of the ecological and evolutionary effects of trophy hunting is required to fully evaluate it as a conservation tool.

For example, Di Minn *et al.* [1] stated that greenhouse gas emissions by ecotourists would be larger than those of trophy hunters because there are more ecotourists than trophy hunters. However, these 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. Di Minn *et al.* [1] also emphasized that maintaining large wildlife populations for trophy hunting would aid biodiversity conservation. However, most of the individual animals that are hunted as trophies are large herbivores, and maintaining large populations of these high-demand

species may not have any effect on the total number of plant and animals species in the area (i.e., biodiversity), or could cause biodiversity to decline due to potential impacts on plant communities from overgrazing and overbrowsing. This decline was the case in Yellowstone National Park, where the ecosystem was severely degraded after extensive hunting by humans and culling of large herbivores failed to take the predatory place of gray wolves as keystone species [2]. In addition, by maintaining high densities of a few select large herbivores inside game ranches (or in the absence of their predators), it could be detrimental where overgrazing or overbrowsing decreases foraging opportunities for coexisting native herbivores [3].

Trophy hunting can also distort community structure and function on game ranches, where less valuable species are replaced by more valuable species [4], or where predators are persecuted to protect valuable large herbivores, which are considered trophy species [5]. In addition, species are frequently introduced to broaden the range of hunted species, and these carry risks of becoming invasive, competing, or hybridizing with indigenous species, and spreading diseases and parasites [6]. Fencing on game ranches can fragment wildlife populations [7], leading to the disruption of dispersal and migratory movements, inbreeding and loss of heterozygosity. If trophy hunting dramatically distorts community structure and function, other potential ecological consequences include changes to predator–prey dynamics, herbivore–plant interactions, and density or behaviorally mediated trophic cascades [8]. These changes could result in ‘trophic downgrading’ of ecosystems, putting additional pressure on biodiversity [9].

There are also evolutionary-scale consequences of the selective harvesting of trophy animals with particular heritable phenotypic traits [10,11]. This artificial selection typically leads to a rapid decline

(within a few generations) in the desired trophy attributes within the hunted population. Such traits, including features such as body size, may be linked to other fitness-related attributes, such as physiological tolerances or disease resistance [10] and, thus, would lead to a decline in fitness. These selective pressures, which amount to domestication, vary as a function of hunting intensity, duration, and population size, and, thus, fluctuate among species [11]. Another form of domestication emerging from trophy hunting is the selective breeding for desirable traits in individuals, such as large manes in lions [12] or, in extreme cases, artificially selected color variants maintained by inbreeding [6].

Di Minin *et al.* [1] are correct in stating that trophy hunting can increase funding for conservation (this is well known), but they have failed to address the effects of trophy hunting on the suite of mechanisms driving species interactions, plant community dynamics, natural selection, trophic cascades, and ecosystem structure and function. While there are many issues relating to the pros and cons of trophy hunting, we suggest that the ecological and evolutionary discussion should focus on relevant variables and interactions that can be linked to trophy hunting. This discussion would then help drive the research that is needed to further the important debate on the ecological consequences of trophy hunting. Moreover, this would alert the trophy-hunting industry to areas of research that need to be funded and supported by the industry itself.

¹Global Trophic Cascades Program, Department of Forest Ecosystems and Society, Oregon State University, Corvallis, OR 97331, USA

²Centre for Integrative Ecology, School of Life and Environmental Sciences, Deakin University, Burwood, VIC 3125, Australia

³Desert Ecology Research Group, School of Biological Sciences, University of Sydney, NSW 2006, Australia

⁴Centre for African Conservation Ecology, Department of Zoology, Nelson Mandela Metropolitan University, Port Elizabeth, 6031, South Africa

*Correspondence: bill.ripple@oregonstate.edu (W.J. Ripple).

<http://dx.doi.org/10.1016/j.tree.2016.03.011>

References

1. Di Minin, E. *et al.* (2016) Banning trophy hunting will exacerbate biodiversity loss. *Trends Ecol. Evol.* 31, 99–102
2. Ripple, W.J. and Beschta, R.L. (2012) Trophic cascades in Yellowstone: the first 15 years after wolf reintroduction. *Biol. Conserv.* 145, 205–213
3. Landman, M. *et al.* (2013) Shift in black rhinoceros diet in the presence of elephant: evidence for competition? *PLoS ONE* 8, e69771
4. Richardson, J.A. (1998) Wildlife utilization and biodiversity conservation in Namibia: conflicting or complementary objectives? *Biodivers. Conserv.* 7, 549–559
5. Lindsey, P.A. *et al.* (2005) Attitudes of ranchers towards African wild dogs *Lycaon pictus*: conservation implications on private land. *Biol. Conserv.* 125, 113–121
6. Castley, J.G. *et al.* (2001) Compromising South Africa's natural biodiversity—inappropriate herbivore introductions: commentary. *South Afr. J. Sci.* 97, 344–348
7. Woodroffe, R. *et al.* (2014) To fence or not to fence. *Science* 344, 46–48
8. Ripple, W.J. *et al.* (2015) Collapse of the world's largest herbivores. *Sci. Adv.* 1, e1400103
9. Estes, J.A. *et al.* (2011) Trophic downgrading of planet earth. *Science* 333, 301–306
10. Coltman, D.W. *et al.* (2003) Undesirable evolutionary consequences of trophy hunting. *Nature* 426, 655–658
11. Crosmarty, W-G. *et al.* (2013) Trophy hunting in Africa: long-term trends in antelope horn size. *Anim. Conserv.* 16, 648–660
12. Lindsey, P. *et al.* (2012) Possible relationships between the South African captive-bred lion hunting industry and the hunting and conservation of lions elsewhere in Africa. *South Afr. J. Wildl. Res.* 42, 11–22