

**1 Discriminating regulation from hunting as a conservation intervention**

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11 **Article impact statement:** Overlooking the role of regulation in hunting programs weakens  
12 inference about successful conservation interventions and misguides policy.

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16 Protecting biodiversity requires that we correctly identify major threats and effective  
17 interventions to abate them (Salafsky & Margoluis 2003; Sutherland et al. 2004). If the scientific  
18 community wants the world to heed our warnings of ecosystem collapse (Ripple et al. 2017),  
19 we should be aware of past warnings and current misunderstandings. A century ago, similar  
20 alarms sounded over extinctions of wild animals taken for commercial meat markets (Roosevelt  
21 1916). The near-extinction averted in the early 20<sup>th</sup> century provides useful contemporary  
22 lessons (Figure 1). Then, over-hunting threatened the persistence of multiple species and the

23 public policy intervention replaced commercial extraction with regulatory systems. Regulated  
24 hunting seems to have saved wildlife from extinction by limiting methods, participants, and  
25 quantities taken by hunters and trappers. Yet, the observation that regulation saved wild  
26 animals of western nations is persistently being misrepresented (as we describe below) and  
27 replaced in the scientific and management literature by an implicit assertion that hunting itself  
28 was the intervention.

29         The misrepresentation of the history is that the act of hunting, rather than regulation of  
30 hunting, saved commercial species from extinction. This misrepresentation was illustrated  
31 recently in a 19,000 word review aimed at “Finding effective ways of conserving large  
32 carnivores ... as a priority in conservation.” (Abstract, Redpath et al. 2017). In that article, 19  
33 prominent conservation scientists wrote, “...many predator populations thrive in the presence  
34 of hunting/trapping programs (hereafter just referred to as hunting) supported by local  
35 people;” (p. 2158, Redpath et al. 2017). Without evidence for the claim populations “thrive”,  
36 the authors condense “hunting/trapping programs” into simply “hunting” without defining  
37 programs to include permits, regulations and enforcement. Nor is that article unusual. Going  
38 back decades, one finds agencies and prominent institutions advocating hunting as a  
39 conservation intervention (Clark & Milloy 2014). For example, assertions, that hunting is an  
40 effective conservation intervention in and of itself, without accompanying evidence of positive  
41 outcomes for the hunted populations, have been published or promoted by The International  
42 Union for the Conservation of Nature, The Wildlife Society, the Association of Fish and Wildlife  
43 Agencies, the Western Association of Fish and Wildlife Agencies, and the Wildlife Management  
44 Institute (Jackson 1996; Batcheller et al. 2010). Similar claims are made by academics penning

45 titles such as, “Why lions need to be hunted” (Howard 1988), or promoting trophy hunting  
46 generally (Di Minin et al. 2016). To be clear, we are not disputing the common and well-  
47 substantiated claim that hunters and their organizations have contributed financially and  
48 through other indirect means to conservation (Holsman 2000). Nor is the problem we detect  
49 one of advocacy – all people prefer asking and answering certain questions and interpreting  
50 data in a particular way. Instead, we discuss how the lack of evidence supporting that advocacy  
51 misrepresents the intervention that protected animal populations in the past.

52         Hunting never directly saves the targeted animal. To our knowledge, there is no  
53 evidence that hunting has ever saved an animal population or species from extinction. By  
54 contrast, restrictions on hunting have certainly stemmed extinctions and extirpations (Wilcove  
55 1999). These superficially obvious statements help to point the way to scientific evaluation of  
56 hunting as a conservation intervention. Specifically, hunting alone could only indirectly protect  
57 non-target individual animals (Treves 2009). The conservation community needs incisive  
58 experiments to disentangle the hypothesis that hunting itself protects animals from the  
59 competing hypothesis that *regulating* hunting protects animals. No one to our knowledge has  
60 tested whether regulation or another aspect of modern hunting or trapping programs was the  
61 effective intervention in the early 20<sup>th</sup> century. Was over-exploitation by hunters and trappers  
62 prevented by the enforcement of quotas and bag limits or prevented by other factors related to  
63 organized hunting? Asserting an effective conservation tool without presenting scientific  
64 evaluation of population-level outcomes risks misleading the public and policy-makers. The  
65 history of fisheries contains many such examples (Finley 2011). By analogy, scientists should cry  
66 foul if public health organizations touted ‘eating’ to fight cancer, rather than touting ‘healthful

67 diets' (i.e., regulated eating). Touting 'hunting' rather than 'regulated hunting' can create a risky  
68 misconception. As Platt (1964) predicted, scientific fields that do not effectively identify and  
69 test between opposed hypotheses will advance slowly, if at all. Only when claims are framed as  
70 opposed hypotheses will the field progress and the many claims about hunting as a  
71 conservation tool be falsifiable.

72         We see three pernicious consequences of omitting regulation from scientific treatments  
73 of conservation interventions. First, a lack of transparency about regulation prevents the  
74 objective evaluation of it as a help or hindrance to conservation efforts. For example, some  
75 might believe that regulation saved public hunting itself – because a society might have banned  
76 all hunting when commercialization threatened the public's wildlife. Others might believe that  
77 regulation is a hindrance to hunting as a conservation instrument. By omitting mention of  
78 regulation, the implicit notion advances that regulation is unnecessary. Indeed, one must  
79 beware of omitting regulation from the narrative about hunting as a conservation intervention,  
80 especially given the potential for financial conflicts of interest created by powerful, moneyed  
81 interests seeking unlimited exploitation. That leads us to the second pernicious consequence of  
82 discounting regulation. When authorities ignore or under-emphasize the importance of  
83 regulation, perpetrators of environmental crime, such as poaching, may feel emboldened or  
84 immune to prosecution. This idea was seemingly advocated by Kaltenborn & Brainerd (2016)  
85 with the notion that poaching acts as a release for rural resentment over national restoration of  
86 controversial wildlife. Treves et al. (2017a) reviewed four other cases where inaccurate  
87 measurement of poaching had led governments to downplay the major threat to endangered  
88 gray wolves (*Canis lupus*). Predators in particular seem to be targets for the notion of hunting

89 as a conservation intervention (Figure 2); the common hypothesis being that the predator  
90 populations benefit indirectly when people kill a minority of them, because then people  
91 tolerate the survivors better or revenue flows to direct conservation (Loveridge et al. 2007;  
92 Treves 2009; Treves & Bruskotter 2014; Chapron & Treves 2017; Macdonald et al. 2017). The  
93 third pernicious consequence of forgetting the importance of regulation relates to the paucity  
94 of scientific evidence into this question. Given this paucity, our criticism of hunting as  
95 conservation might be seen as opposition to hunting itself. We do not, however, view hunting  
96 as incompatible with conservation. Confusing our work with anti-hunting advocacy would once  
97 again confuse the activity with the scientific evaluation of its effectiveness for protecting the  
98 hunted population.

99 To protect biodiversity effectively, scientists must identify interventions that improve  
100 outcomes for populations. Decision-makers must be transparent in their value judgments about  
101 human activities they permit (Treves et al. 2017b) and the evidence they use to allocate natural  
102 resources (Artelle et al. 2018 ). Failure might contribute to ongoing extinctions and the erosion  
103 of public confidence in science.

#### 104 **References**

105

106 Artelle KA, Reynolds JD, A. T, Walsh JC, C. PP, Darimont CT. 2018 Hallmarks of science missing  
107 from North American wildlife management. *Science Advances* 4:eaa0167.

108 Batcheller GR, et al. 2010. *The Public Trust Doctrine: Implications for Wildlife Management and*  
109 *Conservation in the United States and Canada*. Bethesda, MD.

- 110 Chapron G, Treves A. 2017. Reply to comments by Olson et al. 2017 and Stien 2017.  
111 Proceedings of the Royal Society B **20171743**.
- 112 Clark SG, Milloy C. 2014. The North American Model of Wildlife Conservation: An Analysis of  
113 Challenges and Adaptive Options. Pages 289-324 in Clark SG, and Rutherford MB,  
114 editors. Large Carnivore Conservation: Integrating Science and Policy in the North  
115 American West. The University of Chicago Press, Chicago.
- 116 Di Minin E, Bradshaw C, Leader-Williams N. 2016. Banning trophy hunting will exacerbate  
117 biodiversity loss. Trends in Ecology and Evolution **31**:99-102.
- 118 Finley C 2011. All the Fish in the Sea: Maximum Sustainable Yield and the Failure of Fisheries  
119 Management University of Chicago Press, Chicago.
- 120 Holsman RH. 2000. Goodwill hunting? Exploring the role of hunters as ecosystem stewards.  
121 Wildlife Society Bulletin **28**:808-816.
- 122 Howard WE. 1988. Why lions need to be hunted. Proceedings of the Mountain Lion Workshop  
123 **3**:66-68.
- 124 Jackson JJ. 1996. An international perspective on hunting. Pages 7–11 in Leader-Williams N,  
125 Kayera JA, and Overton GL, editors. Tourist Hunting in Tanzania. Occasional Publication  
126 14, International Union for the Conservation of Nature and Natural Resources,  
127 Cambridge.
- 128 Kaltenborn BP, Brainerd SM. 2016. Can poaching inadvertently contribute to increased public  
129 acceptance of wolves in Scandinavia? European Journal of Wildlife Research:DOI:  
130 10.1007/s10344-10016-10991-10343.

- 131 Loveridge AJ, Reynolds JC, Milner-Gulland EJ. 2007. Does sport hunting benefit conservation?  
132 Pages 224-241 in MacDonald D, and Service K, editors. Key Topics in Conservation  
133 Biology. Oxford University Press, Oxford.
- 134 Macdonald DW, Loveridge AJ, Dickman A, Johnson PJ, Jacobsem KS, De Preez B. 2017. Lions,  
135 trophy hunting and beyond: knowledge gaps and why they matter. Mammal Review:doi:  
136 10.1111/mam.12096.
- 137 Platt JR. 1964. Strong inference. *Science* **146**:347–353.
- 138 Redpath S, et al. 2017. Don't forget to look down – collaborative approaches to predator  
139 conservation. *Biological Reviews* **92**:2157–2163.
- 140 Ripple WJ, Wolf C, Newsome TM, Galetti M, Alamgir M, Crist E, Mahmoud MI, Laurance WF,  
141 and 15 ssfc. 2017. World Scientists' Warning to Humanity: A Second Notice. *Bioscience*  
142 **67**:1026–1028.
- 143 Roosevelt TD 1916. *A Book-Lover's Holidays in the Open*. Charles Scribner's Sons, New York.
- 144 Salafsky N, Margoluis R. 2003. What conservation can learn from other fields about monitoring  
145 and evaluation. *BioScience* **53**:120-121.
- 146 Sutherland WJ, Pullin AS, Dolman PM, Knight TM. 2004. The need for evidence-based  
147 conservation. *Trends in Ecology & Evolution* **19**.
- 148 Treves A. 2009. Hunting to conserve large carnivores. *Journal of Applied Ecology* **46**:1350-1356.
- 149 Treves A, Artelle KA, Darimont CT, Parsons DR. 2017a. Mismeasured mortality: correcting  
150 estimates of wolf poaching in the United States. *Journal of Mammalogy* **98**:1256–1264.
- 151 Treves A, Bruskotter JT. 2014. Tolerance for predatory wildlife. *Science* **344**:476-477.

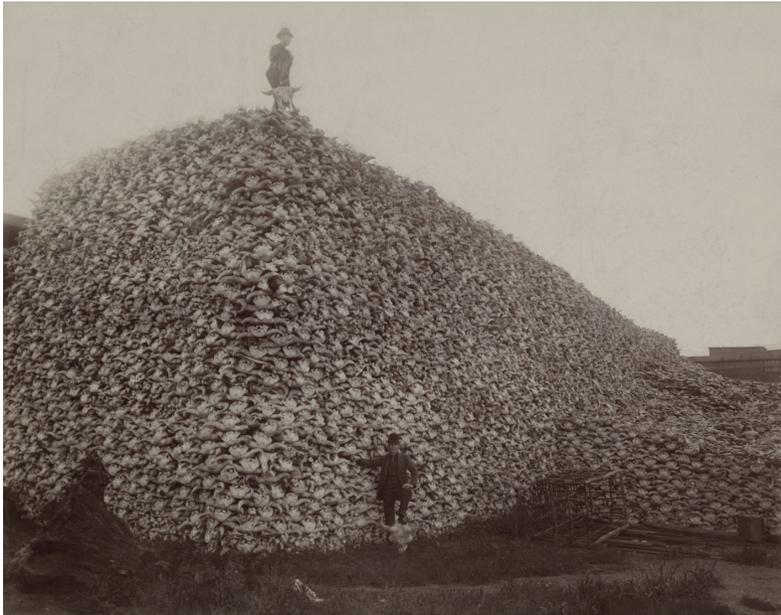
152 Treves A, Chapron G, López-Bao JV, Shoemaker C, Goeckner A, Bruskotter JT. 2017b. Predators  
153 and the public trust. *Biological Reviews* **92**:248-270.

154 Wilcove D 1999. *The Condor's Shadow*. H. Freeman and Co., New York.

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156 Figure 1. Photograph from the mid-1870s of a pile of American bison skulls waiting to be  
157 ground for fertilizer. Public domain photo, credit:

158 [https://en.wikipedia.org/wiki/Market\\_hunters#/media/File:Bison\\_skull\\_pile\\_edit.jpg](https://en.wikipedia.org/wiki/Market_hunters#/media/File:Bison_skull_pile_edit.jpg)



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160 Figure 2. Market hunting of cougars

161 [https://upload.wikimedia.org/wikipedia/commons/3/30/Market\\_hunting\\_of\\_cougars.jpg](https://upload.wikimedia.org/wikipedia/commons/3/30/Market_hunting_of_cougars.jpg)



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