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FINDINGS ABSTRACT



## Producers' perceptions of large carnivores and nonlethal methods to protect livestock from depredation: findings from a multistate federal initiative

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We examined livestock producers' perceptions of wolves, grizzly bears, black bears, and mountain lions, as well as their experiences with using nonlethal methods to protect livestock from depredation. All producers in the study received nonlethal predator management assistance in 2020 from USDA-APHIS-Wildlife Services ("WS") pursuant to a federally funded initiative focused on the use of nonlethal methods to protect livestock. Such methods included assistance from range riders (i.e., individuals who monitor livestock and carnivores), fladry (i.e., flags hung from rope that serve as a repellent), and other audio/visual deterrents (e.g., Foxlights). The producers did not specifically seek nonlethal assistance from WS; rather, they sought assistance from WS with controlling depredation of livestock, and WS personnel determined that nonlethal methods were an appropriate fit for the circumstances. In some cases, lethal methods may have been used prior to, following, or in combination with, nonlethal methods on a producer's operation. In addition, producers may have employed other nonlethal methods themselves, including fencing and livestock guardian animals.

Our objectives were to understand the producers' (1) experiences with, and attitudes toward, the four carnivores of interest; (2) perceptions of the effectiveness of all management methods (lethal and nonlethal) used their operations in 2020; and (3) levels of interest in using nonlethal methods, both before and after receiving assistance from WS in 2020. Data were collected using a self-administered, mail-back questionnaire. The questionnaire was sent to all producers in 10 US states<sup>1</sup> who received nonlethal predator management assistance from WS in 2020 ( $n = 89$ ). We received 40 responses (45% response rate), nearly three-quarters of which were from Montana ( $n = 13$ ), Minnesota ( $n = 10$ ), and Wisconsin ( $n = 6$ ). A majority of respondents produced cattle ( $n = 28$ ), followed by horses/mules ( $n = 11$ ), sheep/goats ( $n = 6$ ), honeybees ( $n = 3$ ), and chickens ( $n = 2$ ). Ten respondents produced multiple livestock types.

In areas on or near respondents' livestock operations, wolves were by far the most commonly encountered carnivore among the four of interest, with 76% of respondents reporting that they encountered wolves either monthly, weekly, or nearly every day. By contrast, 64% of respondents reported that they never encountered grizzly bears, and 43%

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reported that they never encountered mountain lions. Of the four carnivores, wolves were also believed by three-quarters of respondents (77%) to be responsible for most of their livestock losses over the past 4 years, and among those respondents, 85% produced cattle. No respondent identified mountain lions as the carnivore responsible for most of their livestock losses, while 16% of respondents identified black bears and 7% identified grizzly bears in response to the question.

Based upon a 10-item attitudinal scale, with response options ranging from 1 (very negative) to 5 (very positive), respondents had, on average, negative attitudes toward wolves ( $M = 1.96$ ) and grizzly bears ( $M = 2.2$ ), a neutral attitude toward mountain lions ( $M = 3.0$ ), and a neutral to slightly positive attitude toward black bears ( $M = 3.26$ ). Notably, the average attitude toward black bears among the five producers who believed black bears were responsible for most of their livestock losses was slightly more positive ( $M = 3.28$ ) than the overall average toward black bears. Tolerance – a measure of individuals' willingness and ability to live alongside wildlife (McLean et al., 2021) – was measured by asking respondents what change in the population of each carnivore they would like to see in the area surrounding their livestock operation and in their state. Tolerance levels for wolves were the lowest among the four predators, though tolerance levels were nearly as low for grizzly bears. More than one-third of respondents (36%) reported that they wanted wolves completely removed from the area surrounding their operation, while another 59% preferred that wolf populations be decreased either greatly or somewhat in the same area (the corresponding percentages for grizzly bears were 16% and 74%). Tolerance for wolves in a producer's state was only slightly higher, with a lower percentage of respondents preferring complete removal of this carnivore (26%), but a higher percentage preferring greatly or somewhat decreased wolf populations (69%). Tolerance levels for black bears and mountain lions were relatively higher, with no respondents preferring removal of mountain lions, and only one preferring removal of black bears, but only in the area surrounding his/her operation. Moreover, 76% of respondents preferred that black bear populations remain unchanged in the area surrounding their operation, while 50% preferred the same for mountain lions.

Among nonlethal methods, fladry was used on the greatest number of respondent livestock operations ( $n = 17$ ), followed by range riders ( $n = 14$ ) and electric fencing ( $n = 14$ ; Table 1). Among lethal methods, trap and kill was used on the greatest number of respondent livestock operations ( $n = 12$ ), followed by ground shooting ( $n = 6$ ), and snares ( $n = 5$ ). In terms of respondents' perceptions of method effectiveness at protecting livestock, the three methods with the highest mean effectiveness score (5-point scale, 1 = ineffective and 5 = effective) were all lethal in nature: trap and kill ( $M = 4.55$ ), snares ( $M = 4.50$ ), and ground shooting ( $M = 4.33$ ). Among nonlethal methods, guardian animals received the highest mean effectiveness score ( $M = 4.09$ ), followed by range riders ( $M = 4.0$ ) and electric fencing ( $M = 3.58$ ). No nonlethal method was found to be *ineffective* by a majority of respondents, although only 33% of respondents found audio/visual deterrents to be effective (45% found them ineffective and 22% were unsure).

In terms of interest in using nonlethal methods, a majority of respondents reported that they were either somewhat interested (26%,  $n = 10$ ) or very interested (36%,  $n = 14$ ) in using nonlethal methods to protect their livestock before they received nonlethal predator management assistance from WS. Of the remainder, 15% ( $n = 6$ ) were not at all interested in nonlethal methods, 5% ( $n = 2$ ) were not very interested in nonlethal methods, and 18% ( $n = 7$ ) were neutral. Most respondents reported that *after* receiving nonlethal assistance

**Table 1.** Perceived effectiveness of predator management methods.

Method	# Who Used (# Who Rated Effectiveness)	Mean Effectiveness Score	% Ineffective/Effective				
			Ineffective	Somewhat Ineffective	Neither	Somewhat Effective	Effective
Trap and kill	12 (11)	4.55	0	9	0	18	73
Snares	5 (4)	4.50	0	0	25	0	75
Ground shooting	6 (6)	4.33	0	0	17	33	50
Range riders	14 (11)	4.09	9	0	0	55	36
Guardian animals	9 (7)	4.0	0	0	29	42	29
Aerial gunning	4 (3)	4.0	0	0	33	33	33
Electric fencing	14 (12)	3.58	25	0	8	25	42
Fladry	17 (14)	3.50	22	14	7	7	50
Nonelectric fencing	9 (6)	3.50	33	0	0	17	50
Trap and release	6 (6)	3.33	0	33	17	33	17
Other audio/visual deterrents	10 (9)	2.67	34	11	22	22	11

from WS, they became somewhat more interested in using nonlethal methods (33%,  $n = 13$ ) or much more interested in using nonlethal methods (23%,  $n = 9$ ). Less than a quarter of respondents reported becoming either much less interested in nonlethal methods (10%,  $n = 4$ ) or somewhat less interested in nonlethal methods (13%,  $n = 5$ ), while 21% ( $n = 8$ ) reported that their level of interest remained the same. Notably, 88% of respondents who were somewhat or very interested in nonlethal methods prior to receiving assistance from WS reported that their level of interest further increased or remained the same after receiving assistance from WS. Conversely, 63% of respondents who were not at all interested or not very interested in nonlethal methods prior to receiving assistance from WS reported that their level of interest further decreased or remained the same after receiving assistance from WS.

When presented with the choice between using a lethal method or an equally effective nonlethal method, 46% of respondents preferred the lethal method, while 21% reported no preference between the two. Among the 33% who preferred the nonlethal method, four were unwilling to pay any additional money for it (above the cost of the lethal method). The remaining nine were willing to pay amounts ranging from an additional \$100 per year (one respondent) to an additional \$1,000 per year (three respondents). When asked which nonlethal methods they would use at their own expense if the nonlethal methods were no longer provided by WS, a majority were willing to use (or were already using) all but two at their own expense: fladry (48%) and audio/visual deterrents (43%). The nonlethal methods with the highest percentage of respondents willing to use them at their own expense were livestock guardian animals (76%), electric fencing (70%), and range riders (62%).

In summary, our findings showed that attitudes toward and tolerance for wolves were the lowest among the four carnivores, with wolves also believed by a majority of respondents to be responsible for the most livestock losses over the past 4 years. Livestock losses could not entirely explain tolerance or attitudes toward the carnivores, however, as the five producers who believed black bears were responsible for most of their livestock were found to have slightly positive attitudes toward black bears (and negative attitudes toward wolves). Overall, our findings also indicated a fairly high level of interest in using nonlethal methods to prevent livestock depredation. Most respondents indicated that their level of interest in

nonlethal methods increased after receiving nonlethal predator management assistance from WS. We found, however, that respondents who were generally disinterested in nonlethal methods before receiving assistance from WS were less likely than other respondents to have experienced any increase in their level of interest after receiving assistance. Importantly, interest in nonlethal methods did not equate to a preference for nonlethal methods. Only one-third of respondents preferred nonlethal predator management methods to lethal methods. Although we specified in the relevant questionnaire item that respondents should assume the lethal and nonlethal methods were equally effective, they may have been influenced by their own experiences with lethal and nonlethal predator management method effectiveness. In this regard, the three management methods that were perceived as the most effective in protecting livestock were all lethal in nature. Nevertheless, all but one of the nonlethal methods were found to be effective by most respondents, which, when considered together with respondents' interest in using nonlethal methods, provide some evidence that many livestock producers may be willing to integrate appropriate nonlethal methods into their overall strategies for protecting livestock from large carnivores.

## Note

1. The states were Arizona, California, Idaho, Michigan, Minnesota, Montana, New Mexico, Oregon, Wisconsin, and Wyoming.

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## Disclosure Statement

No potential conflict of interest was reported by the author(s).

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