THE HUMANE SOCIETY OF THE UNITED STATES

Government data confirm that grizzly bears have a negligible effect on U.S. cattle and sheep industries

In the United States, data show that grizzly bears (*Ursus arctos*) kill few cattle and sheep. Livestock predation data collected by various governmental bodies differ significantly, however. The most recent data published by the U.S. Department of Agriculture-Animal and Plant Health Inspection Service (USDA)[1] indicate losses many times greater than those collected by states and the U.S. Fish and Wildlife Service (FWS). For instance, the USDA claims grizzly bears killed 3,162 cattle in *nine* states (in 2015), while the FWS verified only 123 such losses in *three* states (in 2013). Montana's Board of Livestock's data show that between 2015 and 2018 cattle losses from grizzly bears numbered 61 or less annually. The USDA's methodology involves collecting data from a few mostly unverified sources, which the USDA then extrapolated statewide without calculating standard errors or using models to test relationships among various mortality factors.[2] This contravenes the scientific method and results in exaggerated livestock losses attributed to native carnivores and dogs. Unfortunately, this misinformation informs public policies that harm native carnivores, including countless legislative attacks on grizzly bears, wolves and the Endangered Species Act.

The Humane Society of the United States analyzed the USDA's embellished predation numbers. Their data show that farmers and ranchers lose nine times more cattle and sheep to health, weather, birthing and theft problems than to all predators combined. In the USDA reports, "predators" include mammalian carnivores (e.g., cougars, wolves and bears), avian carnivores (e.g., eagles and hawks) and domestic dogs. Domestic dogs, according to the USDA's data, kill 85 percent more cattle than grizzly bears. Also according to the USDA, in the states where grizzly bears live (excluding Alaska), they cause far fewer than one percent of unwanted cattle-calf (hereinafter "cattle") losses by inventory.

The USDA's sheep losses report fails to differentiate between black bears and grizzly bears, making an analysis for grizzly bears impossible. Black bears live in approximately 41 states,[3] while in the lower 48 states grizzly bears live in only three: Idaho, Montana and Wyoming. Black bears' and grizzly bears' ranges overlap in those same three states. Grizzly bears also occur in Alaska, but the USDA does not analyze Alaska in their livestock reports.

We present our analysis of the USDA's data sets on cattle deaths in the three, grizzly bear-occupied states (excluding Alaska) and grizzly bears' effects on the national cattle industries. We compare the USDA's cattle data to those of other governmental bodies that also collect this information, which corroborates our findings that while the USDA's predation figures are significantly exaggerated, they are nominal when compared to livestock mortalities from health, weather, theft and birthing problems (we refer to these livestock losses as "maladies"). We describe humane, efficacious and cost-effective non-lethal methods for livestock protection, and show that only a fraction of cattle and sheep growers in grizzly bear-occupied states use non-lethal methods to protect their herds—even as numerous published studies have found that non-lethal methods to protect non-native cattle and sheep from native carnivores are more efficacious and cost effective than the constant slaughter of wildlife that is ubiquitously employed—even on federally protected species.

Dated: Mar. 6, 2019

I. Grizzly bears of the Northern Rocky Mountains remain "threatened" under the Endangered Species Act

On June 30, 2017, the FWS prematurely removed federal Endangered Species Act protections from grizzly bears living in the Greater Yellowstone Ecosystem.[4] In August, immediately after the required 60-day notice period to the agency, the Humane Society of the United States, the Sierra Club and the Center for Biological Diversity filed suit under the Endangered Species Act. Nine Native American tribes led by the Crow Nation also sued the FWS for failure to consult with the tribes concerning the delisting. The states of Idaho, Wyoming and Montana, and some groups (Safari Club International, National Rifle Association, Rocky Mountain Elk Foundation and others) intervened on behalf of the FWS.

On September 25, 2018, the federal court agreed with the Humane Society of the United States and our co-plaintiffs and restored Endangered Species Act protections to grizzly bears.[5] After an injunctive order and the final order preventing grizzly bear delisting, their deaths spiked, showing that even with restored ESA protections, grizzly bears were not immune from heavy-handed persecution.[6] Fig. 15. As of February 2019, defendants have appealed the district court's decision.

II. USDA data show most livestock die from health, weather and other maladies

The USDA's reports show that the primary causes of cattle and sheep losses in the U.S. come from health problems, weather, theft and other maladies, but *not* from native carnivores, including grizzly bears.[7] Nationwide USDA data show that *nine times* more cattle and sheep died from maladies such as illnesses, birthing problems, weather, poisoning and theft (3,990,035), than from all mammalian or avian predators together (474,965). Of the 119 million cattle and sheep inventoried in the U.S. in 2014 and 2015, less than one percent (0.4 percent) died from mammalian and avian predators combined. Figs. 1 - 5. In Idaho, Montana and Wyoming, grizzly bears killed between 0.01 percent and 0.03 percent of cattle inventories. Fig. 3. Of the total unwanted cattle deaths in the Northern Rocky Mountains, between 91 percent and 96 percent came as a result of maladies. Fig. 4.

A. Despite being inflated, USDA data show that few cattle die from grizzly bears, other native carnivores or dogs

In 2015, the USDA inventoried 112.2 million cattle in the U.S.[8] Of that number, 4.5 million died from *all* unwanted causes. Most of those deaths (3.6 million, or 3.2 percent of U.S. cattle inventory) stemmed from health-related maladies, weather and theft. According to the USDA's data, mortalities from all predators amounted to 280,570 cattle deaths, representing a mere 0.3 percent of the U.S. cattle inventory—with grizzly bears taking 0.003 percent of the U.S. cattle inventory. Figs. 1 and 2.

PHOTO BY: DON GETTY

Fig. 1. United States Cattle Inventory and Mortality by Cause

Data from USDA-APHIS (2017), Data Year 2015

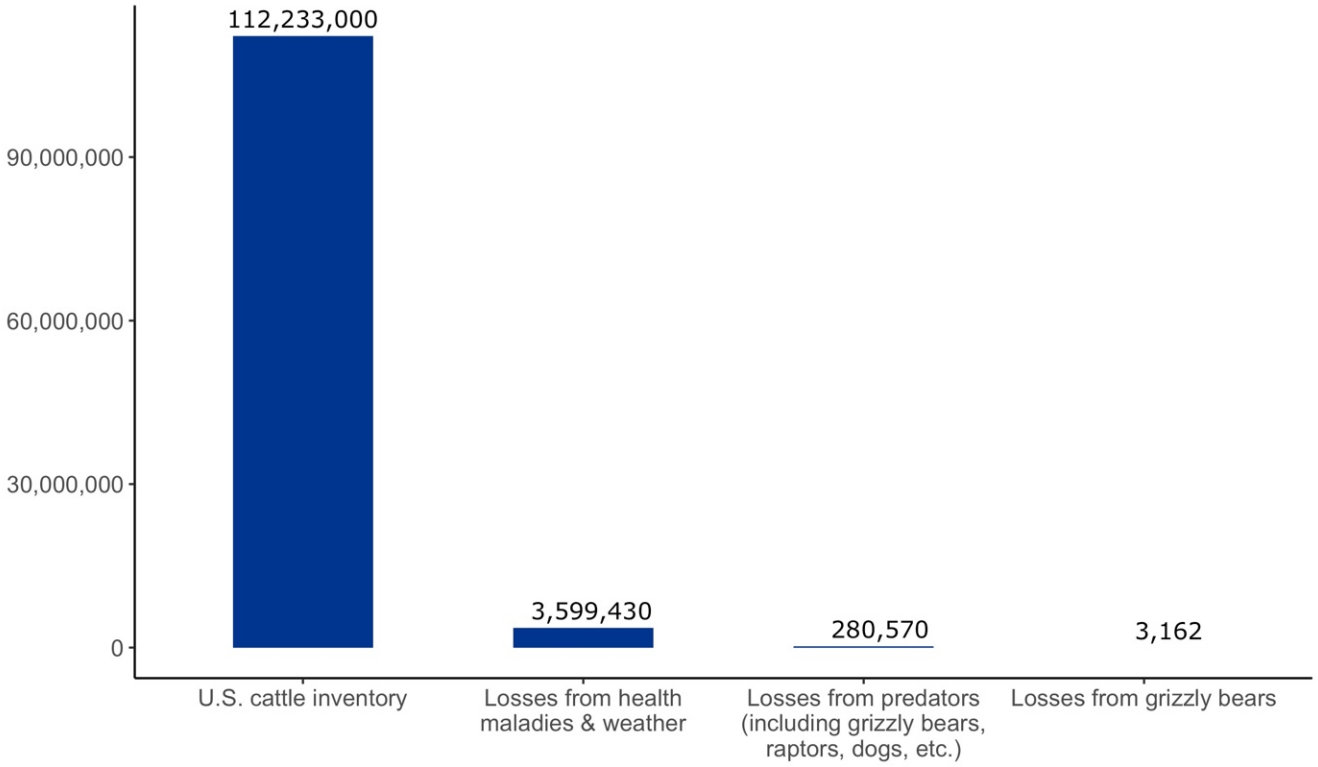


Fig. 2. United States Cattle Mortality by Rank

Data from USDA-APHIS (2017), Data Year 2015

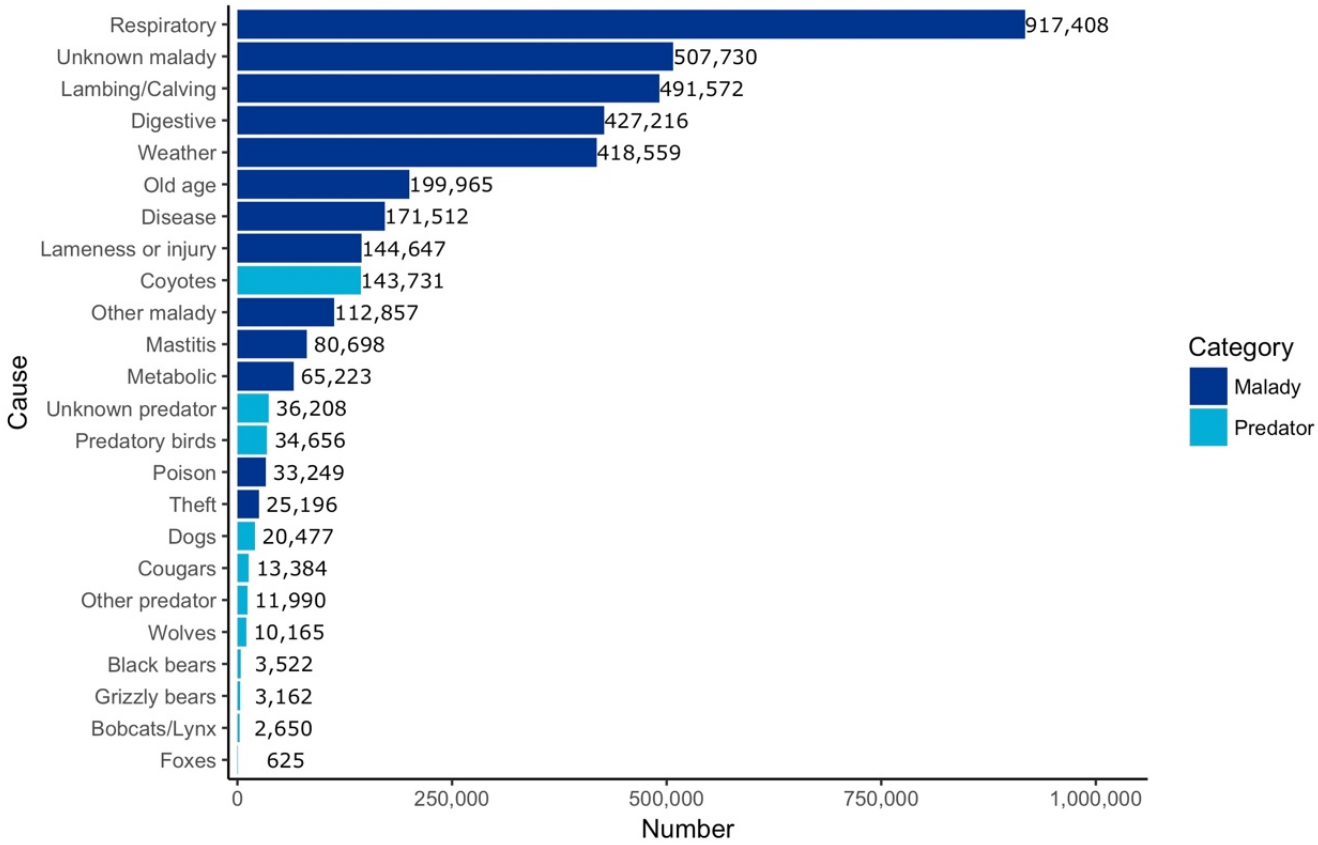


Fig. 3 Cattle Inventory Losses by State (*Unverified* data from the USDA-Animal and Plant Health Inspection Service, 2017 (Data year 2015))					
State	Cattle Inventory	Cattle losses from maladies (illness, birthing problems etc.)	Percent of cattle inventory losses from maladies	Cattle losses from grizzly bears	Percent of cattle inventory losses from grizzly bears
Idaho	3,020,000	89,050	2.95%	308	0.01%
Montana	3,995,000	80,730	2.02%	952	0.02%
Wyoming	1,880,000	35,600	1.89%	553	0.03%
Total	8,895,000	205,380	2.31%	1,813	0.02%

B. <u>Despite being inflated, USDA data show that few sheep die from grizzly bears, black bears, other native carnivores or dogs</u>

In 2015, the U.S. sheep inventory amounted to 6.8 million individuals. Health, weather, poison, theft and other maladies were responsible for the majority of ranchers' and farmers' losses: 390,605 sheep deaths (or 5.7 percent of the U.S. sheep inventory). In comparison, native mammalian carnivores, raptors and domestic dogs killed 194,395 sheep, or 2.9 percent of the U.S. sheep inventory, with grizzly bears and black bears' contributions amounting to 0.10 percent of the U.S. sheep inventory.[9] Figs. 5 and 6. The USDA's sheep predation data fail to distinguish between black bears and grizzly bears. Predation of sheep is greater than of cattle, likely because sheep have smaller body size and lack predator-avoidance skills.[10] Despite this, the USDA's data show few sheep growers use non-lethal methods to protect their flocks (*see*: Figs. 16 and 17 below).

PHOTO BY: JOHN E. SWALLOW

Fig. 4 U.S. Cattle: Unwanted losses by cause and state (Unverified data, USDA-Animal and Plant Health Inspection Service, 2017 (Data year 2015))							
States	Total unwanted cattle losses	Cattle losses from maladies (illness, birthing problems, etc.)		Cattle losses from all predators		Cattle losses from grizzly bears	
		Number	Percent of total unwanted cattle losses	Number	Percent of total unwanted cattle losses	Number	Percent of total unwanted cattle losses
Idaho	93,000	89,050	95.75%	3,950	4.25%	308	0.33%
Montana	88,000	80,730	91.74%	7,270	8.26%	952	1.08%
Wyoming	39,000	35,600	91.28%	3,400	8.72%	553	1.42%
Total	220,000	203,380	92.45%	14,620	6.65%	1,813	0.82%

Fig. 5. United States Sheep Inventory and Mortality by Cause

Data from USDA-APHIS (2015), Data Year 2014

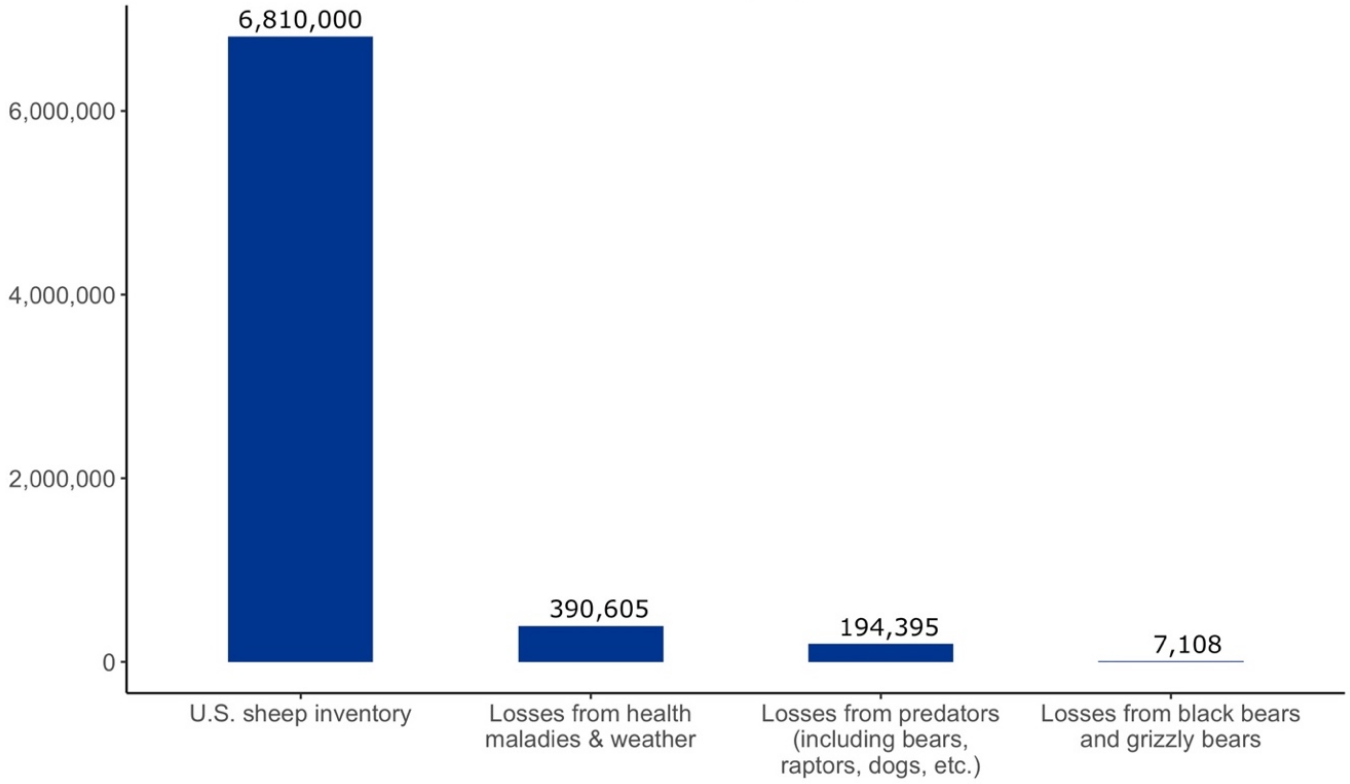
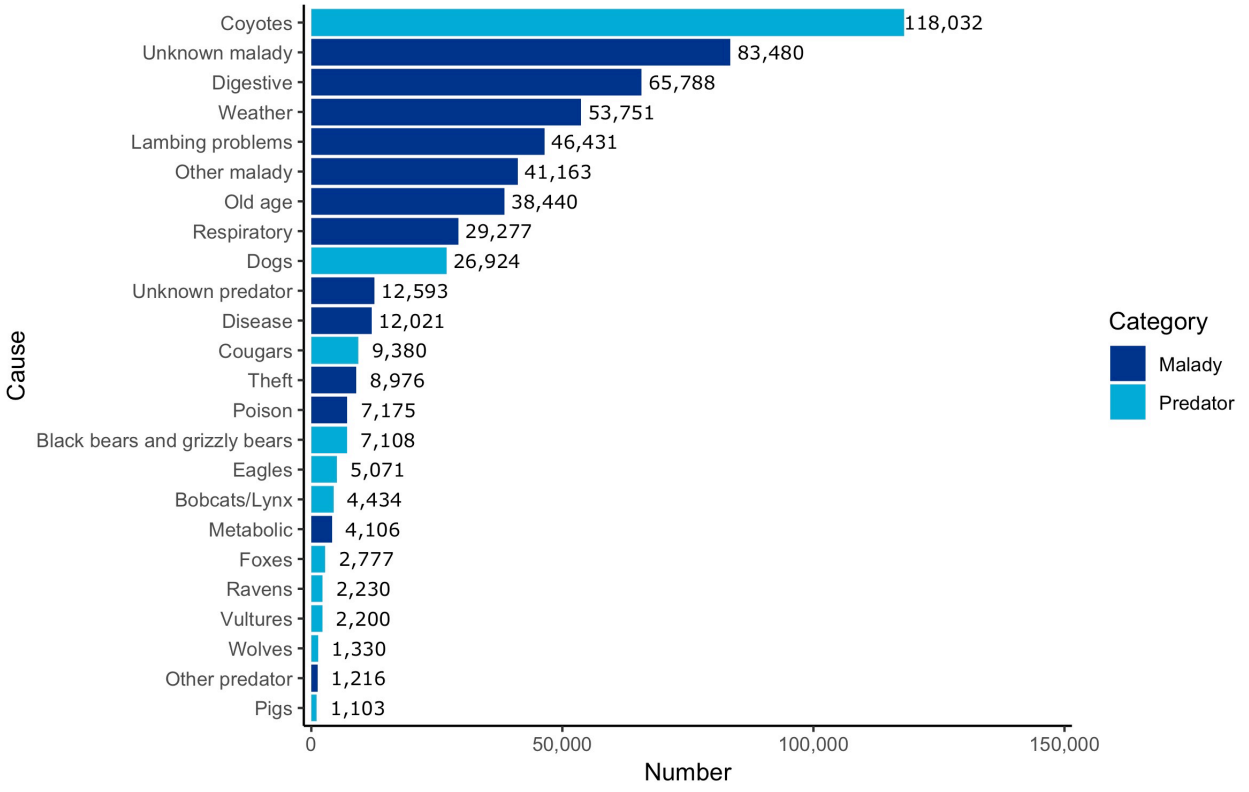


Fig. 6. United States Sheep Mortality by Rank

Data from USDA-APHIS (2015), Data Year 2014

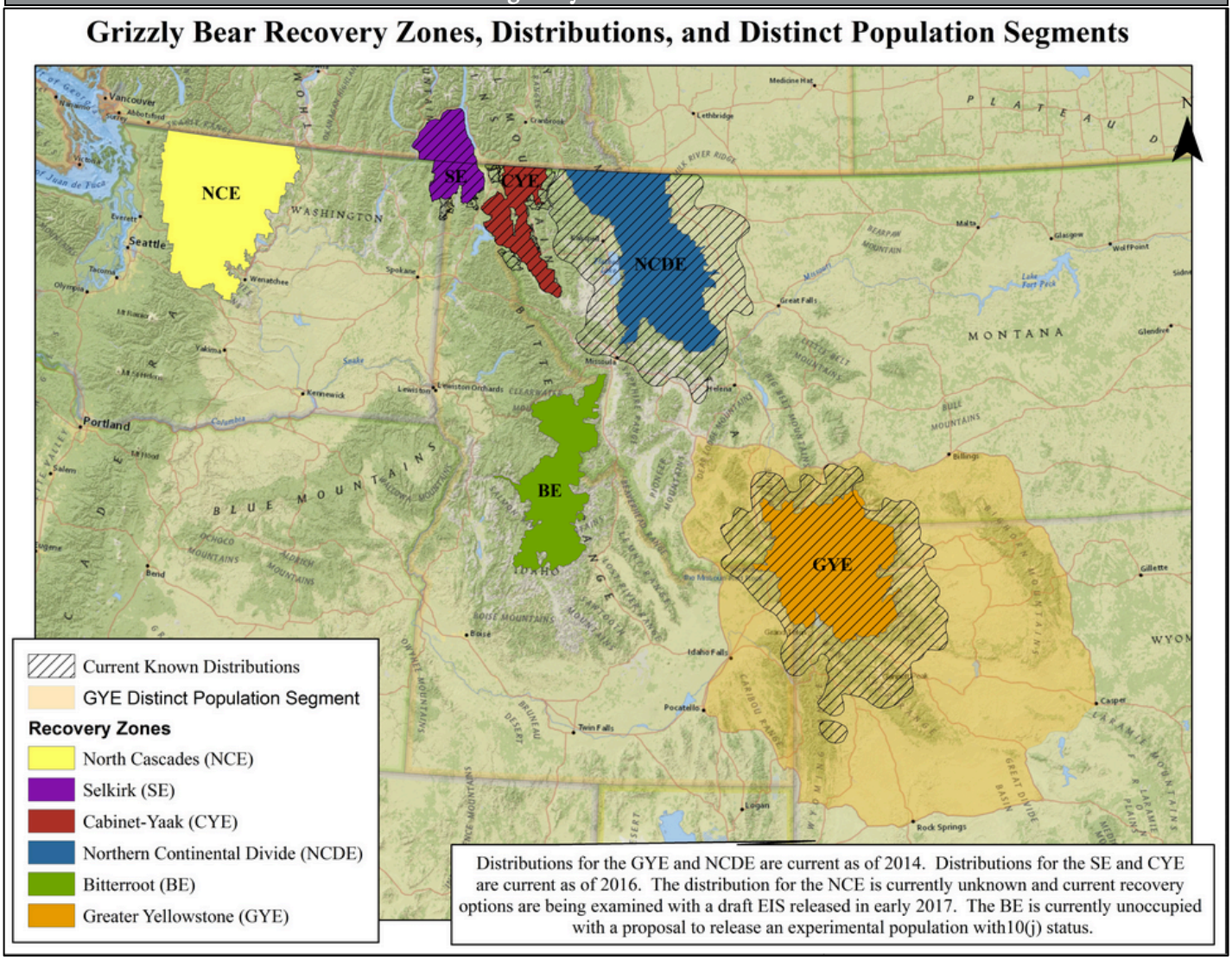


III. Even in grizzly bear-occupied states, USDA's data show nominal losses of cattle and sheep to predators

In the lower 48 states, fewer than 1,800 grizzly bears live in Idaho, Montana and Wyoming. They live in subpopulations located in the Cabinent-Yaak Ecosystem (with a subpopulation of about 50 bears),[11] the Greater Yellowstone Ecosystem (~700 bears),[12] the Northern Continental Divide Ecosystem (~942 bears)[13] and the Selkirk Ecosystem (~80 bears). While the FWS also classifies U.S. subpopulations in the Northern Cascades Ecosystem (which extends into Canada),[14] and Bitterroot Ecosystem, neither have occupant grizzly bears. (The Northern Cascades' Canadian portion may have some bears.) Fig. 7.

We detail these subpopulations here because the USDA reported cattle losses to grizzly bears in Arkansas, Colorado, Georgia, Nevada, Oregon and Wisconsin, *places where no grizzly bears live*, either currently or historically, further damaging the credibility of the agency's livestock losses reports.[15] Fig. 8.

Fig. 7.
Distribution of grizzly bears in the lower 48 states.



*Map courtesy of the FWS.[16]

IV. USDA *unverified* losses data for cattle and sheep losses, ranked

Based on data from other governmental agencies, the USDA exaggerates the cattle and sheep losses it attributes to native carnivores and dogs. Also, the USDA reports attribute wolf and grizzly bear deaths in states where neither species exists. Fig. 8. Given that these data are exaggerated, there is value in showing the USDA's cattle and sheep loss numbers in rank order to demystify predator events on cattle and sheep. We show unwanted losses to cattle and sheep in each grizzly-bear-occupied state in the Northern Rocky Mountain region (the USDA's reports excluded Alaska). The data clearly show that health and weather problems are the biggest concerns livestock growers face. Figs. 9-11.

Fig. 8.
USDA (2017) cattle death claims for grizzly bears
The six highlighted states have no grizzly bear populations

AR	175
CO	270
GA	537
ID	308
MT	952
NV	81
OR	28
WI	132
WY	553

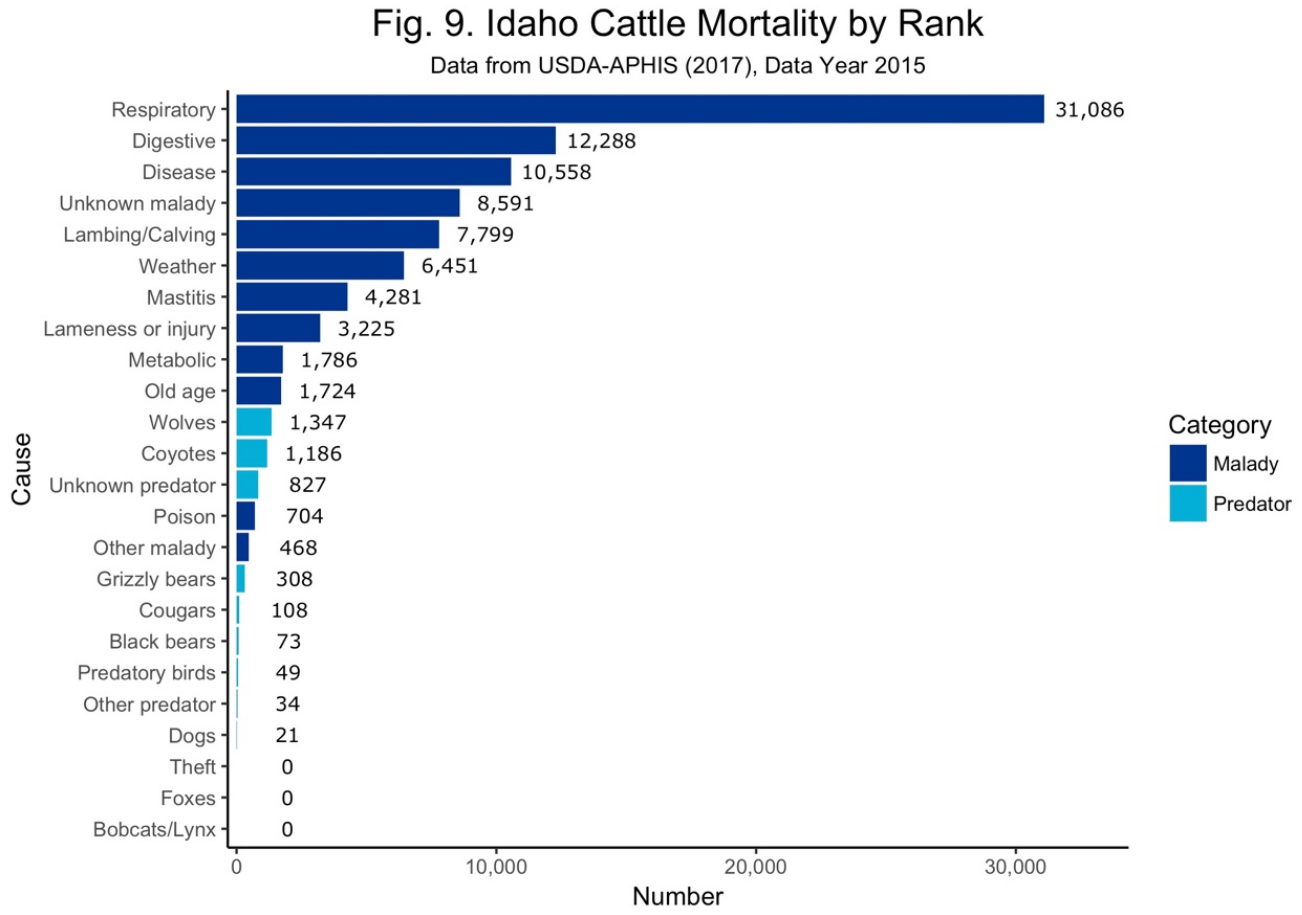


Fig. 10. Montana Cattle Mortality by Rank

Data from USDA-APHIS (2017), Data Year 2015

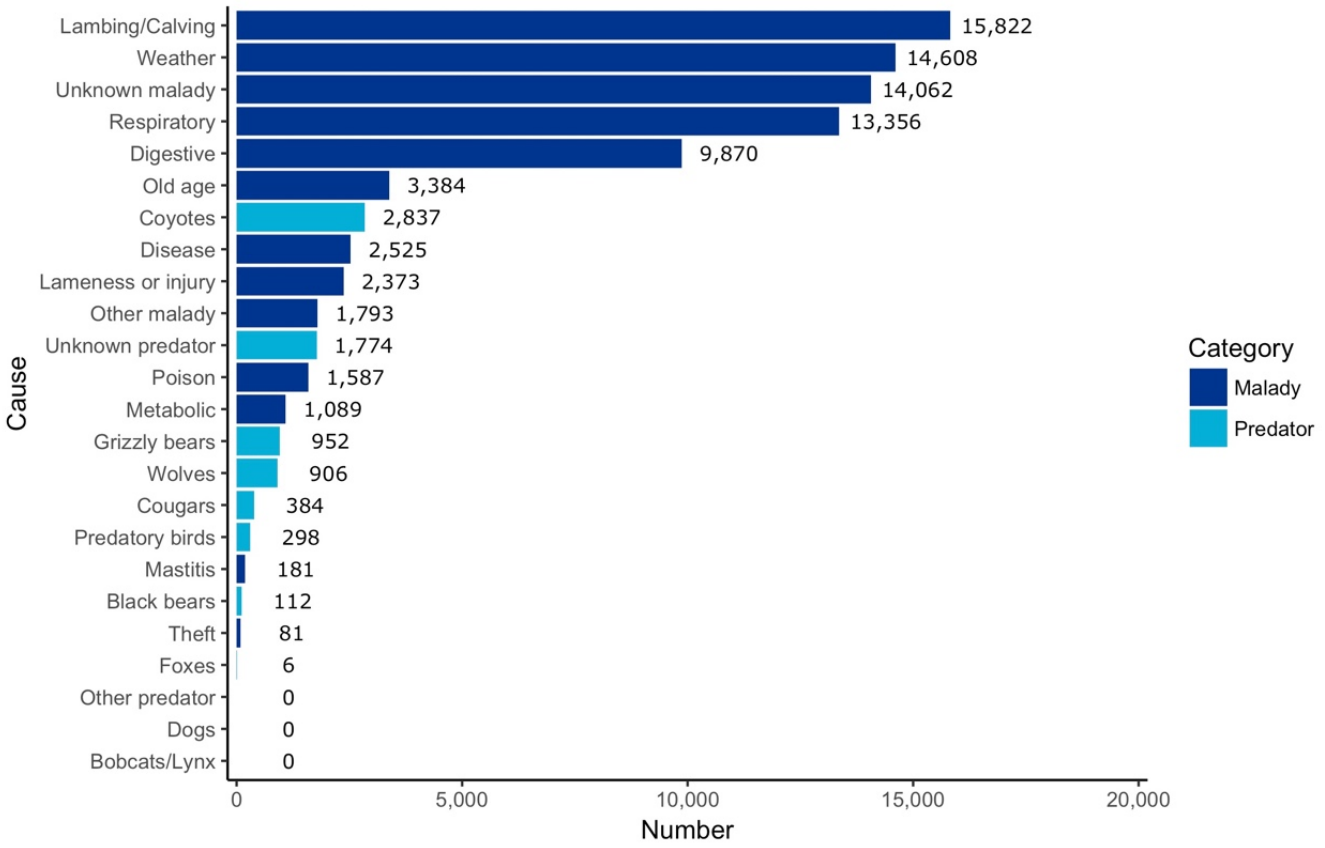
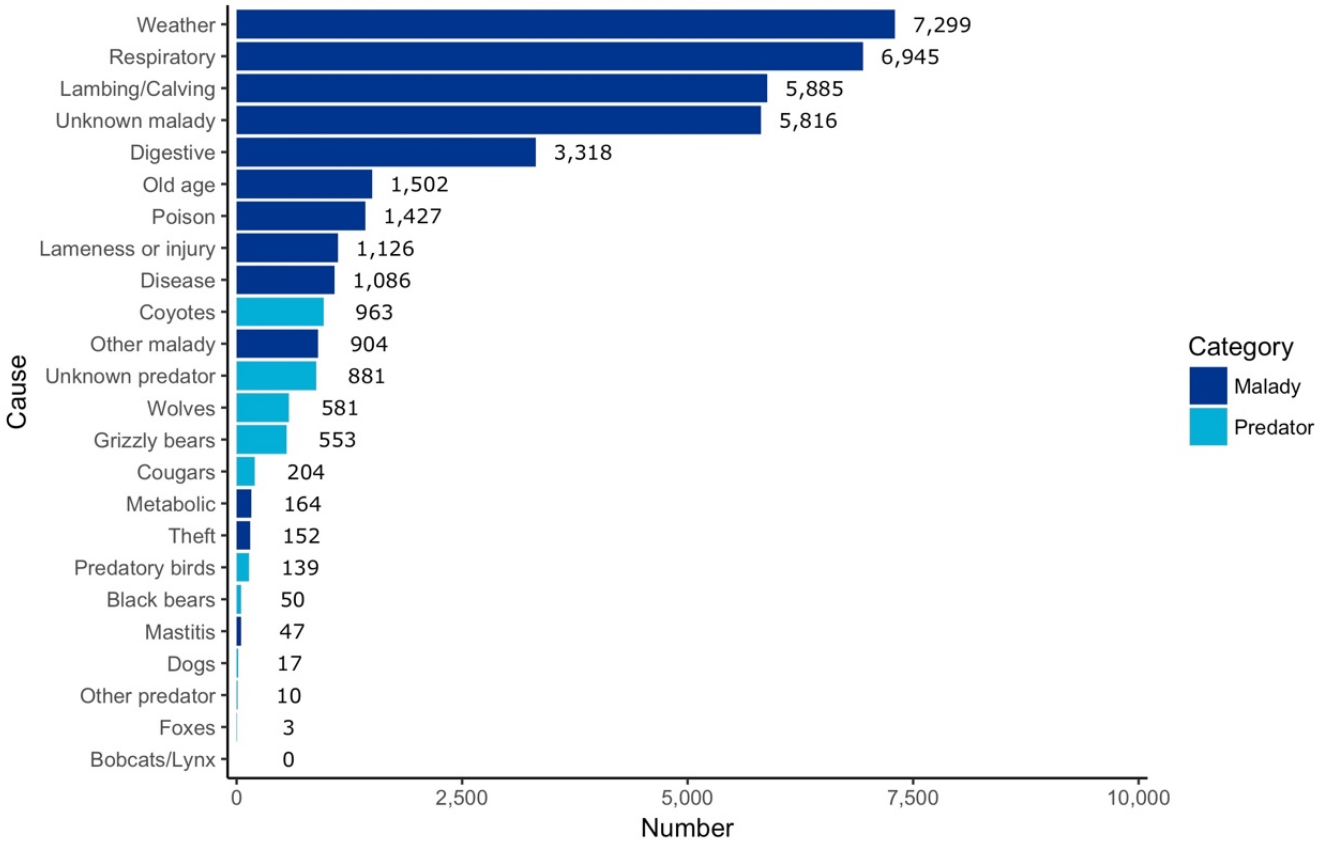


Fig. 11. Wyoming Cattle Mortality by Rank

Data from USDA-APHIS (2017), Data Year 2015



V. The FWS and Montana Board of Livestock's verified grizzly bear-livestock data from the Northern Rocky Mountain states show that USDA numbers are highly inflated

When other governmental agencies confirm data on livestock losses, the results show many fewer losses than the unverified claims by the USDA. (Again, the USDA did not distinguish between black bears and grizzly bears in its sheep report, precluding our analysis of their data concerning grizzly bear-sheep losses.)

- In 2013 in the Greater Yellowstone Ecosystem (Idaho, Montana and Wyoming), the FWS found that grizzly bears killed 123 cattle and 11 sheep. Fig. 12. In comparison, the USDA claimed that grizzly bears killed 308 cattle in Idaho, 952 in Montana and 553 in Wyoming (data year 2015).
- In the Northern Continental Divide Ecosystem, the FWS found that in 2013, grizzly bears killed 23 cattle and 11 sheep. The USDA's data for cattle deaths attributed to grizzly bears in Montana (statewide in 2015) is 952. Fig. 13.
- The Montana Board of Livestock also found a fraction of grizzly bear-, wolf- and mountain lion-livestock deaths compared with those proffered by the USDA. Fig. 14.

Also, the number of grizzly bears killed in the Northern Rockies is not proportional to the nominal losses of livestock caused by grizzly bears. For instance, in the Greater Yellowstone Ecosystem, from a population that the FWS believes is 700, between 2015 and 2018, federal and state agents and individuals killed more than 250 bears, with a majority of annual mortalities occurring in 2018, the year when this population of grizzly bears had their federal protections restored by a federal district court.[17] Fig. 15.

PHOTO BY: WENDY KEEFOVER

Human-caused grizzly bear mortalities result from multiple causes, including mistaken identity kills (by black bear hunters), or because hunters kill elk and leave their carcasses unattended overnight, attracting grizzly bears. Northern Rockies ranchers believe that grizzly bears cause real or perceived threats to livestock.[18] But as the data show, these threats are nominal and can be reduced when ranchers employ non-lethal methods to protect their herds. Members of the Montana-based organization the Blackfoot Challenge offer an example of how ranchers and farmers can successfully reduce livestock mortality from grizzly bears through non-lethal means (see: Section VII).

Fig. 12
Cattle and sheep inventories & mortalities in the range of Greater Yellowstone Ecosystem grizzly bears (2013 data from FWS)[19]

State	Cattle Inventory in grizzly bear range	Grizzly bear-cattle deaths	Percent cattle killed by grizzly bears	Sheep inventory in grizzly bear range	Grizzly bear-sheep deaths	Percent sheep killed by grizzly bears
ID	45,769	1	0.020	18,260	0	0.000
MT	105,250	14	0.000	10,050	17	0.002
WY	253,826	108	0.000	52,600	6	0.000
TTL	404,845	123	0.030	80,910	23	0.028

Fig. 13
Cattle and sheep inventories & mortalities in the range of Northern Continental Divide Ecosystem grizzly bears (2013 data from FWS)[20]

State	Cattle inventory in grizzly bear range	Grizzly bear-cattle deaths	Percent cattle killed by grizzly bears	Sheep inventory in grizzly bear range	Grizzly bear-sheep deaths	Percent sheep killed by grizzly bears
MT	135,000	23	0.017	16,217	11	0.068

Fig.14
Confirmed and probable livestock losses in Montana (data from Montana Board of Livestock)[21]

Confirmed livestock losses in Montana, 2015-2017						
	Grizzly bear		Wolf		Mountain lion	
	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep
2018	61	23	45	7	0	50
2017	57	14	50	6	0	29
2016	33	26	46	5	ND	ND
2015	50	32	39	22	ND	ND
Probable livestock losses in Montana, 2015-2017						
	Grizzly bear		Wolf		Mountain lion	
	Cattle	Sheep	Cattle	Sheep	Cattle	Sheep
2018	20	6	13	6	0	13
2017	31	1	8	2	0	2
2016	43	41	11	5	ND	ND
2015	16	1	7	0	ND	ND

Fig. 15
Greater Yellowstone Ecosystem grizzly bear mortalities, 2013-2018

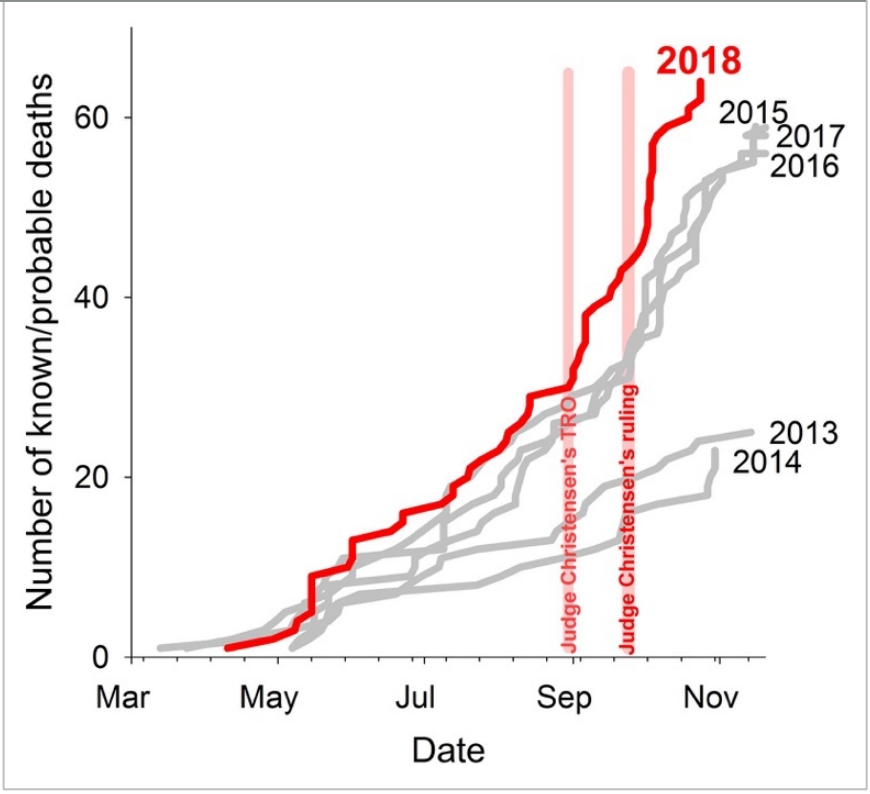


Figure courtesy of David Mattson, Ph.D.

VI. American values concerning predator control

According to a 2017 public attitudes study, lethal predator controls such as shooting animals from aircraft (aerial gunning), neck snares, gassing of pups in dens, leg-hold traps and poisons are unpopular with the American public.[22] Predator control is only acceptable to the public if it removes the particular individuals who prey on livestock, damage crops or cause economic losses.[23] Unfortunately, predator control rarely works that way. Predator control agents typically kill random animals instead of the individual animals responsible for livestock losses.

Another recent study indicates that when states or the federal government engage in lethal predator-control activities for the purpose of killing native carnivores to alleviate alleged or real livestock losses, then poaching activities increase.[24] This is because community members perceive that native carnivores have little value. Conversely, if no state-sponsored predator control is conducted, fewer people poach wildlife, the opposite of what some surmise to be true.[25]

VII. Non-lethal methods to protect cattle and sheep are more cost-effective, less cruel and more efficacious

Not only is the public's view of predator control generally negative, but a bevy of studies also contradict the claimed efficacy of lethal predator control programs. Numerous wildlife biologists have declared these programs biologically and fiscally expensive.[26] That is, removing native carnivores through predator control harms wildlife and their ecosystems.[27] Predator control is also expensive to taxpayers—Wildlife Services receives tax money from municipalities, counties, states and federal appropriations.[28] New studies also show that non-lethal measures are the best means for protecting cattle, sheep and other domestic animals. Such methods include sanitary carcass removal, fladry and or turbo fladry, synchronizing birthing seasons with native ungulates, changing livestock types or breeds, spotlights, airhorns, guard animals, range riders, electric fencing and Foxlights™.[29]

In Montana, a coalition of land owners, biologists and governmental officials have implemented the program called the Blackfoot Challenge that has not only reduced landowner conflicts with grizzly bears, but also saved many grizzly bears' lives. The Blackfoot Challenge ensures that grizzly bears cannot access human-food attractants, including livestock, demonstrating that human and grizzly bear coexistence is possible.

PHOTO BY: DON GETTY

The Blackfoot Challenge, based in northwestern Montana, is a coalition of state and federal agents, livestock growers, land owners and non-profits. According to grizzly bear biologists who work on the Blackfoot Challenge, this consortium has reduced human-bear conflicts by 74 percent.[30] Obtaining that positive outcome required many years of work, education and building relationships. The outcome: increased human safety, fewer livestock losses and less property damage from grizzly bears (and lately wolves too).[31]

To resolve human-bear conflicts, the Blackfoot Challenge surveyed landowners and ranchers to assemble conflict data. It also used data collected by Montana Fish, Wildlife & Parks. It mapped those data to understand the scale of conflicts, which helped ranchers realize that if even one person was doing the right thing, it would take the whole community working together to achieve positive results.[32]

Grizzly bear conflict mitigation involves employing commonsense, non-lethal solutions across entire landscapes, such as using the right kind of electric fencing around calving and lambing pens, boneyards, stored animal feed and around crops. Other strategies include using bear-proof trash receptacles and creating secured dumps in rural communities. And perhaps most importantly, cleaning up calving areas and making boneyards inaccessible to native carnivores.[33] The Blackfoot Challenge accomplished this result because of public and private funding, in-kind donations and donations from partners and the ranching community, which has made services available for free or at low cost to the ranchers.[34] According to Wilson et al. (2017), the lessons learned from the Blackfoot Challenge are:

1. Resources need to be coordinated
2. Efforts must be informed by science such as the GIS mapping of conflict areas
3. The process must incorporate all stakeholders' values, and
4. There has to be a decision-making process that allows all stakeholders to discuss issues, make decisions and implement actions.[35]

Despite the success of the Blackfoot Challenge and its demonstrable benefits, the USDA's data show that few ranchers use non-lethal methods to protect their herds. On average, only 13 percent of cattle growers in grizzly bear-occupied states use all non-lethal methods available to protect their animals. Fig. 16. An average of 19 percent of cattle growers used all non-lethal methods to protect sheep, although an average of 43 percent used guard dogs and an average of 52 percent used fences. Only about one-third used sheds for lambing or penned their sheep at night. On average, fewer than 13 percent removed stillborn or other dead sheep. Fig. 17. This lack of reliance on non-lethal methods in grizzly bear country is tragic.

According to Treves et al. (2016), the published studies that laud the effectiveness of lethal predator control are concentrated in three or four journals, and the scientific methods involved in these studies were insufficient.[36] A subsequent study by Eklund et al. (2017) located 27,781 articles concerning predator control; of that number, only 562 met the authors' criteria for having some scientific merit.[37] And, of those 562 articles, only 21 used scientific methodologies the authors deemed excellent, a number so insufficient that it prevented the authors from conducting a meta-analysis of the efficacy of predator control.[38]

Eklund et al. (2017) writes that although the loss of livestock to predators has occurred for thousands of years—likely since livestock were first domesticated—the scientific study of successful interventions is rare, and unfortunately our understanding of the efficacy of predator control is "based on narrative review" rather than sound science.[39] In fact, Treves et al. (2016) strongly suggest that all lethal predator control should be suspended until "gold standard" reviews of the efficacy of some predator-control methods are completed.[40] Eklund et al. (2017) similarly concluded that the science of predator control is vacuous. In yet a third article concerning predator control, Lennox et al. (2018) also recommend against the expensive, broadscale killing of native carnivores, and call upon us all to adapt to and coexist with carnivores because of their ecological benefits—even in urban areas.[41] If grizzly bears are to survive into the next century, we must make a concerted effort to adapt to living with them.[42]

Fig. 16
Percentage of Cattle Operators Using Non-Lethal Methods (USDA 2017, data year 2015)

State	Percent of operations with any cattle deaths	Percent of operations that used some non-lethal method to protect cattle
ID	6.10%	10.10%
MT	10.60%	14.50%
WY	10.30%	14.00%

Fig. 17.
Percentage of sheep operators using non-lethal methods (USDA 2015, data year 2014)

State	Guard Dogs	Llamas	Donkeys	Fences	Lamb shed	Herding	Night penning	Fright tactics	Remove carrion	Cull	Change Bedding	Frequent checks	Altered breeding season	Other
ID	46.9%	11.3%	23.3%	52.3%	28.4%	4.1%	25.1%	1.4%	8.0%	23.4%	3.7%	19.1%	1.6%	0.9%
MT	38.9%	24.0%	9.3%	37.2%	49.0%	7.9%	48.0%	6.5%	24.5%	23.4%	12.2%	34.5%	0.6%	9.3%
WY	42.9%	2.0%	20.1%	65.1%	26.5%	4.1%	19.7%	1.7%	6.2%	6.3%	6.6%	9.1%	1.7%	6.8%
Avg.	42.9%	12.4%	17.2%	51.5%	34.6%	5.4%	30.9%	3.2%	12.9%	17.7%	7.5%	20.9%	1.3%	5.7%

VIII. Conclusion

The Humane Society of the United States analyzed two data sets compiled by the USDA as part of its livestock reports. We make these data publicly decipherable, and, more importantly, unmask the fraction of losses that livestock operators experience from grizzly bears, other native carnivores and domestic dogs. Using the USDA's data, we found that native carnivores and domestic dogs allegedly killed 0.4 percent of the 119 million cattle and sheep inventoried in the U.S. in 2014 and 2015. Furthermore, we found that other governmental data for the Northern Rocky Mountain region indicate that the USDA's attributions of cattle mortalities (and likely sheep deaths too, although the USDA sheep reports do not distinguish between bear species) by grizzly bears and other carnivores are highly exaggerated because of the agency's suspect methodology.

As this report shows, farmers, ranchers and wildlife managers should fear maladies the most—especially respiratory and birthing problems—that kill nine times more cattle and sheep than all predators (wild mammalian and avian carnivores and domestic dogs) combined. In the face of this evidence, the anxiety of some in society against native carnivores is misplaced. While wildlife managers and cattle and sheep ranchers are quick to kill wolves, coyotes, bears, cougars and bobcats allegedly for livestock protection reasons, the data show that few livestock growers use non-lethal method to protect their herds from predation. In grizzly bear-occupied states, according to the USDA's data, few livestock growers use non-lethal measures necessary to protect herds from predation.

Wildlife biologists have found that predator-control programs to kill grizzly bears and other native carnivores are unscientific, because most studies advocating predator control do not adhere to the scientific method, including the lack of study control areas for purposes of comparison. Three review articles, published in 2017 and 2018, reviewed the corpus of predator-control studies. All concluded that the use of non-lethal methods to protect livestock was more efficacious than killing native carnivores. While some in society complain about wolves and other carnivores, the reality is we humans are an unsustainable "super predator."[43] Because grizzly bears live in a fraction of their historical

range, it is time that we stop conducting lethal predator controls and trophy-hunting practices on grizzly bears in the guise of livestock protection and or ungulate recruitment.

IX. Methodology

Methods:
All data wrangling and analyses were conducted in R v. 3.5.0 (R Core Team, 2018). We used the R package tabulizer (Leeper, 2018) to extract tables from the 2017 USDA report "Death Loss in U.S. Cattle and Calves Due to Predator and Nonpredator Causes, 2015" (1) and the 2015 USDA report "Sheep and Lamb Predator and Nonpredator Death Loss in the United States, 2015" (2). Once extracted, data were combined, summarized, and plotted using R packages dplyr (Wickham et al. 2018), tidyr (Wickham & Henry, 2018), ggplot2 (Wickham, 2016), and extrafont (Chang, 2014).

Data used from each report:
(1) From the 2017 USDA cattle report, we used data from the following tables: B.1. Number and percentage of cattle over 500 lbs. on Jan. 1, 2016, and calf crop (2015), by state, A.2.d. Number of cattle over 500 lbs. who died in 2015, by cause and by state, A.2.e. Number of calves who died in 2015, by cause and by State, A.2.h. Percentage of operations with any calf deaths due to nonpredator, predator and all causes, by state, A.2.j. Cattle death loss due to nonpredator, predator and all causes, as a percentage of inventory of cattle 500 lb. or more on Jan. 1, 2016, by state, A.2.k. Calf death loss due to nonpredator, predator and all causes, as a percentage of calf crop (2015), by state, C.1.g. Percentage of cattle deaths due to nonpredator causes, by cause and by state, C.2.f. Percentage of calf death loss due to nonpredator causes, by cause and by state, D.1.a. For all operations, number and percentage of cattle death loss due to predators, by predator, D.1.c. Percentage of cattle death loss due to predators, by state and by predator, D.2.d. Percentage of calf death loss due to predators, by state and by predator.

(2) From the 2015 sheep report, we used data from the following tables: B.1. Number of ewes, rams, market sheep and lamb crop, by state, A.2.a. Number of sheep and lambs that died, by State and by cause, A.2.d. Percentage of Jan. 1, 2015, adult-sheep inventory lost in 2014, as a percentage of adult-sheep inventory on January 1, 2015, by cause and by state, B.8. Number of sheep and lambs who died due to enterotoxemia, internal parasites or other digestive problems in 2014, by state, B.9. Number of sheep and lambs who died due to respiratory problems, metabolic problems or other disease problems in 2014, by state, B.10. Number of sheep and lambs who died due to weather-related problems, starvation or lambing problems in 2014, by state, B.11. Number of sheep and lambs who died due to old age, being on back or poisoning in 2014, by state, B.12. Number of sheep and lambs who died due to theft, other nonpredator causes, were found dead or died from unknown nonpredator causes in 2014, by state, C.8. Number of sheep and lambs who died by bears, bobcats or lynx, coyotes or dogs, by state, C.9. Number of sheep and lambs who died by mountain lions (cougars/pumas), wolves or vultures, by state, C.10. Number of sheep and lambs who died by ravens, feral pigs, eagles, other known predator causes or other unknown predator causes, by state.

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Endnotes

[1] USDA-Animal and Plant Health Inspection Service, "Death Loss in U.S. Cattle and Calves Due to Predator and Nonpredator Causes, 2015," *https://www.aphis.usda.gov/animal_health/nahms/general/downloads/cattle_calves_deathloss_2015.pdf* (2017); USDA-Animal and Plant Health Inspection Service, "Sheep and Lamb Predator and Non-Predator Death Loss in the United States," *https://www.aphis.usda.gov/animal_health/nahms/sheep/downloads/sheepdeath/SheepDeathLoss2015.pdf* (2015).

[2] In their cattle report, the USDA explains its methodology as follows: "The numbers provided in this report are based on a sample of operations **and are thus estimates of the true numbers**. There is variability associated with each estimate, although the measures of variability (such as the standard error) are not always shown" (emphasis added). USDA-Animal and Plant Health Inspection Service, "Death Loss in U.S. Cattle and Calves Due to Predator and Nonpredator Causes, 2015," ii.

In their sheep report, the USDA explains its methodology here: "For 2015, death losses by cause were estimated to match NASS' total death losses published in "Sheep and Goats," released January 30, 2015. Estimates were generated with SUDAAN® software (Research Triangle Institute, version 11.0.1). Standard errors, where shown, account for the stratified study design...."The number of operations with sheep in 2014 (table A.2.a) was estimated using the number of operations in the sample, weighted by the expansion weight (the number of operations in the population that each sampled operation represents). Similarly, the total number of deaths are estimated by expanding the number of deaths in the sampled operations. For lamb losses, pre- and postdocking losses are captured separately for CO, MT, UT, and WY, while all other Western States count only postdocking losses. The lamb loss estimates in this report are estimated by expanding the postdocking losses for sampled operations in Western States and all losses for sampled operations in Eastern States." USDA-Animal and Plant Health Inspection Service, "Sheep and Lamb Predator and Non-Predator Death Loss in the United States."

[3] Hank Hristienko and Jr. McDonald, John E., "Going in the 21st Century: A Perspective on Trends and Controversies in the Management of the Black Bear," *Ursus* 18, no. 1 (2007).

[4] On June 22, 2017, Interior Secretary Ryan Zinke announced the Yellowstone population of grizzly bears as recovered and delisted it. U.S. Fish and Wildlife Service, "Secretary Zinke Announces Delisting of Yellowstone Grizzly Bear: Partners Celebrate Endangered Species Act Delisting Following Decades of Collaboration," *https://www.fws.gov/news/ShowNews.cfm?_ID=36059&ref=secretary-zinke-announces-delisting-of-yellowstone-grizzly-bear-* (2017). Multiple plaintiff groups sued the FWS. One day before Wyoming and Idaho's trophy hunt on grizzly bears were to commence, Judge Dana Christensen declared the Service's delisting as premature. In 2018, a record 65 Yellowstone-area grizzly bears died—most as a result of human intervention. Fig. 12.

[5] The HSUS and co-plaintiffs won litigation against the FWS for delisting grizzly bears on these grounds: First, the court held that the FWS illegally separated out the Greater Yellowstone Ecosystem population despite their connection to, and interdependence with, the other surviving populations of grizzly bears in the United States. Second, the court found that the FWS failed to ensure that sufficient protections would remain in place to protect grizzly bears after delisting. Finally, it concluded that the delisting decision did not take into account scientific evidence indicating the precarious genetic health of this still vulnerable population. See: *Crow Tribe et al. v. United States*, 343 F.Supp.3d 999 (D. Mont. 2018).

[6] U.S. Geological Survey-Interagency Grizzly Bear Study Team, "Known and Probable Grizzly Bear Mortalities in the Greater Yellowstone Ecosystem," *https://www.usgs.gov/science-explorer-results?es=Known+and+Probable+Grizzly+Bear+Mortalities+in+the+Greater+Yellowstone+Ecosystem* (2018).

[7] U.S. Department of Agriculture-Animal and Plant Health Inspection Service-Veterinary Services, "Death Loss in U.S. Cattle and Calves Due to Predator and Nonpredator Causes, 2015," *https://www.aphis.usda.gov/animal_health/nahms/general/downloads/cattle_calves_deathloss_2015.pdf* (2017); U.S. Department of Agriculture-Animal and Plant Health Inspection Service, "Sheep and Lamb Predator and Nonpredator Death Loss in the United States," *http://usda.mannlib.cornell.edu/usda/current/sgdl/sgdl-05-27-2010.pdf* (2015).

[8] USDA-Animal and Plant Health Inspection Service, "Death Loss in U.S. Cattle and Calves Due to Predator and Nonpredator Causes, 2015."

[9] USDA-Animal and Plant Health Inspection Service, "Sheep and Lamb Predator and Non-Predator Death Loss in the United States."

[10] F. F. Knowlton, E. M. Gese, and M. M. Jaeger, "Coyote Depredation Control: An Interface between Biology and Management," *Journal of Range Management* 52, no. 5 (Sep 1999), <Go to ISI>://000082837300001; Philip J. Baker et al., "Terrestrial Carnivores and Human Food Production: Impact and Management," *Mammal Review* 38 (2008); S. M. Wilson, E. H. Bradley, and G. A. Neudecker, "Learning to Live with Wolves: Community-Based Conservation in the Blackfoot Valley of Montana," *Human-Wildlife Interactions* 11, no. 3 (Win 2017), <Go to ISI>://WOS:000422844800010; Seth M. Wilson et al., "Natural Landscape Features, Human-Related Attractants, and Conflict Hotspots: A Spatial Analysis of Human–Grizzly Bear Conflicts," *Ursus* 16, no. 1 (2005/04/01 2005), accessed 2017/04/28, http://dx.doi.org/10.2192/1537-6176(2005)016[0117:NLFHAA]2.0.CO;2; Seth M. Wilson, Gregory A. Neudecker, and James J. Jonkel, "Human-Grizzly Bear Coexistence in the Blackfoot River Watershed, Montana: Getting Ahead of the Conflict Curve," in *Large Carnivore Conservation: Integrating Science and Policy in the North American West*, ed. S.G. Clark and M.B. Rutherford (2014).

[11] U.S. Fish and Wildlife Service, "Endangered Species: Mammals: Grizzly Bear (*Ursus Arctos Horribilis*)," *http://www.fws.gov/mountain-prairie/es/grizzlyBear.php* (2019).

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[13] U.S. Fish and Wildlife Service, "Northern Continental Divide Ecosystem: Grizzly Bear Conservation Strategy," *https://www.fws.gov/mountain-prairie/science/PeerReviewDocs/NCDE_Grizzly.pdf* (2013).

[14] The FWS provides: "There have been only four confirmed detections of grizzly bears in the greater NCE in the past 10 years, all of which occurred in British Columbia and may comprise only two individuals (IGBC NCE Subcommittee 2016)." U.S. Fish and Wildlife Service, "Endangered Species: Mammals: Grizzly Bear (*Ursus Arctos Horribilis*)," i.

[15] USDA-Animal and Plant Health Inspection Service, "Death Loss in U.S. Cattle and Calves Due to Predator and Nonpredator Causes, 2015."

[16] FWS map of grizzly bears: https://www.fws.gov/mountain-prairie/es/species/mammals/grizzly/GBdistributions.jpg. Last visited December 18, 2018.

[17] U.S. Geological Survey-Interagency Grizzly Bear Study Team. The number of bears found dead is likely a fraction of the true number and perhaps an undercount by over 80%. B. N. McLellan et al., "Rates and Causes of Grizzly Bear Mortality in the Interior Mountains of British Columbia, Alberta, Montana, Washington, and Idaho," *Journal of Wildlife Management* 63, no. 3 (Jul 1999), http://dx.doi.org/10.2307/3802805; Bruce N. McLellan, Garth Mowat, and Clayton T. Lamb, "Estimating Unrecorded Human-Caused Mortalities of Grizzly Bears in the Flathead Valley, British Columbia, Canada," *PeerJ* 6 (2018/10/11 2018), http://dx.doi.org/10.7717/peerj.5781.

[18] U.S. Geological Survey-Interagency Grizzly Bear Study Team.

[19] U.S. Fish and Wildlife Service, *Livestock Losses and Grizzly Bears: Perspectives on Livestock Loss and Risks*, by Chris Servheen (Government memo, 2014).

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