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A THEODORE ROOSEVELT GENIUS PRIZE: INNOVATIVE SOLUTIONS TO
REDUCE HUMAN PREDATOR CONFLICT

Wednesday, July 24, 2019

United States Senate

Committee on Environment and Public Works

Washington, D.C.

The committee met, pursuant to notice, at 10:03 a.m. in room 406, Dirksen Senate Office Building, the Honorable John Barrasso [chairman of the committee] presiding.

Present: Senators Barrasso, Carper, Braun, Rounds, Ernst, Cardin, Markey.

STATEMENT OF THE HONORABLE JOHN BARRASSO, A UNITED STATES
SENATOR FROM THE STATE OF WYOMING

Senator Barrasso. Good morning. I call this hearing to order.

Earlier this year, Republicans and Democrats on this committee joined together to enact a bill called the WILD Act, it is the Wildlife Innovation and Longevity Driver Act. These really smart people behind us come up with these acronyms, and it usually works, the WILD Act. The law supports innovative efforts to conserve wildlife, to manage invasive species, and to protect some of the world's rarest and most beloved animals.

The WILD Act established the Theodore Roosevelt Genius Prize to encourage technological innovation. These prizes annually award \$100,000 to innovators who help solve our Nation's most difficult wildlife and invasive species challenges. The prizes were inspired by cutting-edge conservation innovations that are already in use, such as the DNA analysis to identify the origin of illicit ivory supplies, thermal imaging to notify authorities of poachers, and a fish passage that automatically extracts invasive fish from systems.

So today, we will consider S. 2194, the Promoting Resourceful and Effective Deterrents Against Threats or Risks Involving Species. And you say, how do you come up with a name like that? Well, it is also called the PREDATORS Act, you take

the first letter of each of those words.

The PREDATORS Act is a bill to establish a sixth Theodore Roosevelt Genius Prize, which I have introduced along with Senators Carper and Cramer and Booker. The bill would incentivize the development of non-lethal, innovative technologies that reduce conflict between human and wildlife predators. Although rare, human encounters with predators can lead to injury, and as we know, even death.

In Wyoming, the species most closely associated with this problem is the grizzly bear. Just last year, a hunting guide from Jackson Hole was tragically killed by grizzlies. The two grizzlies responsible for the attack were euthanized. And it is not just hunters that are at risk. In northwest Wyoming, Wapiti, Wyoming, the elementary school near Cody had to build an eight-foot high heavy gauge metal fence around its school yard to protect its students. You can see the image here; "Please close the gate for the safety of people and animals at Wapiti School."

Wyoming is not alone. It is not alone when it comes to grappling with human-predator conflicts. Fatalities occur each year from sharks. In 2018, there were 66 shark attacks, including 32 in the United States. A little over a week ago, a young girl boogie-boarding in Florida suffered shark bites to her foot and ankle. Comparatively, she was lucky. In North

Carolina, a girl lost a leg and two fingers while swimming this summer. An American woman was killed by shark in the Bahamas around the same time.

Bears and sharks are not the only predator species of concern. In Colorado, a runner's encounter with a mountain lion on a trail left him injured the animal dead. Tragically, in Florida, a young child was killed at Disney World by an alligator.

Our distinguished panel is going to help us examine how the establishment of a new Theodore Roosevelt Genius Prize can incentivize technological innovation to reduce future human-predator contact. Our witnesses include Brad Hovinga, who is the Jackson Regional Wildlife Supervisor at the Wyoming Game and Fish Department. I am going to formally introduce him shortly. Forrest Galante, a biologist, wildlife tracker and Host on Animal Planet, of Extinct or Alive, and we are thrilled to have you here joining us. And Dr. Nick Whitney, who is a Senior Scientist for the Anderson Cabot Center for Ocean Life at the New England Aquarium, which is in Boston.

I look forward to hearing from our witnesses about their experiences with human-predator conflicts and how innovative technologies can help reduce them.

At this point, I would normally turn to Senator Carper. He has several different committee meetings today. He is going to

be here shortly. And as I mentioned to Brad, we have a series of three votes starting at 11:00 o'clock. So we are going to have a lot of Senators attending. Some are going to be coming and going. You are going to have a lot of attention to this, because it is a topic of significant interest. As you see members coming and going, realize that they are going to different votes and different things. We are going to keep the hearing going.

Before we hear from all of our three witnesses, I do want to welcome Brad Hovinga here, who has served as the Jackson Regional Wildlife Supervisor for the Wyoming Game and Fish Department during the last four years. He has worked with Wyoming Game and Fish since his graduation from Utah State University, where he was awarded a bachelor's degree in wildlife management. He has served over two decades as a district game warden in Big Piney, Wyoming, and in Lander, Wyoming, and in 2014, was named Officer of the Year for Wyoming from the Shikar Safari Club International.

In recent years, I have had the privilege of talking to him on different occasions about conservation issues affecting Wyoming. I think we have done it at the Elk Antler, the Boy Scout event that they have every year in Jackson Hole. This committee is certainly going to benefit from hearing about your vast experience in resolving predator-human conflicts in

Wyoming.

Mr. Hovinga, we appreciate your being here. It is a privilege to welcome you as a witness before the Environment and Public Works Committee. Thank you for traveling to Washington, and we would like to now hear from you.

STATEMENT OF BRAD S. HOVINGA, JACKSON REGIONAL WILDLIFE
SUPERVISOR, WYOMING GAME AND FISH DEPARTMENT

Mr. Hovinga. Thank you, and good morning, Chairman Barrasso, members of the committee. My name is Brad Hovinga, I am the Jackson Regional Wildlife Supervisor for the Wyoming Game and Fish Department. I appreciate the opportunity to be here today to provide my perspectives on technologies and practices of reducing human-wildlife conflicts. My testimony is based on 27-plus years' experience as a game warden and a regional supervisor investigating these types of conflicts in Wyoming.

Today, I intend to highlight some of the important innovations and technologies currently employed by western wildlife management agencies to reduce human-wildlife conflicts, as well as present some ideas that have potential application for the future. Wyoming is home to a tremendous wildlife resource that is valued by a constituency that is passionate about their wildlife.

Human-wildlife interactions in Wyoming are typically the result of animals seeking unnatural foods in association with property or people, close encounters with humans, damage to property or large carnivores that depredate livestock. The Wyoming Game and Fish Department makes a significant investment in wildlife-human attack response training and has its own response team to investigate and expertly deal with situations

involving human injury or death caused by wildlife. Wyoming also puts forth a considerable educational effort, through our Bear Wise program, that seeks to minimize human-bear conflicts.

Wildlife agencies use a variety of innovative, non-lethal technologies to aid in reducing conflicts. These technologies include the use of chalk and pepper balls, weapon-fired beanbags, a variety of pyrotechnics and unmanned aerial vehicles, or UAVs. Wyoming recently trained personnel in the use of conducted electrical weapons, commonly known as tasers, for use as an aversion tool for wildlife. Colorado and Alaska have seen positive results with these devices with wildlife conflicts in those situations.

Many of the non-lethal technologies used today to reduce and prevent human-wildlife conflict have limitations that could be potentially be improved to increase their effectiveness. The technologies that I will discuss now either currently are in use and have the potential of being improved, or new technologies that I envision having a fundamental impact on the future of reducing human-wildlife conflicts.

Bear spray is frequently a primary tool used in close quarters human-bear conflict situations and often does an excellent job in deterring animals in close contact situations, when used correctly. However, in extreme weather conditions, range and effectiveness of the spray can become limited and have

an adverse effect on the individual deploying the bear spray.

Conducted electrical devices are quickly becoming a valuable tool for wildlife managers as an aversive conditioning technique, as well as a temporary immobilization tool on animals like urban deer. However, in order for effective use on large animals, such as grizzly bears and moose, the current technology is lacking options for long-range deployment that would increase opportunities to use the technology and improve human safety.

Improvements in unmanned aerial vehicles, or drone technology, that allow for the deployment of aversive conditioning tools would greatly improve our ability to keep people safe and influence the behavior of habituated or aggressive wildlife. Developments in FLIR and thermal camera technology for the use with UAVs would significantly increase human safety when assessing dangerous situations.

Lastly, long-range acoustic sound devices, or sound cannons, are devices that directionally deliver sound over long distances. The potential for development of long-range acoustic deterrents for wildlife management exists. Work to develop an appropriate aversive conditioning tool for addressing wildlife conflicts would be greatly beneficial.

The citizens of the United States have a deep and sincere appreciation for wildlife resources, and expect wildlife managers to understand and improve upon past and current

technologies to reduce human-wildlife conflicts. Investigating ways to minimize the pitfalls and reduce the inadequacies of current technology and techniques is a great place for us to focus our work.

The wildlife populations continue to expand into human-dominated landscapes in Wyoming and throughout the west. Human development continues to encroach on wildlife habitat. Development of new, innovative solutions that carry greater effectiveness at reducing conflicts between humans and wildlife is paramount to the co-existence of people and wildlife.

I thank you for the opportunity to share my perspectives and those of the Wyoming Game and Fish Department on reducing human-wildlife conflicts. I look forward to answering your questions.

[The prepared statement of Mr. Hovinga follows:]

Senator Barrasso. Thank you so very much for your testimony.

Now I would like to turn to Mr. Forrest Galante, who is the host on Animal Planet of Extinct or Alive. Welcome to the committee.

STATEMENT OF FORREST GALANTE, WILDLIFE BIOLOGIST AND HOST,
ANIMAL PLANET

Mr. Galante. Thank you very much, Chairman Barrasso, Ranking Member Carper, and members of the committee. Thank you for the opportunity to be here today.

I am a wildlife biologist and animal tracker. For as long as I remember, I have looked for wildlife to experience seeing them in their natural habitat. I grew up on a farm in Zimbabwe. The land was home to flowers, fruits, livestock and wild animals.

As a boy, I enjoyed catching snakes, fishing in the dam, exploring the remote African bush with my mother, one of Africa's first female safari guides and bush pilots. I was enthralled by all wildlife. I learned their behavior, how they survive and thrive, and what threatens them in their existence. From a young age, I knew I would pursue a career in wildlife.

I am honored to be here today to offer my perspective on human-predator conflict, and how traditional and innovative techniques can be used to reduce conflicts and benefit humans, wildlife, communities and habitats. I applaud the committee's leadership role in establishing the five Theodore Roosevelt Genius Prizes. Now signed into law, this legislation encourages innovation to address growing challenges in protecting wildlife.

I also applaud the committee for introducing new

legislation, the PREDATORS Act, to add a new award to incentivize solutions to reduce human-predator conflict. Growing up in Africa, the conflict between predator and human is a daily struggle that I witnessed first-hand, from leopards stealing livestock to people actually being preyed upon by species like crocodiles, lions and more.

Unfortunately, in the long term, the predator almost always loses, as eradication has typically been the method of resolution. However, innovative methods of predator deterrents have begun to arise. These deterrents could easily become the new standard. They will not only resolve the issue, but support local economies by keeping the valuable apex predators in the system, which not only helps the biome, but supports ecotourism.

Many of these methods are still in development and have typically been crudely implemented by scientists like myself attempting to resolve a problem with little resources. I want to emphasize that an understanding of animal behavior and the ecology of a species is essential to developing successful deterrents.

The following is a list of non-lethal deterrents.

Animatronic Deterrents. In Malawi, there was an infamous hyena that used to raid village flocks. An engineer friend of mine came up with a fascinating animatronic decoy. Because hyenas fear large animals and men, he built a large motion-activated

animatronic scarecrow to place at the entry points of the village. With solar panels to power them, they will scare away hyenas that come near. This is a permanent fix that requires a bit of engineering to be sustainably successful.

Alarm Systems. There are really two types, foreign and organic. A foreign alarm is a sound or light not recognized and startling to an animal; an organic one is using something the animal is naturally deterred by, such as a competitors' growl. Setting these up by motion activation has proven successful for foxes, coyotes, leopards and more.

Olfactory deterrents. Like organic alarm systems, an organic smell can oftentimes be enough to deter a predator. For instance, if you have a persistent problem with a coyote, spraying wolf urine around the perimeter can deter the coyotes from entering the area.

Commensalistic Deterrents. In many cases, using an animal to deter another animal has no negative effects. This is simply the sheep dog approach. Living in Africa, we would see that a trained packs of Rhodesian Ridgeback dogs were a fantastic permanent solution to deterring lions. They stay close to home, create an alarm system, and will easily run off a lion that is trying to sneak in for a free meal.

Barrier methods. In many places around the world, fresh water is the reason for predator-prey interactions. Using

barriers to create safe swimming and washing areas in river systems can eliminate attacks by crocs, hippos and other animals.

The list goes on, but the key element here is fully understanding the predator which we are trying to deter. The point is true for predators in any habitat.

There are several new pieces of technology that, once properly understood and implemented, will be the new standard. Before wrapping up, I would like to share a few quick examples.

The HECS technology is a passive technology that blocks the body's naturally occurring electric energy. Basically, by wearing a wetsuit that has the technology of a Faraday cage, the same thing that is in the door of your microwave oven at home, it blocks the body's naturally occurring energy signal. To a shark, you are now perceived as an inanimate object.

The shark shield is a lightweight, wearable electronic device. The patented technology creates a powerful three-dimensional electrical field which causes unbearable spasms in the shark's sensitive EMR receptors, turning sharks away as soon as they come into contact with the electrical field.

The clever buoy is an ocean monitoring platform that specializes in detecting large marine life using sonar and identification software systems to relay critical information to authorities responsible for beach safety.

Once technology like the clever buoy system is perfected, implemented and combined with something like the shark shield, you have a virtual net that can make a beach safe for any swimmers, which is just amazing, in my opinion.

Thank you again for inviting me to be a part of today's hearing. I look forward to answering any questions that you may have.

[The prepared statement of Mr. Galante follows:]

Senator Barrasso. Thank you so very much. And now, Dr. Whitney.

STATEMENT OF NICK WHITNEY, SENIOR SCIENTIST AND CHAIR, FISHERIES
SCIENCE AND EMERGING TECHNOLOGIES PROGRAM, ANDERSON CABOT CENTER
FOR OCEAN LIFE, NEW ENGLAND AQUARIUM

Mr. Whitney. Thank you, Chairman Barrasso, Ranking Member Carper and members of the committee, for inviting me to testify today on the topic of human-predator conflict as it relates to sharks.

I am a senior scientist and shark researcher at the Anderson Cabot Center for Ocean Life in the New England Aquarium. The New England Aquarium is a catalyst for global change through public engagement, innovative scientific research, and leadership in education and ocean advocacy. Our mission is to conduct research on topics related to ocean health and conservation and develop science-based solutions to marine conservation problems.

I personally have studied sharks for over 20 years, and have tagged over a dozen different shark species, including white sharks, tiger sharks and bull sharks, the three species considered most dangerous to humans. Although I am a scientist, I am also a husband and father of three young kids, and my heart goes out to the victims and families whenever someone is bitten by a shark. While cold facts and statistics are useless to people who have suffered through these incidents, we owe it to the public to develop our response using the best available

science.

The truth about shark bites is that they are incredibly rare. Despite the millions of people that go into the ocean around the world each year, only 66 unprovoked shark bites were recorded globally in 2018, and only five of those bites were fatal.

Despite some truly terrible incidents, most shark bites are noteworthy for their lack of severity considering the damage that we know sharks can inflict. In fact, most incidents appear to be cases of mistaken identity or investigatory bites in which a shark uses its teeth to inspect an object and then quickly releases once it realizes that it is not food. Unfortunately, even a tentative bite can cause serious injuries or death, depending on the size and species of the shark involved.

When it comes to conflicts between humans and predators, humans have long had the upper hand. By any measure, we are the deadliest species to have ever existed. Today, we are killing about 100 million sharks a year in global fisheries, with further immeasurable impacts from habitat destruction, pollution and climate change.

This is unfortunate, because healthy shark populations are extremely valuable to humans. Economically, shark fisheries are valued at over a billion dollars annually, and shark ecotourism may be worth over \$300 million globally.

Ecologically, sharks represent a crucial part of the marine ecosystem, the health of which will determine if our planet remains habitable for the nine billion or more humans expected by 2050, many of whom are highly dependent on the oceans as their primary source of protein, and at risks from the threats of climate change.

Despite everything we know, people's fear of sharks is amplified and often exploited by news media well aware that scary stories will attract an audience. Innocuous sightings of sharks swimming in the ocean are often accompanied by headlines suggesting vicious attacks, and reports of small, non-threatening shark species are presented along with pictures of white sharks attacking seals.

In the United States, the most recent area of media focus has been on the growing number of white shark sightings around Cape Cod, Massachusetts, where there have been five shark bites on humans since 2012, including a tragic fatality in 2018 that was the State's first shark-related death in over 80 years.

The increase of white shark presence along the Cape is thought to be driven largely by the growing population of grey seals, which are a preferred prey item for white sharks. In response to these increased sightings, the Massachusetts Division of Marine Fisheries and the Atlantic White Shark Conservancy have been conducting research to understand shark

movements and inform public safety strategies.

Starting this year, the New England Aquarium is joining the team to apply the latest in high-tech tagging technology to understand these sharks' fine-scale behaviors, as well as the nature and frequency of white shark feeding events on seals. I brought a few of those tags here.

In the meantime, towns across the Cape have been working with the Conservancy and the Massachusetts Division of Marine Fisheries to raise awareness about sharks through community engagement and outreach. Research information is shared in a two-way conversation with the public through the Conservancy's Sharktivity smart phone app, as well as on the group's website. This implementation of cutting-edge scientific research, in conjunction with public outreach and education programs, is likely the most effective way to ameliorate the impact of shark-human conflicts.

Although it is tempting to reach for quick solutions to prevent shark bites, any new technologies claiming to be one size fits all solution run the risk of giving people a false sense of security and should therefore be subject to rigorous scientific testing before being broadly implemented. In addition to what is being proposed today, sustained funding for scientific research is the key to achieving the depth of knowledge required to sustainably manage our ocean resources and

to produce effective new tools and strategies to avoid conflicts between humans and sharks.

Thank you.

[The prepared statement of Mr. Whitney follows:]

Senator Barrasso. Thanks to all of you for your testimony. Very interesting.

I will just start with some questions I wanted to start with. This past weekend, on Sunday, I was in Buffalo, Wyoming, where it was Longmire Days. He is a sheriff in books by Craig Johnson. There is another equally famous officer from Wyoming, another fictional character that C.J. Box writes about, Joe Pickett, who was a game warden for many years. You were a game warden for 20 years. Anybody that would sit there and Google Joe Pickett detective series, the guy there in the picture looks like it could be you. The hair is a little darker, well, a lot darker. But it could have been you 20 years ago.

Having read most of the books, it shows just how dangerous the job is that game wardens do for them in their lives in terms of not just interaction with wildlife, but humans. So we appreciate what you do.

I wanted to get a bit into this topic and ask some questions for you as well as for Forrest. Last year, the Associated Press reported on grizzly bear attacks, and the one fatal one we had in Wyoming, of an outfitter, and noted that conflicts between grizzly bears and humans in the Yellowstone region have become more common as this species has recovered from near extermination in the early 20th century. Although fatal attacks on humans are still rare, and I heard about it in

Cody on the 4th of July, talking to folks, they have the bear spray canisters at the airport, there was a story in USA Today about bear spray not being mandatory, but it is a good idea and a suggestion.

What factors are you seeing that generally account for the upticks in human-predator conflicts? I am going to ask you, Forrest, the same question.

Mr. Hovinga. Certainly, Mr. Chairman, over the years, since in the last couple of decades, the grizzly bear population has increased and expanded in Wyoming. From 1990 to as recently as last year, looking at the numbers, grizzly bears have expanded from an area approximately the size of 23,000 kilometers to an area of approximately 68,000 kilometers. So the grizzly bear population continues to expand.

Bear densities in the greater Yellowstone area, in the primary conservation area have expanded out in and now occupy about 97 percent of the demographic monitoring area where grizzly bears are managed. They have continued to expand, as the population expands. They reach a density in those core areas and expand outward.

As they expand outward, outside the DMA, the demographic monitoring area, they tend to expand those populations, expand into areas that are more human-dominated landscapes. There is more people, more activity, more roads, more camping. And just

generally, those bears are now coming into contact with more people than they ever have.

Consequently, our conflicts that we deal with in Wyoming between people and bears, about one-third of those conflicts now occur outside the DMA. So grizzly bears have expanded into those human-dominated landscapes and are now making more contacts with development and people in areas where those conflicts typically haven't happened before.

Senator Barrasso. Mr. Galante?

Mr. Galante. I think Brad summed it up perfectly, the fact that encroachment is the biggest issue. That is a two-way bridge: human populations are increasing as are the bear populations in Wyoming. Prevention is the best option. Prevention is much better than being reactive. What I mean by that is, if we can put some of these innovative techniques into play ahead of having problems, having encroachment issues, people going into bear habitat and bears going into people habitat, then we will see much more passive interactions between people and animals.

Something Brad and I discussed yesterday was using negative reinforcement in order to do that. What I mean by that is, whether you are using the alarm systems that I noted, or shocking the bears, or whatever the situation is, to give the bears a negative association with human beings as opposed to a

positive one when they are raiding trash cans and taking food.

Senator Barrasso. And to the issue of bear spray, which we advocate in Wyoming, not mandatory but we suggest is a good idea, your agency advocates the use of bear spray as an effective deterrent to aggressive or charging bears. Can you just talk a little bit about some inadequacies of the bear spray, when it works, when it doesn't? How can we improve on that?

Mr. Hovinga. Certainly, Mr. Chairman. First off, will say that we do love bear spray and promote bear spray as an agency. Our employees carry bear spray in the field. We encourage everybody recreating in areas that could be occupied by grizzly bears to carry bear spray.

The one thing, when we teach bear spray education, is that bear spray is a great tool, most of the time, to deter animals during an attack or close contact situation. But one of the pitfalls we do see with bear spray occasionally, and is good for people to be aware of, is that in adverse weather conditions, like strong crosswinds or headwinds, bear spray can have its effects limited.

If you have a strong crosswind, it may be more difficult for that bear spray to actually reach the intended target, where normally you can get a good 30 feet worth of bear spray in front of you. That distance may be reduced and the effectiveness of

how much spray reaches the animal could be reduced also.

Also, consequently, if you have a headwind, you might imagine, as a spray, with lots of particles blowing back onto the user of the bear spray, the self-contamination issue is certainly something to be aware of with bear spray.

So there have been new technological advances in the law enforcement realm, where there has been new products that deal with, like a pepper gel. So it is a heavier substance, that is less affected by the wind, less affected by heavy rain, and it decreases the potential for self-contamination with spray. That would be a great advancement for us to have with bear spray.

Senator Barrasso. Thanks. Senator Braun.

Senator Braun. Thank you. Interesting conversation, because I practiced conservation and managed a lot of land, at least I did before I got here, still can do it as much as I can on the weekends. But I am putting in perspective, Wyoming, I think has maybe close to four times the land mass of Indiana. We have about six times the population or so of Wyoming. Most of our wildlife is concentrated into one-third of the 20 million to 21 million acres we have in Indiana.

To look at, from Lewis and Clark days, when we had probably grizzlies, a whole panoply of wildlife there, and of those 20 million acres, I think 19 million would have been wooded, ironically, we probably have more deer living on one-third the

terrain now when they were completely gone. I remember the only place you could go deer hunting was on a military base, because of subsistence farming and the land that had been cleared from 19 million acres down to about a million.

So through conservation, good stewardship, we brought that back to 6 to 7 million acres. Beavers are everywhere. Otters have been reintroduced. Both of which now have had trapping seasons, because they have gotten out of hand. Beavers are almost everywhere. It is a beautiful story.

Believe it or not, mountain lion sightings. Because we have more deer than we had, and it was spread over three times the land area. Now it is like a buffet, where you have crops to boot. I don't view this as pepper spray and being afraid of it, but I personally think we will have nesting, we will have mountain lions that are reproducing in southern Indiana.

Bobcats, for instance, I don't think we had any on trail cams. Now they are pretty well universally around. In a place like Indiana, where you at least have expanse in Wyoming, in the west, we are going to run into that conflict. Coyotes have prospered, there are more in Indiana now than probably before. I mentioned the other wildlife that has really done well.

Bobcats, we recently had a hearing associated whether we should introduce a trapping and hunting season. Because most of the people in Indiana that pay for DNR and buy a license, or are

wanting to hunt small game, so those kinds of conflicts.

I would like to ask you, because I think there have been actually mountain lions passing through. I believe they are possibly reproducing. In a place like Indiana, where you don't have the expanse, where you are going to run into these conflicts very quickly, do you see where an apex predator like that could actually live side by side? I think it would be a beautiful thing if it could happen. But I know even many of the most fearless hunters would be a little bit careful if they knew you had a full, active breeding population of mountain lions in southern Indiana.

Any of you who want to weigh in on it, I would be interested to hear what you think and how we would manage through it.

Mr. Hovinga. Certainly, Mr. Chairman, Senator Braun. When you have deer populations like you described, and mountain lions move into the area, when there is a prey base to support that animal, they are certainly likely going to do well. As far as mountain lions go, in Wyoming, we have a lot of mountain lions, we have a lot of deer, we have a lot of prey base for those animals. They tend to do well.

We don't have a lot of conflicts with those animals, with mountain lions, outside of urban areas. Sometimes in urban areas, when they come in and they typically come into urban

areas looking for prey, which is the deer that reside in urban developments. That is when those conflicts arise. Typically, it takes on the picture of a mountain comes in in the middle of the night looking for prey, it finds prey, it suddenly gets light and people come out from everywhere. That is when the conflict arises.

So certainly those are manageable situations. I do think, to answer your question, I do think you can have, even in areas with a larger population base and less land, coexistence of mountain lions and deer in those communities.

Senator Braun. Are there active hunting seasons on mountain lions and grizzlies in Wyoming and throughout the west?

Mr. Hovinga. Mountain lions, yes, Senator. Grizzlies, no. Grizzlies are currently federally listed under the Endangered Species Act. We coordinate our management efforts with the U.S. Fish and Wildlife Service on anything we do grizzly related. It has gone back and forth over the last few years. We had control last year when the hunting guide was killed in Wyoming, we had management authority over grizzly bears at that time. We had a hunting season proposed. However, the judge's decision put that bear back on the Endangered Species List before we had the opportunity.

Senator Braun. I think we are going to have a round for some other questions, and I will come back and finish here. I

have a few more. What is the harvest on mountain lions in a State like Wyoming through hunting? Roughly.

Mr. Hovinga. As far as the number we harvest, I don't have that exact number with me. But it is in the hundreds.

Senator Braun. In the hundreds, okay.

Mr. Hovinga. Yes. And in our particular area, in my region, we will harvest in between 20 and 30 mountain lions in our area.

Senator Braun. And the population is sustainable over time with that?

Mr. Hovinga. Absolutely. The way we manage mountain lions is, we have areas that we leave as, some are source areas, that are designed to continually grow in population and be a source for other areas and manage others for stable populations. We have a little higher harvest in those areas.

Senator Braun. Thank you.

Senator Barrasso. Thank you, Senator Braun. Senator Carper.

STATEMENT OF THE HONORABLE THOMAS R. CARPER, A UNITED STATES
SENATOR FROM THE STATE OF DELAWARE

Senator Carper. Thanks, Mr. Chairman. I have a statement I want to read, but first, let me just say welcome. We also are in different committees, and in one of my other committees, Homeland Security Committee, we had what we call markup, where we were debating a bunch of nominations and bills. I needed to be two places at one time. So I did do that. I apologize for missing your statements, but we are glad you are here, and we appreciate your responding to our questions.

Ironically, Mr. Chairman and colleagues, my wife, I think I mentioned this, she is hiking the Appalachian Trail this week with her sister and brother-in-law in western North Carolina. I get a daily report on predators that are attacking them and preying on them. I hope she will come back in one piece next week.

When I originally heard about this hearing, I said, well, I don't know if I have a dog in that fight. As it turns out, I have a wife and sister-in-law and brother-in-law. So this is more germane to me than I first thought.

While we don't have a whole lot of top predators in the First State, Delaware is the First State, we were the First State to ratify the Constitution, that is why we are called the First State. Like a lot of Americans, Delawareans are

fascinated by predators. In fact, a couple of years ago, one enterprising Delawarean mounted, if you can believe this, a 110-pound fiberglass shark to his dune buggy in honor of a white shark named Hilton that was tracked off Delaware's coast in 2017. While that dune buggy has driven thousands of miles, Hilton has swum thousands more, I think from South Carolina to about as far north as Nova Scotia.

But as the immense popularity of Shark Week demonstrates, millions of Americans are enthralled with these creatures, and with good reason. Predators such as bears and sharks really do play uniquely significant roles in their ecosystems and ours.

These animals control the entire food chains, indirectly influencing everything from the spread of invasive species to carbon sequestration. They sustain healthy populations of commercially and recreationally important fish and game species, and even help to enhance plant diversity.

Many predators are also important for ecotourism. However, as humans continue to encroach upon wildlife habitat and compete with predators for the same space and the same natural resources, our relationships with these animals can become, in some cases, adversarial.

What is more, human-predator interactions are increasingly common, as more people recreate, like my family this week, in wildlife habitat. More than 300 million people visit our

national parks each year, and our coasts are more popular than ever for surfing, for swimming, for boating and for fishing.

Human-predator interactions can impact predators and humans alike. Humans have a history of culling entire predator populations due to conflicts, which has negative effects on our ecosystem.

Predators can also threaten our recreational opportunities, food and economic security, and in rare but serious cases, cause human injury or loss of life. My wife was describing how they have these bear bags that they put food and stuff, provisions in, and hoist them up so they are up in the trees so bears can't get them. She had a very funny-looking bear bag compared to the other hikers; it was sort of like a made at home kind of deal.

Just last fall, two grizzly bears sadly killed a hunting guide in Wyoming. A short while later, a young man tragically lost his life after an encounter with a great white shark off of Cape Cod. Although such tragic outcomes are exceedingly rare, they do happen. As a result, we should consider how human-predator conflicts may evolve over time.

As the range of some prey species shifts in response to climate change, some species cease to exist entirely. Predators may be forced to move to new areas to follow the prey, or find new sources of food. This begs a couple of questions. One of them is, what can we do to meaningfully address human-predator

conflicts. A second question would be, how can we protect predators and preserve the important role they play in the environment, while minimizing harmful human-predator interactions.

I like to say that there are no silver bullets when we are trying to solve a particular issue. There are no silver bullets, a lot of silver BBs. Some of are bigger than others. One approach is the legislation before us today, which will support innovative, non-lethal technologies to study, to monitor and to manage predators.

Mr. Chairman, I appreciate your commitment to innovation and technology. I am pleased to support you in this legislative effort. With that said, I also want to highlight the importance of engaging citizens productively in addressing these conflicts. We need to make sure that good science and data can be used by wildlife managers and decision makers when managing predators. The public, who care most about these animals, must have the opportunity, formally or informally, to collaborate with scientists and managers on solutions.

Finally, Democrats on this committee have proposed a number of bills to address habitat loss, wildlife conservation, and climate change, all of which affect predators, as we know. Many of these bills are bipartisan and non-controversial. I hope this committee will work soon to advance some of those

legislative solutions as well.

Thanks again, Mr. Chairman, for holding the hearing today. I look forward to working with you to advance this bill. I again apologize for missing the first part of this hearing.

Thank you.

[The prepared statement of Senator Carper follows:]

Senator Barrasso. Would you like to proceed, Senator Carper, with a few questions, since Senator Braun and I have both had a chance to ask some?

Senator Carper. Yes, I would appreciate that. Thank you. I have 14 questions. Not really.

[Laughter.]

Senator Barrasso. They are up to it. They can handle it. They are good.

Senator Carper. We will divide them up. The first question, this will be for all three of you, if you would. We already see the impacts of climate change on wildlife, increasing air and water temperatures, rising sea levels, destroying or altering habitat as we know. Evolving weather and rainfall patterns impact food and water availability.

In response to these changes, wildlife behaviors are also changing. For example, orcas are moving north into the Arctic, and scientists have documented the northward migration of bull shark nurseries. Given these impacts, how do you think climate change impacts the increasing frequency of human-predator conflicts in the U.S.? Mr. Whitney, I am going to ask you to lead off, and I will ask each of you to respond. How do you think climate change affects the increasing frequency of human-predator conflicts in the U.S.?

Mr. Whitney. Thank you for the question. Yes, as you

noted, climate change and rising ocean temperatures do have an impact on several species, including sharks. Most sharks are ectothermic, which means they are cold-blooded. Their body temperature is going to be at whatever level the seawater is that they are swimming in.

Senator Carper. What was that term?

Mr. Whitney. Ectothermic.

Senator Carper. Thank you. I always say, what did you learn today? One thing.

Mr. Whitney. You can say cold-blooded, too.

Senator Carper. We use that term a lot around here.

[Laughter.]

Mr. Whitney. So as ocean temperatures rise, the sharks' body temperatures will rise, and their metabolic rate will increase, which means they are more active, they are burning more calories, they need to consume more prey to replace those calories.

What we typically see is sharks changing their distribution to stay within their preferred temperature range. They tend to have a range of a few degrees that they like to stay in. So as the area of that preferred temperature range moves north or in whatever direction, depending on what part of the world you are in, the sharks are likely to move to follow that. The same thing is true, most of their prey are going to cold-blooded as

well, so their prey will move to follow those temperatures.

So in terms of what that means for shark-human conflict, it potentially means that you have sharks coming into areas more commonly where they haven't been in recent history. So people may be used to swimming off beaches and not seeing many sharks, and now, with the warmer water temperatures, you can have more humans in the water, because the water is warmer, for one thing, and they will stay in longer, but then also more shark species coming into those areas.

Senator Carper. Great. That was good. Thank you.

Mr. Galante.

Mr. Galante. Thank you, Senator Carper. As you see species' ranges shift and increase, I think the biggest key is understanding the ecology, as Dr. Whitney pointed out. Then being adaptive for that. So understanding what species are going to shift into what new ecological niches, where they are going to occur, where they haven't previously, and what preventive methods we can take ahead of their being conflict to ensure that there is no issue with predators coming into that environment.

As you pointed out, there is absolutely no doubt that predators are constantly moving, and they are going to occupy new ecological roles in new environments. If we are ahead of that game, understanding and predicting that, then we can

mitigate conflict altogether.

Senator Carper. All right. Very good, thank you.

Mr. Galante. Thank you.

Senator Carper. And Mr. Hovinga.

Mr. Hovinga. Thank you, Ranking Member Carper.

Climate change with large carnivores in Wyoming is real similar to what these gentlemen have talked about here with other predators. Certainly, climate change affects not only the vegetation and what happens with the vegetative components of the landscape, but it also affects what happens with prey base on the landscape. So when there are changes in vegetation or changes in prey base, that obviously changes how those large carnivores or predators react to that.

For example, grizzly bears or bears in general being omnivores, can eat a variety of foods on the landscape. However, the foods that they typically may eat that are at a high elevation, if climate change were to cause an issue with those particular foods to be developed, those bears would typically change location and change food sources that may put them in a position to be in more close contact with humans.

So certainly something for us to be aware of, and to track what the effects of climate change are. That will need to be considered in management of all wildlife species in Wyoming.

Senator Carper. All right, thank you. If I could, Mr.

Chairman, maybe one more quick point. This would be for you, Mr. Hovinga. I take it back; this would be for Dr. Whitney.

Technology is often seen as a cure-all for complex conservation challenges. However, as I mentioned earlier, technology is just one tool in the toolbox. Thinking specifically about addressing human-predator conflicts, are there additional non-technology options we need to add to that toolbox?

Mr. Whitney. Yes. Thank you, Senator Carper, for the question. I think there are definitely tools besides technologies that need to be incorporated here. A big one is public education, an outreach just informing the general public about the presence of predators, what they may be doing in the area. I think Mr. Hovinga mentioned that in his testimony on grizzlies.

Just hearing some of the stuff about grizzlies, you look at the contradiction. If someone saw a grizzly bear feeding in Yellowstone, you would stay away from that area. With sharks, we take the places where they are feeding and we swim through them in orange shorts and bikinis. So it is really a matter of learning to recognize that areas where sharks may be feeding, adjusting your behavior appropriately, and then taking the things that we are learning about their behavior and their movements and communicating those to the public, so they can

make informed decisions about their use of the ocean.

Senator Carper. Great, thanks. Thank you all very, very much.

Senator Barrasso. Senator Markey.

Senator Markey. Thank you, Mr. Chairman, very much.

This issue is very relevant to Massachusetts, Dr. Whitney knows this for sure. Because we have seen the return of the great white sharks to Cape Cod. That might be an encouraging sign of a recovering ecosystem. But it brings new challenges for the coexistence of a healthy marine environment, and our residents, our tourists, and our bustling \$7.4 billion blue economy in Massachusetts.

In September of last year, I know Senator Carper referred to this, Arthur Medici was killed by a white shark in Wellfleet, the first shark fatality in Massachusetts since 1936. I would like to take a moment to extend my deepest condolences to Mr. Medici's family.

In the wake of that incident, and an additional shark attack in Truro, Cape Cod national seashore officials and Cape Cod towns are making every effort to ensure the Cape residents and the four million visitors that flock to the national seashore each year can safely enjoy our nationally acclaimed beaches. In order to safely co-exist with sharks, we must increase our scientific understanding of their movements and

behavior near the coast.

Dr. Whitney, thank you for joining us today. Does whet shark behavioral and tracking research require sustained, secure research funding over several years?

Mr. Whitney. Thank you for the question, Senator Markey. Yes, understanding the behavior and movements of any species, especially a large shark, is going to require sustained research. That is a project that has been ongoing now for about ten years with the Massachusetts Division of Marine Fisheries, as well as with the Atlantic White Shark Conservancy. It has been a combination of some public funding and also private fundraising that has kept that research going.

Most of our work is funded by federal grants that normally have a one-year timeline, or maybe two at the most. As you can imagine, it can be very difficult to get answers about the long-term movements of species that may live for over 70 years, and their movements cover entire ocean basins. So to just go out and study those over a 12-month grant period will not give you a lot of information.

Senator Markey. You testified that in addition to scientific research, public outreach is the most effective way to reduce shark-human conflict. Your shark-tagging data is publicly available, and the Atlantic White Shark Conservancy's Sharktivity app combines awareness efforts with citizen science.

Dr. Whitney, in addition to informal interactions by way of apps and websites, is more formal and structured communication needed to train Cape communities on shark safety and incident response?

Mr. Whitney. I would say absolutely. Any form of educating the community is a positive thing, and more formalized education would be helpful, not just in helping people understand the biology of the animals themselves, but also the best ways to handle in the event of an attack or a bite on a human, how to actually take the appropriate action to save lives.

Most of these bites on humans are not predatory bites. White sharks are capable of eating seals, which are far more formidable in the water than humans. So the fact that most humans that are bitten by white sharks are released rather quickly and actually make it to the beach is a sign that the sharks are not intentionally trying to feed on humans. But of course, even a tentative bite from a white shark can be deadly.

So the most important thing is to make sure that people who are bitten get the medical attention they need as fast as possible to prevent those fatalities.

Senator Markey. Thank you. I couldn't agree more. Cape Cod National Seashore is currently coordinating efforts to educate and inform visitors and residents of shark safety and

train first responders.

Historically, Cape Cod Seashore Advisory Commission has provided a structured, defined format for communication and education and citizen input from outer Cape communities that are most at risk of white shark encounters. Unfortunately, the advisory commission's authorization expired on September 26th, 2018, only a few weeks after the fatal shark incident in Wellfleet.

That is why I have introduced legislation to reauthorize this citizen commission through 2029, restoring this critical forum for citizen input, an outreach sorely needed to keep our Cape communities safe. I hope that with the support of my colleagues here in the Environment and Public Works Committee and the Energy and Natural Resources Committee, that we can find a way to reauthorize that legislation.

Do you think that would be an important thing to do, doctor?

Mr. Whitney. I am absolutely in favor of more formal education for cape communities, absolutely.

Senator Markey. Much appreciated. Thank you, Mr. Chairman.

Senator Barrasso. Thank you very much. Before heading back to Senator Braun, I do have some additional questions. Just wanted to give you an opportunity, Mr. Galante, to talk

about a show you are going to be hosting during Shark Week on Extinct or Alive on the Animal Planet about your recent travels. Perhaps you could share a little bit about that.

Mr. Galante. Yes, certainly. What I do as far as a career is, I travel around the world, primarily working with predators. I do that on television as an education platform, like Mr. Markey spoke about. This year, during Shark Week, we go looking for what is arguably the rarest shark on earth, the Pondicherry shark, a species not seen since the 1970s.

We travel literally to the ends of the earth in search of it, through the Maldives and into very remote Sri Lanka, where we are faced with numerous predators, leopards and tiger sharks, things both terrestrial and aquatic. Not only is it a great adventure, but we have a fantastic scientific discovery that comes out with the episode. It is both worlds.

Senator Barrasso. It is an hour show?

Mr. Galante. It is.

Senator Barrasso. It is an hour, so people can tune in if they want to see exactly what you find.

Mr. Galante. That is correct. It will be on this Wednesday, yes, this Wednesday at 8:00 p.m. on Shark Week.

Senator Barrasso. Thanks. Senator Braun.

Senator Braun. Quick question, and Brad, I think I have to aim this at you again. Bobcats would be the current issue in

Indiana, because there has been such great restoration. Our Department of Natural Resources has done an excellent job. Of course, that impacts turkey populations, they are predators of fawns. So it is starting to disrupt, again, it is not a human-predator interaction as much as most of the people that pay for hunting licenses in Indiana are maybe not interested in feeding the bobcats, so to speak.

So in again, an area that is as compressed as ours is, do you think we will need a bobcat season, either trapping and/or hunting, eventually, to maintain their populations at a healthy level that doesn't beat back the prey to where it would impact hunters who are more interested in turkey hunting and rabbit hunting and squirrel hunting? Even though they don't mind bobcats around, other than if the prey is gone because there are too many.

What do you think we need to do there eventually?

Mr. Hovinga. Thank you, Senator Braun. In Wyoming and in the west, bobcat management revolves heavily around those cyclic sorts of components of the prey base for bobcats. Bobcats typically, in Wyoming and the western States, rely on small mammals as prey. Bobcat populations tend to fluctuate with upticks and population declines in those small mammal populations.

We don't see effects from specifically bobcats on animals

like mule deer. We may see some in the eastern part of the State with turkey, however, I am just not that familiar with that. We could certainly find that information for you in Wyoming. I am on the far western side of Wyoming, and we don't have any turkeys where we are.

But I suspect they would, they would prey on turkeys, given the opportunity. At some point, you may likely be able to support recreational trapping or hunting of bobcats, based on those populations, and establish and how your prey population relates to the bobcat population. That will just a time will tell, as bobcats are able to establish, and if your agency can document any effects on those prey base populations.

Senator Braun. Coyotes would be the parallel to bobcats. Mountain lions, like I say, I think are just coming into the area. Coyotes almost had, I think, unlimited hunting and trapping and still are growing in number. So it is different in a State that has less geography.

Mr. Hovinga. Correct, Senator Braun. In Wyoming, we do see some of those impacts from coyote populations. We have made some moves, through management, to address some of the harvest of coyotes in an area that are popular for fawning and calving areas for big game animals, in an effort to try to reduce some of those impacts to the deer population. But coyotes do have an impact on deer populations from time to time, specifically when

deer populations are low.

Senator Braun. Thank you.

Senator Barrasso. Senator Cardin.

Senator Cardin. Thank you, Mr. Chairman. I really appreciate our witnesses, what they do every day. I came in close encounter yesterday with a deer in Baltimore City. Pretty close to downtown Baltimore City. So we recognize we have challenges today, make no mistake about it.

I want to start with habitat first, if I might. One of the ways to deal with this issue is to do a better job in protecting the habitat of wildlife. This committee has a pretty good record. The last Congress, we reported out of our committee three bills that I sponsored with Republicans: The National Fish and Wildlife legislation that was filed with Senator Crapo, the National Fish and Wildlife Foundation reauthorization that was with Senator Cassidy. That by the way is where the Genius Prizes are handled. And the U.S. Fish and Wildlife Service Compensation Act, so that damages that are caused, they can recover the funds, recover for the damages, put it into the trust funds and use it to protect and repair the habitat that has been damaged. That is with Senator Gardner.

I mention that because all three of those bills have been reported out by this committee, but were held up last year because we couldn't find a vehicle to get it to the finish line.

So they reported out the LANDS Bill. I would urge the leadership of this committee to find ways that we can get those bills moving. I do think habitat protection is an area that we can all work on that can have a major impact on dealing with the confrontation between wildlife and humans.

I want to deal with the realities of climate, which is affecting the realities that the growth of population, the changing in weather patterns have all brought about more conflict between humans and wildlife. I just think this needs to be on our radar screen as we deal with mitigation issues on this conflict.

It is interesting, when you look at the greatest threats, it is insects. We have programs to deal with it. But if you are looking at what is the greatest risk to life, it is insects. We need to deal with that. Climate change is affecting the vulnerability in regard to insects and human health.

So I hope as we go through this that we look at a comprehensive way to deal with this very important issue. I agree with the Chairman, this is a very important issue, and we need to act on it. But I would urge us to act on it in a way that is mindful of habitat, mindful of the realities of population growth, mindful of the changes in weather patterns, and that we look at way that takes all that into consideration. And where the greatest risks are to human life and human safety,

not necessarily the ones that make the headlines in our paper, because of the very rare encounter between a bear and a human, which happens too often, or a shark and a human, which happens too often. But it is a rare episode, as compared to some of the others. I don't know how many people have lost their cars or their lives to deer. My guess is it is quite substantial.

So if anyone wants to comment on that, fine. I just wanted to make those observations. I would be glad to hear from any one of you in an extra two minutes of presentation before the committee.

Mr. Galante. You are absolutely right, Senator, and I think a big part of that is, as we have briefly addressed, just encroachment issues, building highways through areas that have high deer populations, and things of that nature. What you end up seeing is these ecosystems are in a state of flux, meaning that they are not stable with regard to their predator prey base. Once they are stabilized, you will have less encounters such as deer on freeways and things like that.

Then of course, there are preventive methods, like what they are doing in Florida, where they are building wildlife corridors under the freeways and over the freeways, to prevent such encounters. With regard to insects and climate change and things of that nature, that is a very large topic that would take a long time to figure out any kind of a permanent solution.

But the ultimate solution would be conservation. It is understanding the ecosystems and understanding how to keep them within balance, and once they are balanced, how that affects all the human populace that surrounds them.

Senator Cardin. Thank you. Thank you, Mr. Chairman.

Senator Barrasso. Thank you, and I wanted to thank you again for your leadership on this, Senator Cardin, specifically. I know we had a hearing a week or two ago on our upcoming Highway Bill. We had the head of the Wyoming Department of Transportation we talked specifically about these interactions with deer and the damage and the loss of life there. That is why I think as part of our markup next week on the Highway Bill we actually have some things included in the bill that have to do with that. You will be happy to see that coming.

I want to just ask a couple of other questions. I know we are in the middle of a vote right now, so people are coming and going. Mr. Galante, to what extent can predator senses be impacted or targeted by innovators, things like smell, sight, hearing, touch, taste? You commented a little bit on how that would work, things we can do to deter unwanted interactions with humans.

Mr. Galante. Yes, hugely. Understanding the ecology of a species and its behavior is the best way to come up with non-lethal deterrents. What I mean by that, as Dr. Whitney can

attest to, sharks have a specialized EMR receptive organ named the Ampullae of Lorenzini. If you target that, by putting out electrical currents, you can create fantastic shark deterrents.

The same thing can be said for terrestrial animals, whether you are talking about a canine with a heightened sense of smell, or you are talking about animals with a heightened sense of hearing or sight. It is targeting these specific species based on what instincts and what they use as predators, which is most key to them, and targeting that specific sensory organ and deterring them that way, which is a fantastic non-lethal way to mitigate human-predator conflict.

Senator Barrasso. Senator Carper, I think you had a unanimous consent request.

Senator Carper. I do. Mr. Chairman, I ask unanimous consent to enter into the record written testimony and letters from stakeholders as well as other supplemental materials.

Senator Barrasso. Without objection.

[The referenced information follows:]

Senator Barrasso. Mr. Hovinga, since the goal of the Genius Prize we are considering is to protect both predators and humans, regarding predators, the key to protecting their lives involves preventing conflicts with humans in the first place. Can you explain why, from your years and history and knowledge, after a conflict with humans occurs, it may be necessary to euthanize some of these predators?

Mr. Hovinga. Certainly, Mr. Chairman. That is an unfortunate reality sometimes with wildlife management and wildlife behavior, that we have to realize. With a lot of wildlife, bears specifically and other large carnivores, those behaviors that end up becoming a part of an animal's everyday behavior, that becomes dangerous toward humans, those are learned behaviors. Those are typically learned through successes over time. It usually revolves around those successes in obtaining food.

They tend to learn that behavior over a long period of time. It is perpetuated by success. Just to give you an example of the situation I have dealt with before, this specific one is a black bear, where a black bear learned that if you approach people once in a while, they'll drop their back pack and run away and you can go over and receive a food reward out of that back pack.

Over time, that particular bear learned to be more

aggressive and the more aggressive that bear was, the higher the probability of that person dropping a backpack and running away. Fortunately, we were able to intervene in that situation, prior to that becoming dangerous and actually somebody becoming injured.

So those learned behaviors are very, very difficult for animals to unlearn. They typically don't unlearn them. It is irresponsible for us as a wildlife management agency to allow animals to remain on the landscape that engage in behavior that is dangerous toward people. Unfortunately, sometimes those animals need to be removed from the population.

So the populations are nearly always doing well enough that those removals are not significant in the scheme of the population management. But certainly, a requirement to keep people safe.

Senator Barrasso. And a final question, to all three of you, are there technologies currently not available that you envision coming down the line, having the potential to be developed into usable technology to reduce these conflicts? We will start with Dr. Whitney.

Mr. Whitney. Thank you for the question, Chairman Barrasso. One of the focuses of my research is utilizing new technologies to learn about shark fine-scale behavior. The tags in front of me here use accelerometers, the same technology that

is found in a Fitbit or in your smartphone. So we are not just tracking where the sharks go anymore, we are actually tracking their fine-scale movements. We can count how many tailbeats they make during a day or every change in pitch and posture. So we can actually measure activities.

Then we are also starting to use the same technology along with video cameras, so we can get an idea of the context of what is happening, and what other sharks or prey items are around while they are engaging in these behaviors.

So technologies like that are constantly developing and expanding our ability to understand what is happening with the predators. There is also tracking technology now where you can actually follow a shark with an AUV, an underwater unmanned vehicle. You can follow the shark around and occasionally take video clips of what the shark is doing, or record water samples so you know what is happening around the shark.

So things like that are the most exciting in our line of research.

Senator Barrasso. They do that with submarines, we find the enemy submarines, you follow them around that way, too. Fascinating.

Mr. Whitney. Yes.

Senator Barrasso. Mr. Galante.

Mr. Galante. As Dr. Whitney stated, using Fitbits and

shark tags, and as Mr. Hovinga stated, using drones, in my opinion, the best use of technology is actually repurposing existing technology, and adapting it to be available for wildlife use, whether that is taking technologies that exist in the tech realm, in the hunting realm, in the fishing realm, in the military realm, and applying that toward wildlife science.

Because what we see is with very small tweaks to existing technology, we are able to apply that tech to our fields, our respective fields of wildlife work. It is much cheaper, more effective and certainly much quicker than trying to develop new technology for these purposes.

Senator Barrasso. Mr. Hovinga.

Mr. Hovinga. Thank you, Mr. Chairman. I certainly agree with Mr. Galante, as far as those new technologies, and repurposing. One technology that we have used in the past for aversive conditioning on bears and other habituated wildlife is air horns. But a technology that is out there that would be really helpful is the use of some sort of an acoustic technology or sound cannon. Those are directional devices that can project sound a very long distance. You might imagine, using an air horn or something, if you are outside, it doesn't take very much distance for that sound to kind of fade.

But those technologies out there that have been used by law enforcement for crowd control purposes for decades, the military

certainly has acoustic sound technologies that they have to use. And some of that technology could certainly be used or modified or made portable enough that it could be used for an aversive conditioning technique for wildlife. Maybe something portable enough that is directional, it could be even a frequency that, instead of just being loud, is something that has a very aversive sort of effect on a bear, and make that technology even more effective.

What if that technology became portable enough that people could carry that, similar to how they do bear spray? Those technologies would be real advantageous.

Senator Barrasso. I want to thank all of you for being here. This is fascinating. We had a lot of opportunity to ask questions. We thank you for your testimony.

The hearing record is going to be open for two weeks, and some of the members who haven't been able to be here and wanted to, but had conflicts, may actually send written questions. We hope that you quickly will respond to those.

So with that, thank you again for sharing your time and your expertise. The hearing is adjourned.

[Whereupon, at 11:17 a.m., the committee was adjourned.]