

For example, there's a strong statistical suggestion that the QBO influences the North Atlantic Oscillation, a pattern of seesawing atmospheric pressures that dominates European weather. When the QBO winds are in a westerly phase, pressure differences over the North Atlantic tend to be more extreme. That strengthens the jet stream and boosts the chances that northern Europe will experience warmer, stormier winters like this past one, which brought floods to the United Kingdom. The expected easterly phase at the end of this year would have given northern Europe a good shot at a colder, drier winter. Instead, the return to westerly winds means that Europeans are more likely to see another stormy winter. "It's not a sure thing that that would be the forecast, but it loads the dice toward those sorts of conditions," says Scott Osprey, a climate scientist at the University of Oxford in the United Kingdom and lead author of the *Science* study.

Scientists have identified several possible causes for the break. The QBO is thought to be driven by tropical waves—generated by warm, circulating air—that propagate up from the troposphere into the stratosphere. But when Osprey's team plugged the anomalous QBO data into a climate model, the disruption appeared to originate outside of the tropics. One possible culprit is this past winter's strong El Niño, which not only brought unusually warm waters to the eastern equatorial Pacific Ocean, but also shook up atmospheric waves and weather patterns well beyond the tropics. A "blob" of warm water that has been growing in the northern Pacific Ocean since 2013 is another possible cause, as is a sudden stratospheric warming event that occurred this past winter in the high latitudes of the Northern Hemisphere.

The two teams are not yet ready to indict climate change as the more fundamental culprit, but they are concerned. "You can't encounter any new phenomenon without wondering if there's some impact of climate change," says Anne Smith, an atmospheric scientist at the National Center for Atmospheric Research in Boulder, Colorado. Osprey's team suspects that global warming will slow down the QBO and make it more vulnerable to future disruptions.

And indeed, they found hints of this, in one of the three climate models they studied. Under an extreme climate change scenario that forecasts warming of about 3.7°C by the end of the century, the model suggested QBO disruptions could occur up to three times every 100 years. If warming is playing a role, this first break in the QBO might not be the last. ■

Betsy Mason is a freelance writer in the San Francisco Bay Area in California.

WILDLIFE BIOLOGY

No proof that predator culls save livestock, study claims

New analysis calls for more rigorous studies

By Ben Goldfarb

On 5 August, biologists from the Washington Department of Fish and Wildlife ascended in a helicopter to shoot two members of the Profanity Peak wolf pack, which had been preying on cattle in the state's northeast corner. After the cull failed to end predation, the state removed four more members of the 11-wolf pack. Some conservationists were outraged, but the logic behind such lethal control seems airtight: Remove livestock-killing wolves, coyotes, bears, and other predators, and you'll protect farmers and ranchers from future losses.

A new study, however, claims that much of the research underpinning that common sense notion is flawed—and that the science of predator control needs a methodological overhaul. Adrian Treves, a conservation biologist at the University of Wisconsin, Madison, and his colleagues examined more than 100 peer-reviewed studies, searching for ones that randomized study sites, intervening on some by removing or deterring predators while leaving others untouched. Not a single experiment in which predators were killed has

ever successfully applied this randomized controlled design, they report this week in *Frontiers in Ecology and the Environment*. "Lethal control methods need to be subjected to the same gold standard of science as anything else," Treves says. He argues that policymakers should suspend predator management programs that aren't backed by rigorous evidence.

David Mech, a wolf expert at the University of Minnesota (UM), Twin Cities, isn't persuaded. He notes that many of the studies Treves scrutinized "met some pretty good scientific standards, but just weren't quite perfect. ... Drawing the conclusion that therefore all these depredation management programs should stop until gold standard studies are done—that's a very big leap."

Lethal control has long been a staple of wildlife management. Eurasian lynx have

been culled by hunters in Norway, wolves killed in Spain and Sweden, jackals and caracals eliminated in South Africa. In the United States, predator control often falls to the federal APHIS Wildlife Services, a branch of the U.S. Department of Agriculture. In 2015, the agency killed 385 gray wolves, 284 mountain lions, and more than 68,000 coyotes. Unlike the Profanity Peak wolf pack, which wasn't targeted until it began killing livestock, coyote populations in many states are subject to preemptive thinning.

Treves says he was inspired to look at the science behind predator control by a book unrelated to wild carnivores: *The Emperor of All Maladies: A Biography of Cancer*, Siddhartha Mukherjee's epic history of cancer. As Treves paged through it, he says, "a light bulb went off in my head." He suspected that predator

"Lethal control methods need to be subjected to the same gold standard of science as anything else."

Adrian Treves, University of Wisconsin, Madison

management was plagued by the same methodological problems that had once led cancer researchers to promote ineffective cures—particularly a dearth of randomized controlled trials. Although removing carnivores to ease livestock loss makes intuitive sense, Treves and other scientists were skeptical: For instance, some research suggests that coyote populations subject to culling have higher pup survival rates, and that male cougars expand their ranges in response to hunting.

What Treves found when he and his co-authors—Miha Krofel, a wildlife researcher at Slovenia's University of Ljubljana, and Jeannine McManus, a researcher at the Landmark Foundation in Riversdale, South Africa—dived into the literature confirmed his suspicions. Only 12 studies came close to Treves's gold standard or even a lesser "silver" standard, in which livestock losses before and after predator management were monitored, or analyzed in retrospect. Many other studies had flaws that he says make it impossible to draw reliable inferences. A 1999 experiment purporting to show the effectiveness of shooting coyotes from helicopters, for instance, had a higher density of sheep in its control pastures, which could have made them more attractive to hungry coyotes. Oth-



Federal officials shot four pack members after wolves killed cattle in Montana.

ers failed to properly randomize intervention and control sites or described their methods inadequately, making replication impossible.

"There are so many ways that these studies could have been improved," says Robert Crabtree, a carnivore ecologist and founder of the Yellowstone Ecological Research Center in Bozeman, Montana. "Not by spending more money, but by paying careful attention to standardization protocols, transparency, and replication."

Some of the authors whose studies Treves critiques object to his analysis. He discounted a 2008 study suggesting that trapping male wolves reduces livestock loss, for instance, in part because it excluded certain data points. But lead author Elizabeth Harper, then at UM, says that the paper thoroughly explains why each data point was excluded, and that the omissions kept misleading data from contaminating the results. Harper adds that she isn't convinced Treves's own study lives up to his standards: The authors assessed the validity of studies themselves, rather than asking independent experts. "That could create their own bias," Harper says.

Others say that Treves is setting an impractically high bar. The complexity of field biology precludes most gold standard experiments, argues Adrian Wydeven, Timber Wolf Alliance coordinator at Northland College in Ashland, Wisconsin. Scientists face countless variables, including subtle differences in habitat, weather, and the unpredictable movements of animals themselves. "I just don't see that it's an attainable standard—it's not like being in the lab," Wydeven says. Such research also relies on the cooperation of farmers and ranchers, who may not be ea-

ger to take part in a randomized, controlled study. When wolves are at the door, who wants their flock to be one that doesn't get help?

Treves counters that two of the studies he and his colleagues analyzed did meet the standard. Both evaluated nonlethal predator deterrence techniques: guard dogs and strings of flapping red flags that scare off wolves and coyotes. Performed by Tom Gehring, a biologist at Central Michigan University in Mount Pleasant, they showed that wolves and coyotes both steered clear of cattle farms patrolled by Great Pyrenees dogs, and that the flags deterred wolves, but not coyotes.

To prepare for the studies, done on Michigan's Upper Peninsula, Gehring combed through data on the ranges of local wolf packs to identify vulnerable farms, then visited each operation to secure its commitment. He paired farms based on attributes like size and location and randomly assigned one to the treatment group and one to the control group. "It was an ordeal," Gehring acknowledges. "It took months."

In the end, he claims, the rigorous design was well worth the trouble. Before his experiments, he says, many ranchers and biologists were skeptical that guard dogs could protect stock against wolves. By the end, though, the ranchers who had been assigned to the control group were clamoring for dogs of their own. "You don't hear anybody question that guard dogs work in Michigan anymore," Gehring says. ■

Ben Goldfarb is a freelance writer in New Haven, Connecticut.

SCIENTIFIC INTEGRITY

Accusations fly after big Gates grant

Panel promises verdict on old dispute between WHO and the University of Oxford

By Kai Kupferschmidt

When a big consortium led by University of Oxford researchers José Villar and Stephen Kennedy in the United Kingdom bagged a \$29 million grant from the Bill & Melinda Gates Foundation in March 2008, it seemed a cause for celebration. Their goal was to develop global standards to assess whether a fetus is on a healthy growth trajectory. Such standards would allow doctors to spot problems early and help prevent deaths in babies as well as mothers.

But the announcement shocked and angered some researchers at the World Health Organization's (WHO's) Department of Reproductive Health and Research in Geneva, Switzerland. Since late 2006, they had been heading a major effort to do the same thing in which Villar and Kennedy both participated; Kennedy had even signed a contract for Villar to develop a key protocol for the study, which Villar had yet to deliver. But members of the WHO group now say that the Oxford duo were using ideas developed in the WHO project in their competing grant proposal; some accuse them of deliberately delaying their WHO work while they were courting the Gates Foundation.

Thus began a bitter dispute involving three important players in global health that is still awaiting a resolution 8 years later. An independent panel is now looking into the matter and may soon arrive at a verdict, a WHO spokesperson says. WHO decided to commission the investigation last year after seeking advice from Frank Wells, an independent consultant on research ethics based in Ipswich, U.K.

In the executive summary of his report for WHO, which *Science* has obtained, Wells cautioned that the case was tangled. But he warned that doing nothing could create the impression that WHO didn't take misconduct allegations seriously. He found it "surprising" that the organization lacked a formal policy to deal with such allegations, and



No proof that predator culls save livestock, study claims

Ben Goldfarb (September 8, 2016)
Science **353** (6304), 1080-1081. [doi:
10.1126/science.353.6304.1080]

Editor's Summary

This copy is for your personal, non-commercial use only.

- | | |
|----------------------|--|
| Article Tools | Visit the online version of this article to access the personalization and article tools:
http://science.sciencemag.org/content/353/6304/1080 |
| Permissions | Obtain information about reproducing this article:
http://www.sciencemag.org/about/permissions.dtl |

Science (print ISSN 0036-8075; online ISSN 1095-9203) is published weekly, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue NW, Washington, DC 20005. Copyright 2016 by the American Association for the Advancement of Science; all rights reserved. The title *Science* is a registered trademark of AAAS.