From: **Adrian Treves** atreves@wisc.edu
Subject: Fall Wolf Season Comments
Date: June 18, 2021 at 10:17 AM
To: Johnson, Randy D - Dnr randy.johnson@wisconsin.gov, DNRWildlifeWebmail@wisconsin.gov
Cc: Ross, Laurie J - DNR Laurie.Ross@Wisconsin.gov

Please find attached my comments for the Wolf Harvest Advisory Committee, which I also ask be shared with the Wolf Management Planning Committee, the Natural Resource Board, and the cognizant wolf team staff of the DNR. Thanks in advance and have a good weekend

And please note the attached contains links to each of my prior public comments since May 15th 2021 for the public record.

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The University of Wisconsin–Madison occupies ancestral Ho-Chunk land, a place their nation has called Teejop (day-JOPE) since time immemorial.

In an 1832 treaty, the Ho-Chunk were forced to cede this territory.

Decades of ethnic cleansing followed when both the federal and state government repeatedly, but unsuccessfully, sought to forcibly remove the Ho-Chunk from Wisconsin.

This history of colonization informs our shared future of collaboration and innovation.

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Public comment to Wolf Harvest Advisory Committee, the Wolf Management Planning Committee, the WDNR, and the WI NRB
18 June 2021 from Prof. Adrian Treves, PhD

Thanks for the opportunity to comment on your proposed agenda and debates. I wish you good luck and thoughtful deliberation respecting the public trust duties assigned to you.

I applied with my lab colleagues to serve as independent scientific voices. We were declined. Therefore, I caution against debating the science within your group because the WDNR has not selected a group with diverse experience and worldview relating to wolf science. So, my comment here is restricted to helping you distinguish good science from better science and choose the better. Obviously, I think my lab's is the best but make up your own mind with the principles below drawn from the National Academies of Science's (NAS 2017) manual on fostering scientific integrity.

I have commented on the science of wolf policy in Wisconsin at length in various public comment periods. You can find all of the science and evidence I cited here and more at http://faculty.nelson.wisc.edu/treves/publications.php for free download. At this link (http://faculty.nelson.wisc.edu/treves/pubs/Treves_FSA_Putrevu_inal.pdf) you can find our most recent paper in press, which quantifies the effects of the February 2021 wolf hunt on the population status. This peer-reviewed paper comes out in the international peer-reviewed scientific journal PeerJ in the next few weeks (Treves, Santiago-Ávila et al. 2021).

You will also see an explanation of public trust duties and why the North American Model of wildlife management (NAM) distorts or ignores the fundamental role of the public trust (Wood 2009, Bruskotter, Enzler et al. 2011, Bruskotter, Enzler et al. 2012, Wood 2013, Nie, Barns et al. 2017, Treves, Chapron et al. 2017, Treves, Artelle et al. 2018, Treves, Santiago-Ávila et al. 2018, Nie, Landers et al. 2020).

During your discussions, you will probably hear a lot of opinions and assertions of fact (fact claims), which can be hard to disentangle because people tend to mix the two. It may also not be obvious that the state makes assertions of fact without the best available science behind them. The following four steps should help you to discriminate unsupported fact claims from ones that are substantiated and discern good evidence from poor.

For example, an interest group that asserts that "wolves need population control" most likely means something akin to "I feel there should be fewer wolves." The word 'need' should be viewed with skepticism until one is talking about survival or subsistence. Wolves--like all wildlife--do not need our help to control their population densities or geographic range. They do that themselves (see my Appendix to prior public comments in full).

You may also hear variations on "agencies need flexibility to kill problem wolves." Translate this as "I believe agencies should have flexibility…" and ask the speaker to translate "flexibility" and identify the "problem" wolves pose very precisely. These mixes of opinion (a personal value judgment usually) and fact claims are nowhere more obvious than in how most U.S. wildlife agencies, many ex-agency staff, and wildlife-consumers talk about killing wildlife, using euphemisms such as flexibility when they mean kill, harvest when they mean hunt, recreation when they mean killing for fun, and blood buys goodwill for a variety of unclear reasons. Proponents of these euphemisms and views may be sitting around you, so you are their equal and should feel empowered to question the euphemisms to make them transparent.

Note: For the scientific evidence evaluating whether blood does or does not buy goodwill, whether killing wolves does or does not protect domestic animals, and other claims about conserving wolves, see my May 15th public comment please (Appendix).

What role do facts play in your deliberations?

Science and facts do not make decisions. People make decisions based on their values but informed by facts and evidence. The science can tell us what has been, what is now, and what might be, and how to evaluate actions and their consequences. People with values still have to decide (Lynn 2010, Santiago-Ávila, Treves et al. 2020).

You may disagree with personal opinions and personal value judgments because your values differ but one doesn't evaluate opinions and value judgments with evidence. Those are two different sources of knowledge ("I feel" versus "I know").

How do we know something?

Imperfect as we humans are, so is our knowledge. But science does approximate knowledge of reality. And some scientific observations, measurements, or analyses are better approximations than others.

Here's how you can tell good from better science in four steps:

1. Transparency: Transparency is the most important principle of the best available science (NAS 2017) so if someone states a fact without evidence their statement is not scientific. The science that is more transparent is more reliable because it makes clear its assumptions, its methods, and shares the data it uses.

If the authors do not share the data, they are likely trying to hide something (or being forced to hide something). The reason better science is more transparent is because it allows a peer scientist to reproduce the results (or not) independently without having to trust the original authors (NAS 2017). See also citations to scientific integrity and reproducibility from the international scientific community in Treves 2019, Treves 2019, Treves and Santiago-Ávila 2020, Treves and Batavia 2021, Treves, Paquet et al. 2021.

There is a shortcut many scientists and others use for referring to facts or evidence rather than describing the assumptions, methods, and analyses fully. That shortcut is to cite a peer-reviewed, published scientific study as I have been doing (e.g., name and year, sometimes with additional names or 'et al.' which means 'and others' in Latin, and sometimes a lowercase letter a, b, c, etc, after the year to denote multiple peer-reviewed articles in the same year). The full citation should be in footnotes or endnotes. Given the shortcut is also a shorthand, it pays to look at the full citation for several reasons: if the person asserting a fact is one of the authors, they should be able to answer all questions about the methods, data, and assumptions. If the journal has no ISI impact factor or a low one (using a Google search) or if the journal has unclear editorial policies (e.g., Proceedings of the Vertebrate Pest Conference) one's skepticism should increase. Sometimes but not always the ISI impact factor reflects the quality of journals, but it is not necessarily appropriate to judge individual research articles that way. Yet, a scientist who published all or most of their articles in a single, low-ranked journal suggests they may be struggling to pass peer review at stronger journals.

2. Independent review: The scientific community requires complete transparency to take the first step in evaluating new science for its reliability and reproducibility (i.e., can the study be repeated or replicated?) by subjecting research to independent peer review, usually with 2-3 anonymous reviewers or reviewers with no personal or professional sympathies or antipathies to the authors or their institutions (Treves and Batavia 2021). "Peers" in this context means fellow scientists able to evaluate the quality of the work based on having done such work themselves or having studied the field for years. Transparency when thorough allows peer reviewers to independently confirm if the findings merit publication. This approval is only the first step in endorsing a scientific finding because subsequent checks on quality post-publication are equally or more important. I return to that topic in step 3.

Despite the importance of independent review, most government wildlife agencies do not take the time or effort or cannot pass authentically independent peer review. In the scientific community, such literature is called gray or white literature (e.g., Greenfire 2021), because it has not undergone the transparency of independent review and is therefore less reliable.

So be skeptical of unpublished or non-peer-reviewed reports or reports reviewed by reviewers selected by the agency or the authors. No matter how deep the voice, no matter how many years of experience someone claims (or years on the land or years of hunting), opinions without substantiating evidence are all equivalently unreliable and questionable because experiences, anecdotes, and opinions are not transparent about methods, assumptions, or data.

Now let's imagine that two or more peer-reviewed studies seem equally transparent but differ in an important result (observation, measurement or result of analysis) in step 3.

3. Strength of inference: The only way to distinguish good science from better science when the two are equally transparent and independently peer-reviewed is by scrutinizing the methods to evaluate the strength of the inference and the potential biases. Bias in scientific terms refers to inaccuracy or imprecision of estimates, observations, or measurements, which can distort results to a smaller or larger extent.

The better science is the one using a higher standard of inference (Treves, Krofel et al. 2019). A standard of inference is a globally accepted standard for confidence in the design used for that research. Note that here and below, the results are irrelevant to this evaluation — it judges only the quality of the methods. In the biomedical field and many other scientific fields that have wrestled with a problem of reproducibility (meaning many promising research findings failed to be replicated because of errors, fabrications, or unintentional biases), the gold-standard of reproducibility is achieved through randomized, controlled experiments (Ioannidis 2005). This standard is difficult to achieve in wildlife populations, but note it has been achieved many times for evaluating non-lethal methods for protecting domestic animals and property (Miller, Stoner et al. 2016, Treves, Krofel et al. 2016, Eklund, López-Bao et al. 2017, Lennox, Gallagher et al. 2018, Moreira-Arce, Ugarte et al. 2018, van Eeden, Crowther et al. 2018, van Eeden, Eklund et al. 2018, Khorozyan and Waltert 2019, Treves, Krofel et al. 2019, Khorozyan and Waltert 2020).

Because few other wildlife studies can achieve the gold standard, scientists recognize a silver standard of before-and-after comparison (Treves, Krofel et al. 2019). The silver standard means that wildlife were observed or measured before an event or human intervention and then the wildlife were observed or measured again afterwards. We used that standard when evaluating Michigan's lethal control program on wolves (Santiago-Avila, Cornman et al. 2018). This study is the best of its kind in my opinion because of transparency and improving on the methods in (Bradley, Robinson et al. 2015), which attempted a similar comparison but were not transparent in several ways. Even though it is better than Bradley in

transparency, Santiago-Ávila's analysis nevertheless only rises to the level of silver standard because before-and-after comparisons introduce an uncontrolled variable of time among other possible uncertainties. Therefore, we called on the state of Michigan (and proposed such for Wisconsin at other times) to perform the gold standard experiment if they claim lethal management is effective. It has been years now with no such experiment being conducted.

Some studies do not achieve the silver standard because they are only correlational. Many models fall into this category including my own work at times because we lacked the time, resources, or foresight to conduct the before-and-after comparison. This lowest standard, or bronze standard, is the weakest because so many confounding variables are left uncontrolled. If no stronger inference exists (that is reliable), then correlations may be the only basis for a decision but always remember they represent weak inference (Treves, Krofel et al. 2019).

In the final step 4, we'll consider a hypothetical situation in which two studies seem equally transparent with equally strong inference, but differ in a key finding.

4. The need for more information and comprehensive disclosures of potentially competing interests: Sometimes statistical and analytical methods are so complicated and unclear that even experts cannot distinguish good from better science based on scrutiny of fully transparent data, assumptions, and methods. This is rare in science but does happen and usually reflects the need for additional, better experiments or new data. There is one additional feature of better science that can help you distinguish between two pieces of scientific research even if they are equivalent in transparency, independent review, and strength of inference.

Did the authors declare or have undeclared, potentially competing interests (and what about the reviewers and editors?). Every human has interests so having an interest is not a problem by itself (Treves and Batavia 2021). Problematic interests are those that distort the results or methods because the author stands to gain from a certain finding. When the authors, reviewers, or editors stand to gain from a particular result either directly from material gain or indirectly through career advancement, fame, status, or the patronage of powerful, influential, or moneyed interests, then the interest may be potentially competing with the reliability of the scientific findings. Such competing interests do NOT disqualify a scientific finding necessarily, but they must be disclosed and discussed transparently by the authors, reviewers, and editors, or the process has been compromised. We as readers are allowed to judge those potentially competing interests and how they may have influenced the findings (Treves and Batavia 2021). For example, a researcher who is paid by a wildlife agency to complete a study is NOT independent of that agency and may have a competing interest to keep their donor or superior happy. Receiving funding is not a competing interest on its own because a scientist's findings may go against the wishes of the donor. Therefore, one should look especially carefully at findings that match the wishes of the donor because those are most vulnerable to a competing interest by the scientist who may intentionally or unintentionally skew the results in favor of the donor. So, ask about the competing interests for studies that are not made available to you and for the studies made available to you, look at the acknowledgments and competing interest statements. Finally, if the results support the preferences of powerful interest groups, look especially carefully at the methods. Follow the money and the careers.

Remember not to prefer a scientific study because of its results or conclusions--or because it conforms to your existing opinions or worldview. The best available science is judged on its methods, not its findings. You will see many people disparage a scientific finding because they don't like its results or its authors. They may not say it aloud but personal animosities and career advancement play a large role in such likes and dislikes.

I look forward to reviewing the studies produced in support of the agency's decisions in order to evaluate them using this four-step analysis. I also offer my advice to any of you who wish, no matter your worldview, if I can support the interpretation of scientific evidence.

Please see the Appendix below for my comments to WI DNR and NRB since January 2021. For links to our newest peer-reviewed paper estimating that the WI wolf population was cut down 27-33% from April 2020-April 2021, **click here**.

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http://faculty.nelson.wisc.edu/treves/publications.php)

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Appendix of public comments in 2021 with scientific literature

Prof. Adrian Treves, PhD, offered the following comments on Wisconsin Wolf management:

16 June 2021: regarding the scarcity of evidence making the goals of WDNR regulations impossible to achieve, and the scarcity of evidence making hounding, night-time hunting, and snowmobile pursuit risky and unscientific. For the full text of the comment, Click here

4 June 2021: The WDNR has often claimed that hunting wolves and other predators will generate net benefits for society. The common benefits claimed are protection of livestock, human safety, and improved tolerance for the survivors in the same population. The scientific evidence does not support these claims. Click here.

15 May 2021: regarding all aspects of wolf science relevant to your work, read below or click here. For the Appendices click here and for references cited click here.

Full text cover page of Prof. Treves' public comment submitted on 15 May 2021:

To: Wisconsin Natural Resources Board,
Wisconsin Department of Natural Resources,
Wolf Management Plan Committee, and
Wolf Harvest Advisory Committee
Via: Randy Johnson, WDNR Large Carnivore Specialist, Randy.Johnson@wisconsin.gov
Laurie J. Ross, Board Liaison, Laurie.Ross@wisconsin.gov

Re: Setting Quota for 2021 Wolf Hunting Season and Revision of Wolf Management Plan

Thank you for the opportunity to comment on Wisconsin's wolf management planning and the formulation of guidelines for a November 2021 wolf hunt. I am a Wisconsin resident and a professor at the University of Wisconsin in Madison. Specifically, I am a wolf ecologist and the founder of the Carnivore Coexistence Lab. I conduct interdisciplinary research on the human dimensions of wolf management and the law relating to coexistence with gray wolves. I have published more than 134 peer-reviewed scientific articles on ecology, management, and conservation. I have been investigating human-wolf coexistence in Wisconsin since 2000, with my most recent peer-reviewed scientific article on Wisconsin wolves published on May 10, 2021.

I will address four issues in my comments, and for the sake of brevity, will include supplemental information on each topic in appendices for your review, as well as providing a collection of scientific articles that are relevant to the critical issues.

First, as the Wisconsin Department of Natural Resources (DNR) revises its plan for the management of gray wolves, and takes immediate action to set a quota for the fall 2021 hunt, it must consider those actions in context of its role as a trustee, which must manage and conserve wildlife populations, including wolves, on behalf of current and future generations. I thus preface my comments on these upcoming decisions with a summary of my assumptions about the responsibilities of a public trustee, based on my extensive research about the duties in caring for a public asset such as wolves.

Second, because a trustee cannot manage an asset responsibly without full information, I describe the information and data that DNR must have before it makes management decisions about the Wisconsin wolf population, to avoid substantial impairment of that public asset.

Third, I discuss the lessons we have learned from the past history of Wisconsin wolf management and policy, drawing on my research into ecology, human dimensions of wildlife management and law. Finally, since I believe DNR must set realistic expectations for its wolf management goals, I end with a caution about what the science tells us that public wolf-hunting cannot achieve.

I. Duties of a Wildlife Trustee

Before DNR makes a decision about how to manage the wolf population, it must frame that decision in terms of how it interprets its duties as a public trustee of that wildlife asset. As a scientist working for a public institution, I believe I have my own duties as a public trustee, to provide the agency and the public with the best available science and help them to interpret diverse facts. I have extensively studied and published on the subject of the duties of a wildlife trustee, and I propose three primary principles to guide DNR's management decisions, including the decision on the upcoming fall 2021 hunt.

· First, the highest-priority duty for a wildlife trustee is to ensure that the health of wildlife populations is not substantially impaired. In the context of the Wisconsin wolf population, this means: (a) avoiding actions that will risk lowering the population to state listing level of 250; (b) protecting the renewal capacity of the public asset, by preventing harm to the reproductive capabilities of the wolf population; (c) preventing any harm to the wolf population that would result in the federal government removing the state from its trustee position by placing wolves back on the federal Endangered Species list--thus putting the U.S. Fish and Wildlife Service in the role of primary trustee; and (d) if any actions have already been taken that risk the harms detailed above, putting a plan in place to ensure that this damage is repaired.

· The second priority for a wildlife trustee is to preserve wildlife for future generations. This requires: (a) prioritizing future generations' interests in preservation over current users' interests in exploitation; (b) regulating use by current generations with precautions taken to protect against errors; and (c) preventing illegal, unregulated, or undetected uses that drain the public asset.

· Finally, the third priority for a wildlife trustee is to act transparently, so that the public on whose behalf it is managing the asset can see that it is doing so responsibly, effectively, and cost-efficiently. That requires: (a) demonstrating the use of the best available science and information to protect wildlife and regulate human uses; (b) providing accountability to all trust beneficiaries; (c) correcting errors forthrightly and honestly; (d) acting in a manner that is incorruptible and is not unduly influenced to favor one class of beneficiaries over another.

In Appendix 1, attached, I fully explore each of these trust responsibilities in the context of Wisconsin wolf management, with citations to scientific support.

This support includes a study that my colleagues and I have submitted for review, which concludes that during the February 2021 hunt, the state trustee allowed just over 300 wolf-hunters and wolf-poachers to reduce the state

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During your discussions, you will probably hear a lot of opinions and assertions of fact (fact claims), which can be hard to disentangle because people tend to mix the two. It may also not be obvious that the state makes assertions of fact without the best available science behind them. The following four steps should help you to discriminate unsupported fact claims from ones that are substantiated and discern good evidence from poor.

For example, an interest group that asserts that "wolves need population control" most likely means something akin to "I feel there should be fewer wolves." The word 'need' should be viewed with skepticism until one is talking about survival or subsistence. Wolves--like all wildlife--do not need our help to control their population densities or geographic range. They do that themselves (see my Appendix to prior public comments in full).

You may also hear variations on "agencies need flexibility to kill problem wolves." Translate this as "I believe agencies should have flexibility…" and ask the speaker to translate "flexibility" and identify the "problem" wolves pose very precisely. These mixes of opinion (a personal value judgment usually) and fact claims are nowhere more obvious than in how most U.S. wildlife agencies, many ex-agency staff, and wildlife-consumers talk about killing wildlife, using euphemisms such as flexibility when they mean kill, harvest when they mean hunt, recreation when they mean killing for fun, and blood buys goodwill for a variety of unclear reasons. Proponents of these euphemisms and views may be sitting around you, so you are their equal and should feel empowered to question the euphemisms to make them transparent.

Note: For the scientific evidence evaluating whether blood does or does not buy goodwill, whether killing wolves does or does not protect domestic animals, and other claims about conserving wolves, see my May 15th public comment please (Appendix).

What role do facts play in your deliberations?

Science and facts do not make decisions. People make decisions based on their values but informed by facts and evidence. The science can tell us what has been, what is now, and what might be, and how to evaluate actions and their consequences. People with values still have to decide (Lynn 2010, Santiago-Ávila, Treves et al. 2020).

You may disagree with personal opinions and personal value judgments because your values differ but one doesn't evaluate opinions and value judgments with evidence. Those are two different sources of knowledge ("I feel" versus "I know").

How do we know something?

Imperfect as we humans are, so is our knowledge. But science does approximate knowledge of reality. And some scientific observations, measurements, or analyses are better approximations than others.

Here's how you can tell good from better science in four steps:

1. Transparency: Transparency is the most important principle of the best available science (NAS 2017) so if someone states a fact without evidence their statement is not scientific. The science that is more transparent is more reliable because it makes clear its assumptions, its methods, and shares the data it uses.

If the authors do not share the data, they are likely trying to hide something (or being forced to hide something). The reason better science is more transparent is because it allows a peer scientist to reproduce the results (or not) independently without having to trust the original authors (NAS 2017). See also citations to scientific integrity and reproducibility from the international scientific community in Treves 2019, Treves 2019, Treves and Santiago-Ávila 2020, Treves and Batavia 2021, Treves, Paquet et al. 2021.

There is a shortcut many scientists and others use for referring to facts or evidence rather than describing the assumptions, methods, and analyses fully. That shortcut is to cite a peer-reviewed, published scientific study as I have been doing (e.g., name and year, sometimes with additional names or 'et al.' which means 'and others' in Latin, and sometimes a lowercase letter a, b, c, etc, after the year to denote multiple peer-reviewed articles in the same year). The full citation should be in footnotes or endnotes. Given the shortcut is also a shorthand, it pays to look at the full citation for several reasons: if the person asserting a fact is one of the authors, they should be able to answer all questions about the methods, data, and assumptions. If the journal has no ISI impact factor or a low one (using a Google search) or if the journal has unclear editorial policies (e.g., Proceedings of the Vertebrate Pest Conference) one's skepticism should increase. Sometimes but not always the ISI impact factor reflects the quality of journals, but it is not necessarily appropriate to judge individual research articles that way. Yet, a scientist who published all or most of their articles in a single, low-ranked journal suggests they may be struggling to pass peer review at stronger journals.

2. Independent review: The scientific community requires complete transparency to take the first step in evaluating new science for its reliability and reproducibility (i.e., can the study be repeated or replicated?) by subjecting research to independent peer review, usually with 2-3 anonymous reviewers or reviewers with no personal or professional sympathies or antipathies to the authors or their institutions (Treves and Batavia 2021). "Peers" in this context means fellow scientists able to evaluate the quality of the work based on having done such work themselves or having studied the field for years. Transparency when thorough allows peer reviewers to independently confirm if the findings merit publication. This approval is only the first step in endorsing a scientific finding because subsequent checks on quality post-publication are equally or more important. I return to that topic in step 3.

Despite the importance of independent review, most government wildlife agencies do not take the time or effort or cannot pass authentically independent peer review. In the scientific community, such literature is called gray or white literature (e.g., Greenfire 2021), because it has not undergone the transparency of independent review and is therefore less reliable.

So be skeptical of unpublished or non-peer-reviewed reports or reports reviewed by reviewers selected by the agency or the authors. No matter how deep the voice, no matter how many years of experience someone claims (or years on the land or years of hunting), opinions without substantiating evidence are all equivalently unreliable and questionable because experiences, anecdotes, and opinions are not transparent about methods, assumptions, or data.

Now let's imagine that two or more peer-reviewed studies seem equally transparent but differ in an important result (observation, measurement or result of analysis) in step 3.

3. Strength of inference: The only way to distinguish good science from better science when the two are equally transparent and independently peer-reviewed is by scrutinizing the methods to evaluate the strength of the inference and the potential biases. Bias in scientific terms refers to inaccuracy or imprecision of estimates, observations, or measurements, which can distort results to a smaller or larger extent.

The better science is the one using a higher standard of inference (Treves, Krofel et al. 2019). A standard of inference is a globally accepted standard for confidence in the design used for that research. Note that here and below, the results are irrelevant to this evaluation — it judges only the quality of the methods. In the biomedical field and many other scientific fields that have wrestled with a problem of reproducibility (meaning many promising research findings failed to be replicated because of errors, fabrications, or unintentional biases), the gold-standard of reproducibility is achieved through randomized, controlled experiments (Ioannidis 2005). This standard is difficult to achieve in wildlife populations, but note it has been achieved many times for evaluating non-lethal methods for protecting domestic animals and property (Miller, Stoner et al. 2016, Treves, Krofel et al. 2016, Eklund, López-Bao et al. 2017, Lennox, Gallagher et al. 2018, Moreira-Arce, Ugarte et al. 2018, van Eeden, Crowther et al. 2018, van Eeden, Eklund et al. 2018, Khorozyan and Waltert 2019, Treves, Krofel et al. 2019, Khorozyan and Waltert 2020).

Because few other wildlife studies can achieve the gold standard, scientists recognize a silver standard of before-and-after comparison (Treves, Krofel et al. 2019). The silver standard means that wildlife were observed or measured before an event or human intervention and then the wildlife were observed or measured again afterwards. We used that standard when evaluating Michigan's lethal control program on wolves (Santiago-Avila, Cornman et al. 2018). This study is the best of its kind in my opinion because of transparency and improving on the methods in (Bradley, Robinson et al. 2015), which attempted a similar comparison but were not transparent in several ways. Even though it is better than Bradley in

transparency, Santiago-Ávila's analysis nevertheless only rises to the level of silver standard because before-and-after comparisons introduce an uncontrolled variable of time among other possible uncertainties. Therefore, we called on the state of Michigan (and proposed such for Wisconsin at other times) to perform the gold standard experiment if they claim lethal management is effective. It has been years now with no such experiment being conducted.

Some studies do not achieve the silver standard because they are only correlational. Many models fall into this category including my own work at times because we lacked the time, resources, or foresight to conduct the before-and-after comparison. This lowest standard, or bronze standard, is the weakest because so many confounding variables are left uncontrolled. If no stronger inference exists (that is reliable), then correlations may be the only basis for a decision but always remember they represent weak inference (Treves, Krofel et al. 2019).

In the final step 4, we'll consider a hypothetical situation in which two studies seem equally transparent with equally strong inference, but differ in a key finding.

4. The need for more information and comprehensive disclosures of potentially competing interests: Sometimes statistical and analytical methods are so complicated and unclear that even experts cannot distinguish good from better science based on scrutiny of fully transparent data, assumptions, and methods. This is rare in science but does happen and usually reflects the need for additional, better experiments or new data. There is one additional feature of better science that can help you distinguish between two pieces of scientific research even if they are equivalent in transparency, independent review, and strength of inference.

Did the authors declare or have undeclared, potentially competing interests (and what about the reviewers and editors?). Every human has interests so having an interest is not a problem by itself (Treves and Batavia 2021). Problematic interests are those that distort the results or methods because the author stands to gain from a certain finding. When the authors, reviewers, or editors stand to gain from a particular result either directly from material gain or indirectly through career advancement, fame, status, or the patronage of powerful, influential, or moneyed interests, then the interest may be potentially competing with the reliability of the scientific findings. Such competing interests do NOT disqualify a scientific finding necessarily, but they must be disclosed and discussed transparently by the authors, reviewers, and editors, or the process has been compromised. We as readers are allowed to judge those potentially competing interests and how they may have influenced the findings (Treves and Batavia 2021). For example, a researcher who is paid by a wildlife agency to complete a study is NOT independent of that agency and may have a competing interest to keep their donor or superior happy. Receiving funding is not a competing interest on its own because a scientist's findings may go against the wishes of the donor. Therefore, one should look especially carefully at findings that match the wishes of the donor because those are most vulnerable to a competing interest by the scientist who may intentionally or unintentionally skew the results in favor of the donor. So, ask about the competing interests for studies that are not made available to you and for the studies made available to you, look at the acknowledgments and competing interest statements. Finally, if the results support the preferences of powerful interest groups, look especially carefully at the methods. Follow the money and the careers.

Remember not to prefer a scientific study because of its results or conclusions--or because it conforms to your existing opinions or worldview. The best available science is judged on its methods, not its findings. You will see many people disparage a scientific finding because they don't like its results or its authors. They may not say it aloud but personal animosities and career advancement play a large role in such likes and dislikes.

I look forward to reviewing the studies produced in support of the agency's decisions in order to evaluate them using this four-step analysis. I also offer my advice to any of you who wish, no matter your worldview, if I can support the interpretation of scientific evidence.

Please see the Appendix below for my comments to WI DNR and NRB since January 2021. For links to our newest peer-reviewed paper estimating that the WI wolf population was cut down 27-33% from April 2020-April 2021, **click here**.

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http://faculty.nelson.wisc.edu/treves/publications.php)

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The University of Wisconsin–Madison occupies ancestral Ho-Chunk land, a place their nation has called Teejop (day-JOPE) since time immemorial.
In an 1832 treaty, the Ho-Chunk were forced to cede this territory.
Decades of ethnic cleansing followed when both the federal and state government repeatedly, but unsuccessfully, sought to forcibly remove the Ho-Chunk from Wisconsin.
This history of colonization informs our shared future of collaboration and innovation.
Today, UW–Madison respects the inherent sovereignty of the Ho-Chunk Nation, along with the eleven other First Nations of Wisconsin.

Appendix of public comments in 2021 with scientific literature

Prof. Adrian Treves, PhD, offered the following comments on Wisconsin Wolf management:

16 June 2021: regarding the scarcity of evidence making the goals of WDNR regulations impossible to achieve, and the scarcity of evidence making hounding, night-time hunting, and snowmobile pursuit risky and unscientific. For the full text of the comment, Click here

4 June 2021: The WDNR has often claimed that hunting wolves and other predators will generate net benefits for society. The common benefits claimed are protection of livestock, human safety, and improved tolerance for the survivors in the same population. The scientific evidence does not support these claims. Click here.

15 May 2021: regarding all aspects of wolf science relevant to your work, read below or click here. For the Appendices click here and for references cited click here.

Full text cover page of Prof. Treves' public comment submitted on 15 May 2021:

To: Wisconsin Natural Resources Board,
Wisconsin Department of Natural Resources,
Wolf Management Plan Committee, and
Wolf Harvest Advisory Committee
Via: Randy Johnson, WDNR Large Carnivore Specialist, Randy.Johnson@wisconsin.gov
Laurie J. Ross, Board Liaison, Laurie.Ross@wisconsin.gov

Re: Setting Quota for 2021 Wolf Hunting Season and Revision of Wolf Management Plan

Thank you for the opportunity to comment on Wisconsin's wolf management planning and the formulation of guidelines for a November 2021 wolf hunt. I am a Wisconsin resident and a professor at the University of Wisconsin in Madison. Specifically, I am a wolf ecologist and the founder of the Carnivore Coexistence Lab. I conduct interdisciplinary research on the human dimensions of wolf management and the law relating to coexistence with gray wolves. I have published more than 134 peer-reviewed scientific articles on ecology, management, and conservation. I have been investigating human-wolf coexistence in Wisconsin since 2000, with my most recent peer-reviewed scientific article on Wisconsin wolves published on May 10, 2021.

I will address four issues in my comments, and for the sake of brevity, will include supplemental information on each topic in appendices for your review, as well as providing a collection of scientific articles that are relevant to the critical issues.

First, as the Wisconsin Department of Natural Resources (DNR) revises its plan for the management of gray wolves, and takes immediate action to set a quota for the fall 2021 hunt, it must consider those actions in context of its role as a trustee, which must manage and conserve wildlife populations, including wolves, on behalf of current and future generations. I thus preface my comments on these upcoming decisions with a summary of my assumptions about the responsibilities of a public trustee, based on my extensive research about the duties in caring for a public asset such as wolves.

Second, because a trustee cannot manage an asset responsibly without full information, I describe the information and data that DNR must have before it makes management decisions about the Wisconsin wolf population, to avoid substantial impairment of that public asset.

Third, I discuss the lessons we have learned from the past history of Wisconsin wolf management and policy, drawing on my research into ecology, human dimensions of wildlife management and law. Finally, since I believe DNR must set realistic expectations for its wolf management goals, I end with a caution about what the science tells us that public wolf-hunting cannot achieve.

I. Duties of a Wildlife Trustee

Before DNR makes a decision about how to manage the wolf population, it must frame that decision in terms of how it interprets its duties as a public trustee of that wildlife asset. As a scientist working for a public institution, I believe I have my own duties as a public trustee, to provide the agency and the public with the best available science and help them to interpret diverse facts. I have extensively studied and published on the subject of the duties of a wildlife trustee, and I propose three primary principles to guide DNR's management decisions, including the decision on the upcoming fall 2021 hunt.

· First, the highest-priority duty for a wildlife trustee is to ensure that the health of wildlife populations is not substantially impaired. In the context of the Wisconsin wolf population, this means: (a) avoiding actions that will risk lowering the population to state listing level of 250; (b) protecting the renewal capacity of the public asset, by preventing harm to the reproductive capabilities of the wolf population; (c) preventing any harm to the wolf population that would result in the federal government removing the state from its trustee position by placing wolves back on the federal Endangered Species list--thus putting the U.S. Fish and Wildlife Service in the role of primary trustee; and (d) if any actions have already been taken that risk the harms detailed above, putting a plan in place to ensure that this damage is repaired.

· The second priority for a wildlife trustee is to preserve wildlife for future generations. This requires: (a) prioritizing future generations' interests in preservation over current users' interests in exploitation; (b) regulating use by current generations with precautions taken to protect against errors; and (c) preventing illegal, unregulated, or undetected uses that drain the public asset.

· Finally, the third priority for a wildlife trustee is to act transparently, so that the public on whose behalf it is managing the asset can see that it is doing so responsibly, effectively, and cost-efficiently. That requires: (a) demonstrating the use of the best available science and information to protect wildlife and regulate human uses; (b) providing accountability to all trust beneficiaries; (c) correcting errors forthrightly and honestly; (d) acting in a manner that is incorruptible and is not unduly influenced to favor one class of beneficiaries over another.

In Appendix 1, attached, I fully explore each of these trust responsibilities in the context of Wisconsin wolf management, with citations to scientific support.

This support includes a study that my colleagues and I have submitted for review, which concludes that during the February 2021 hunt, the state trustee allowed just over 300 wolf-hunters and wolf-poachers to reduce the state

wolf population by 27-33%. We predict that in order to allow the wolf population to recover from this impairment, the state would need to protect it from hunting or high rates of government lethal control for several years, assuming that reproduction has not also been substantially impaired.

II. Data DNR Must Have to Avoid Substantial Impairment of Trust Asset

As I detail in Appendix 1, Wisconsin could suffer from a substantial impairment to its wolf population as a result of: 1) damage to or deterioration of the reproductive output of the wolves; 2), numerical depletion of the wolf population; or 3) deterioration or loss of ecological functions in the wild ecosystems of the state.

My primary concern with the future of Wisconsin wolf management is that DNR does not seem to have sufficient information to assess the status of the wolf population, to determine if there has already been such a substantial impairment, especially following the February 2021 wolf hunt, or to allow it to measure the effects of future actions to prevent them from causing substantial impairment to pack reproduction, ecological function, or a self-sustaining healthy population. If DNR has this information, it has not been shared with the public, who are the beneficiaries of the wildlife trust resources that DNR manages on our behalf.

Before DNR takes additional actions that may impair the Wisconsin wolf population, such as setting a quota for any future wolf hunts, it must have information necessary to evaluate the current status of the population, and quantify the threats posed to pack reproduction, juvenile recruitment, ecological functions, and natural ecological interactions. I suggest that the revision of the Wolf Management Plan include processes to gain this baseline of information, to update it regularly, and to present it to the public in an accurate, precise, reliable, and unbiased form. The information needed to make responsible management decisions includes the following:

1. Number of wolf packs in the state and how many breed successfully each year

2. Number of wolves in each pack

3. Survival of juveniles and causes of death by November each year

4. Survival of adults and causes of death each year

5. Locations of illegal kills and methods and motivations of poachers) those who kill wolves illegally)

6. Effectiveness of non-lethal and lethal methods of protecting domestic animals from wolf predation

7. Detailed records of marked wolves (collared or otherwise tagged) from marking until death or disappearance, including locational data and cause of death or disappearance

8. The ecological effects of human-caused wolf mortality, including evaluation of the effects of intentional killing, whether by the public or by government agents

9. Reliable social science data on attitudes to wolves and tolerance for various scenarios involving coexistence with wolves, inclination to poach wolves, and support for DNR policies, measured in a uniform random sample of state residents and out-of-state hunters

10. Veterinary and pathological information on diseases and causes of death for a relatively large random sample of recovered wolf carcasses

11. Other information on changing rates of nonhuman causes of death or reproductive impairment each year

12. Critically, the effect on the wolf population after wolves were killed, nearly twice the state "quota," in February 2021, and illegal kills since April 2020

Very little of this information is currently available. Until DNR has gathered sufficient baseline data, and set up processes to monitor changes, it should not make any additional decisions out of ignorance that may endanger the state wolf population, and violate its primary duties as a trustee.

III. Lessons Learned from History of WI Wolf Management

I have spent substantial time studying Wisconsin's record of wolf management, and the science on which it has been based, and I have detailed much of this work in Appendix 2. As DNR revises its Wolf Management Plan and sets up future hunts, it is crucial that it spend time reflecting on the errors that have been made in the past--both so it can correct the damage that has already been done to the state wolf population, and understand how to avoid those same mistakes going forward. My most urgent concerns relate to the state's conduct of the unprecedented February 2021 wolf hunt, which had the following novel, and alarming, characteristics:

• Timing. The hunt was held during the last week in February, so it would overlap with wolf mating season. The state has never held such a hunt before.

 • Methods. The February hunt allowed night-time hunting, pursuit by hounds in deep snow, and pursuit by snowmobile.

• To my knowledge there has never been any peer-reviewed research about the effects of this combination of methods and timing of a hunt on a wolf population.

 • Finally the NRB's explicit desire to set a "conservative" quota for hunting Wisconsin's wolves, suggests a different approach than was taken in the February 2021 hunt. As a scientist, I interpret conservative assumptions or conservative methods as those that are less likely to cause error.

I recommend using the minimum bound of the most reliable and proven population estimate, and the upper bound of background non-harvest mortality. For the latter, I strongly recommend embracing the replicated findings that background mortality increases significantly when wolves are not federally listed, so as to avoid recommending quotas that will damage the wolf population quickly. I counsel against using 'black box' models that are not subjected to rigorous external evaluation and recommend any model be opposed against simpler alternative models. At every step of the process of producing and using science, transparency will support well-informed decisions. Other principles of scientific integrity such as independent review and reproducibility are similarly indispensable.

Likewise, transparency will be an asset for separating personal or agency values from the values of the broadest public, which should take much higher priority. To attain the goals of the broadest public, I recommend against any hunt or any hunting method that targets breeding adults, and recommend in general that the DNR focus on protecting the reproductive capacities of Wisconsin wolf packs when feasible. The most critical intervention for long-term sustainability of the state wolf population will be to enforce anti-poaching laws because illegal killing is the major cause of mortality. Failure to do so seems to favor escalations of wildlife crimes from low rates of overt poaching to high rates of cryptic poaching.

IV. Setting Realistic Goals for What Wolf Hunting Seasons Can Achieve

Finally, since 2005 and accelerating in 2016, my work has focused on evaluating two scientific claims made about hunting as a wildlife management tool. The first claim is that the public will tolerate controversial wildlife better if regulated killing is permitted. The second common claim is that illegal killing will diminish if legal killing is permitted. I present years of evidence from numerous independent sources that contradict both claims (Appendix 3). Furthermore, evidence shows that killing wolves to protect livestock more often backfires and creates additional conflicts. Lethal methods of limiting wolf predations on livestock have also been subject to less rigorous experimental tests than non-lethal methods, which are more likely to reduce such conflict. (Appendix 4).

V. Conclusion

I believe a public trustee should prioritize preserving Wisconsin's wolves for future generations as the highest priority, then secondarily regulating current uses, preventing and repairing unregulated, illegal, or undetected uses, and accounting transparently with the best available science to the broadest public. These duties apply to future wolf management planning and to the coming months before recommending any quota for a november 2021 wolf-hunt. However, I find most of the information needed is lacking to act as a responsible trustee and make prudent, science-based, transparent decisions about wolves.

Furthermore, my study of the history of wolf policy suggests such gaps in information are not new and the DNR has experienced many shortcomings in transparency and scientific integrity since 1999. The February 2021 wolf-hunt has created long-lasting uncertainty about the resiliency of wolves in our state and exposed the risks posed by hunting without deliberative, science-based decision-making.

What is needed now is deliberative, reasoned, pluralistic, precautionary policy guided by multiple sources of scientific evidence that have been tested by internationally recognized standards for strength of inference and reliability. I call for careful collection of the needed information by independent, diverse researchers who can and must be allowed to transparently share all information and discuss it before submitting their consensus -- after scientific debate insulated from undue political influence. I call for strict avoidance of the conditions preceding the February 2021 wolf-hunt. Finally, Icall for abandoning long-held but erroneous assumptions that recreational hunting of wolves improves human tolerance, reduces poaching, or protects livestock.

Thanks for your attention to the four (4) Appendices attached with this comment.

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II. Data DNR Must Have to Avoid Substantial Impairment of Trust Asset

As I detail in Appendix 1, Wisconsin could suffer from a substantial impairment to its wolf population as a result of: 1) damage to or deterioration of the reproductive output of the wolves; 2), numerical depletion of the wolf population; or 3) deterioration or loss of ecological functions in the wild ecosystems of the state.

My primary concern with the future of Wisconsin wolf management is that DNR does not seem to have sufficient information to assess the status of the wolf population, to determine if there has already been such a substantial impairment, especially following the February 2021 wolf hunt, or to allow it to measure the effects of future actions to prevent them from causing substantial impairment to pack reproduction, ecological function, or a self-sustaining healthy population. If DNR has this information, it has not been shared with the public, who are the beneficiaries of the wildlife trust resources that DNR manages on our behalf.

Before DNR takes additional actions that may impair the Wisconsin wolf population, such as setting a quota for any future wolf hunts, it must have information necessary to evaluate the current status of the population, and quantify the threats posed to pack reproduction, juvenile recruitment, ecological functions, and natural ecological interactions. I suggest that the revision of the Wolf Management Plan include processes to gain this baseline of information, to update it regularly, and to present it to the public in an accurate, precise, reliable, and unbiased form. The information needed to make responsible management decisions includes the following:

1. Number of wolf packs in the state and how many breed successfully each year

2. Number of wolves in each pack

3. Survival of juveniles and causes of death by November each year

4. Survival of adults and causes of death each year

5. Locations of illegal kills and methods and motivations of poachers) those who kill wolves illegally)

6. Effectiveness of non-lethal and lethal methods of protecting domestic animals from wolf predation

7. Detailed records of marked wolves (collared or otherwise tagged) from marking until death or disappearance, including locational data and cause of death or disappearance

8. The ecological effects of human-caused wolf mortality, including evaluation of the effects of intentional killing, whether by the public or by government agents

9. Reliable social science data on attitudes to wolves and tolerance for various scenarios involving coexistence with wolves, inclination to poach wolves, and support for DNR policies, measured in a uniform random sample of state residents and out-of-state hunters

10. Veterinary and pathological information on diseases and causes of death for a relatively large random sample of recovered wolf carcasses

11. Other information on changing rates of nonhuman causes of death or reproductive impairment each year

12. Critically, the effect on the wolf population after wolves were killed, nearly twice the state "quota," in February 2021, and illegal kills since April 2020

Very little of this information is currently available. Until DNR has gathered sufficient baseline data, and set up processes to monitor changes, it should not make any additional decisions out of ignorance that may endanger the state wolf population, and violate its primary duties as a trustee.

III. Lessons Learned from History of WI Wolf Management

I have spent substantial time studying Wisconsin's record of wolf management, and the science on which it has been based, and I have detailed much of this work in Appendix 2. As DNR revises its Wolf Management Plan and sets up future hunts, it is crucial that it spend time reflecting on the errors that have been made in the past--both so it can correct the damage that has already been done to the state wolf population, and understand how to avoid those same mistakes going forward. My most urgent concerns relate to the state's conduct of the unprecedented February 2021 wolf hunt, which had the following novel, and alarming, characteristics:

• Timing. The hunt was held during the last week in February, so it would overlap with wolf mating season. The state has never held such a hunt before.

 • Methods. The February hunt allowed night-time hunting, pursuit by hounds in deep snow, and pursuit by snowmobile.

• To my knowledge there has never been any peer-reviewed research about the effects of this combination of methods and timing of a hunt on a wolf population.

 • Finally the NRB's explicit desire to set a "conservative" quota for hunting Wisconsin's wolves, suggests a different approach than was taken in the February 2021 hunt. As a scientist, I interpret conservative assumptions or conservative methods as those that are less likely to cause error.

I recommend using the minimum bound of the most reliable and proven population estimate, and the upper bound of background non-harvest mortality. For the latter, I strongly recommend embracing the replicated findings that background mortality increases significantly when wolves are not federally listed, so as to avoid recommending quotas that will damage the wolf population quickly. I counsel against using 'black box' models that are not subjected to rigorous external evaluation and recommend any model be opposed against simpler alternative models. At every step of the process of producing and using science, transparency will support well-informed decisions. Other principles of scientific integrity such as independent review and reproducibility are similarly indispensable.

Likewise, transparency will be an asset for separating personal or agency values from the values of the broadest public, which should take much higher priority. To attain the goals of the broadest public, I recommend against any hunt or any hunting method that targets breeding adults, and recommend in general that the DNR focus on protecting the reproductive capacities of Wisconsin wolf packs when feasible. The most critical intervention for long-term sustainability of the state wolf population will be to enforce anti-poaching laws because illegal killing is the major cause of mortality. Failure to do so seems to favor escalations of wildlife crimes from low rates of overt poaching to high rates of cryptic poaching.

IV. Setting Realistic Goals for What Wolf Hunting Seasons Can Achieve

Finally, since 2005 and accelerating in 2016, my work has focused on evaluating two scientific claims made about hunting as a wildlife management tool. The first claim is that the public will tolerate controversial wildlife better if regulated killing is permitted. The second common claim is that illegal killing will diminish if legal killing is permitted. I present years of evidence from numerous independent sources that contradict both claims (Appendix 3). Furthermore, evidence shows that killing wolves to protect livestock more often backfires and creates additional conflicts. Lethal methods of limiting wolf predations on livestock have also been subject to less rigorous experimental tests than non-lethal methods, which are more likely to reduce such conflict. (Appendix 4).

V. Conclusion

I believe a public trustee should prioritize preserving Wisconsin's wolves for future generations as the highest priority, then secondarily regulating current uses, preventing and repairing unregulated, illegal, or undetected uses, and accounting transparently with the best available science to the broadest public. These duties apply to future wolf management planning and to the coming months before recommending any quota for a november 2021 wolf-hunt. However, I find most of the information needed is lacking to act as a responsible trustee and make prudent, science-based, transparent decisions about wolves.

Furthermore, my study of the history of wolf policy suggests such gaps in information are not new and the DNR has experienced many shortcomings in transparency and scientific integrity since 1999. The February 2021 wolf-hunt has created long-lasting uncertainty about the resiliency of wolves in our state and exposed the risks posed by hunting without deliberative, science-based decision-making.

What is needed now is deliberative, reasoned, pluralistic, precautionary policy guided by multiple sources of scientific evidence that have been tested by internationally recognized standards for strength of inference and reliability. I call for careful collection of the needed information by independent, diverse researchers who can and must be allowed to transparently share all information and discuss it before submitting their consensus -- after scientific debate insulated from undue political influence. I call for strict avoidance of the conditions preceding the February 2021 wolf-hunt. Finally, Icall for abandoning long-held but erroneous assumptions that recreational hunting of wolves improves human tolerance, reduces poaching, or protects livestock.

Thanks for your attention to the four (4) Appendices attached with this comment.