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Comments on Setting the Quota for Wisconsin's Fall 2021 Wolf Hunt
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To the Wisconsin Natural Resources Board:

Please consider these comments as you deliberate over setting the quota for Wisconsin's fall 2021 wolf hunting, trapping, and hounding season, and as you evaluate the July 27, 2021 recommendation from the Department of Natural Resources (DNR) to set the quota at 130 wolves (DNR's Recommendation).[1]

The Board has a solemn responsibility to manage Wisconsin's wildlife in trust on behalf of all current and future Wisconsin residents. The Board's ability to execute this trust has already been severely compromised by the state law requiring the Board to hold a wolf hunt every year that wolves are not on the state or federal endangered species list, regardless of the impact that such a hunt might have on the state wolf population.

Nevertheless, the Board must do its best to uphold its public trust responsibilities and to manage the wolf population responsibly, and must proceed cautiously in setting a quota for the fall 2021 wolf hunt.

Simply put, accepting DNR's Recommendation--or, worse yet, approving a quota in excess of that recommendation--could have disastrous effects on the overall health of Wisconsin's wolf population and drop its numbers down to dangerously low numbers--perhaps below the 1999 Wolf Management Plan's population goal of 350 wolves, or even below a level of 250 wolves, meriting a return to the state endangered species list.

For this reason, and the other reasons explained below, I urge the Board to carefully consider the science, including what is known about the Wisconsin wolves, and just as importantly, what is *not* known. Given these uncertainties, the only responsible course of action that is consistent with NRB's public trust responsibilities is to cancel the 2021 fall hunt--and if that is not legally possible, to at least set the fall 2021 quota at the minimum level allowable by law.

I. Introduction

Although DNR's recommendation purports to be "conservative," it is the opposite. In science, "conservative" means avoiding systematic errors that make results inaccurate or highly imprecise. In management, "conservative" decisions refer to those that avoid high risk situations or system failures. Given DNR's lack of accurate knowledge about the Wisconsin wolf population, its recommendation is not conservative; it is reckless.

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[1] Wisconsin Department of Natural Resources, Natural Resources Board Agenda Item 4H, August 2021 Board Meeting: *Request approval of the fall 2021 wolf season harvest quota* (July 26, 2021), available at: https://widnr.widen.net/view/pdf/isocryvdt4/2021-08-4H-Approval-Wolf-quota.pdf?t.download=true&u=2ge66j

Indeed, DNR's Recommendation lacks the hallmarks of scientific integrity: transparency, independent review of methods and results, and reproducibility of the findings and inferences drawn from accurate and precise facts.[2] Sadly, DNR is not alone in this failure. In the context of hunt management and scientific integrity, a recent review analyzed 667 hunt management plans across North America and found the vast majority lacked most or all of the hallmarks of science and so did not deserve the adjective 'science-based' alongside their plans.[3]

Therefore, I am disappointed but not surprised that DNR's Recommendation lacks transparency, reproducibility, and independent review. **What concerns me even more is DNR's Recommendation conceals how much science it is leaving out**. For example, p.3 the laundry list of what they considered does not include citations to peer-reviewed evidence, thereby concealing which studies they consulted and which they ignored.

Below, I detail the flaws in the reasoning behind DNR's recommendation, which disregards the best available science, and is based on faulty factual assertions and insufficient data about the wolf population—especially in the wake of the February 2021 hunt.

A. DNR's Recommendation is Built on Faulty Foundation of Inaccurate Facts

DNR's recommendation is based on false assertions of fact and assumptions that have no factual support, while at the same time, DNR's recommendation omits crucial information that it should have put before the Board. These errors corrupt each stage of DNR's reasoning, as DNR (1) inaccurately assesses the size of the Wisconsin wolf population, (2) makes unsupported assumptions based on inadequate data about wolf reproductive success, (3) employs a fictional estimate of background mortality, (4) misuses a limited model for estimating the impact of the recommended quota, (5) fails to address the near certainty that more wolves will be killed than the number set in the quota, and (6) ignores some of the most fundamental questions about the impact that the recommended quota will have on the health and stability of the state's wolf packs.

1. DNR Disregards Best Available Science in Favor of Relying on an Estimate of the Wolf Population that it Knows is Inaccurate

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[2] National Academies, Fostering Integrity in Research. 2017, The National Academies Press: Washington, DC. https://doi.org/10.17226/21896 .

[3] Artelle, K.A., J.D. Reynolds, T. A., J.C. Walsh, P.P. C., and C.T. Darimont, Hallmarks of science missing from North American wildlife management. Science Advances 2018. 4(3):eaao0167. https://doit.org/10.1126/sciadv.aao0167 ; and
Artelle, K.A., J.D. Reynolds, T. A., J.C. Walsh, P.P. C., and C.T. Darimont, Distinguishing science from "fact by assertion" in natural resource management. Science Advances (eLetter), 2018. 4(3):eaao0167 http://advances.sciencemag.org/content/4/3/eaao0167/tab-e-letters .

Instead of relying on the best available science to estimate the state wolf population in November 2021, DNR conjures a crude estimate of the population which it knows to be incorrect, and uses this inaccurate information to inform the rest of its modeling.

DNR's Recommendation claims it is impossible to estimate the size of the state wolf population following the February 2021 wolf hunt. That is false. My colleagues and I published a peer-reviewed study that I shared with them on 18 June 2021. In it we estimated that as of April 15, 2021, there were between 695-751 wolves in Wisconsin including those overlapping tribal reservations.[4] DNR ignores that study entirely, even though it is the only peer-reviewed estimate available of the state wolf population, it was provided to DNR in plenty of time to develop its quota recommendation, and it would have provided the agency with a much stronger foundation for its population modeling.

Instead of using this peer-reviewed estimate, DNR fashions a crude approximation of the wolf population, which it concedes includes large gaps of information. DNR starts with incomplete wolf monitoring data collected between December 1, 2020 and the start of the February hunt, and then makes a truncated estimate of the wolf population based on its imprecise "occupancy model." From that imprecise model, DNR accounts for the effects of the February 2021 hunt by simply subtracting the reported "harvest" of 218 wolves, and then removes another 42 wolves estimated to live on tribal reservations.

Based on this arbitrary process, DNR arrives at a state population estimate of 935 wolves, which deliberately undercounts several sources of wolf mortality, and is >24.5% higher than the estimate from our peer-reviewed study.

As I have observed in prior comments, DNR did not fully disclose the implications of its choice when it switched from its prior wolf census method to the sole use of its novel "occupancy model" in winter 2020. I have several concerns with DNR's use of this population model, which are underscored by the particularly unconventional way in which DNR employed the model in making the current recommendation.

First, the methods of DNR's occupancy model has not been made public, nor has it been validated through the process of peer review to my knowledge. Indeed, DNR and its Wolf Harvest Advisory Committee have acknowledged that this model estimates higher wolf populations than its pior, peer-reviewed, validated census method. DNR has failed to provide support to show this estimate is more accurate, leading to the possibility that every claim DNR makes based on its occupancy model may be systematically biased toward over-estimating the wolf population.[5] Therefore, their decision was not "conservative".

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[4] Treves, A., F.J. Santiago-Ávila, and K. Putrevu, Quantifying the effects of delisting wolves after the first state began lethal management. PeerJ, 2021. 9: e11666. https://doi.org/10.7717/peerj.11666 .

[5] Claims that the occupancy model is more accurate because it includes uncounted loners and uncounted packs are pure speculation until scientific data is presented to substantiate them. Indeed, the pack count from April 2020

Second, DNR's occupancy model has wide bounds of uncertainty (imprecision of 20%). For example, in 2020, the occupancy model estimated the state population at a median of 1,195 wolves, with a lower bound of 957 wolves--the lower bound being 238 wolves lower than the median. Yet despite these wide bounds of imprecision, and DNR's acknowledgment that its truncated numbers are not a reliable estimate of the population, DNR chose to use the median population estimate of 1,195 wolves, rather than the precautionary lower bound of 957 wolves--which would have been the "conservative" choice.[6]

Third, DNR applies the previous nine years of population change and harvest numbers to justify its use of the "Adams model" to estimate the impact of its recommended quota, but it does not acknowledge that population size estimates from those nine prior years were based on DNR's old census method (as depicted in Table 1). Nevertheless, DNR then inputs population estimates for winter 2020 that are based on its new occupancy model, without discussion of the likely discrepancies of combining these two methods, or taking any extra precautions against the inevitable errors that would result from comparing two data sets that use different methods.

Fourth, DNR provides no support for its novel approach of using a "truncated" version of its occupancy model." This novel approach has not passed peer review, nor is it likely to do so, because it fails to account for background mortality from February 22, 2021 to April 14, 2021, which covers the time of year that is the highest risk to wolves [7].

This novel "truncation" method exposes an additional logical inconsistency in DNR's process. DNR's Recommendation contends that we can judge the sustainability of the recommended quota by looking at data from historic years (during which the occupancy model was not used) and recent years (when the occupancy model was not truncated). But none of these data are comparable to the truncated data from the 2020-2021 season, which fails to appropriately

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is consistent with the older census method's estimate of 1034 wolves in the state, given the four decades of data showing an average pack size around 4 wolves in late winter. Also the occupancy model produces wide bounds of uncertainty. Proponents of the occupancy model should improve its precision and validate its accuracy before using it to plan and manage wolves in Wisconsin. And when they do use it, they should present its wide bounds of uncertainty transparently to decision-makers and the public.

[6] By coincidence, if DNR had chosen to use the lower bound number of 957 wolves from its 2020 population estimate, and then applied its crude formula (subtracting 218 wolves killed in the legal harvest and 42 reservation wolves), that would put its estimate of the state wolf population at 691, which is very similar to our peer reviewed estimate.

(a) [7]Santiago-Ávila, F.J., R.J. Chappell, and A. Treves, *Liberalizing the killing of endangered wolves was associated with more disappearances of collared individuals in Wisconsin, USA.* Scientific Reports, 2020. 10: 13881. /10.1038. | https://doi.org/10.1038/s41598-020-70837-x; **and**

(b) Stenglein, J.L., A.P. Wydeven, and T.R. Van Deelen, C*ompensatory mortality in a recovering top carnivore: wolves in Wisconsin, USA (1979–2013)*. Oecologia, 2018. 187(1): 99–111. https://doi.org/10.1007/s00442-018-4132-4.

account for winter mortality, and thus cannot be used in the same way as the data from prior years.

Finally, by merely subtracting the number of wolves that were reported killed during the February 2021 hunt, DNR fails to account for the additional wolves that were killed through illegal poaching related to that hunt. In our recent published analysis, we estimated that there were 98-105 additional wolves that died or disappeared since 3 November 2020, as we explained in great detail [8]. That estimate derives from a peer-reviewed model [9]. My colleagues and I have informed them of this work on several occasions, notably 15 May 2021 [10].

In sum, DNR's Recommendation rests on a faulty and incomplete wolf population estimate that (1) ignores the best available science estimating the wolf population following the February 2021 hunt; (2) is based on DNR's untested and unsupported occupancy model, which has a systematic bias toward overestimating the wolf population; (3) truncates the occupancy model in an unconventional, untested, and clearly unwarranted way, to exclude one of the highest periods of background wolf mortality; and then (4) arbitrarily arrives at what DNR purports to be a current population number, by merely subtracting the reported numbers of wolves legally killed during the February hunt, without accounting for additional poaching deaths that would almost certainly precede, accompany, and follow that wolf-hunt. Taken together, these errors provide a faulty basis for DNR's additional modeling, leading to a quota recommendation that is too high, and involves risks to the wolf population that DNR fails to quantify or recognize.

2. DNR Does Not Have Key Data on Wolf Reproduction during Summer 2021

Wisconsin's wolf population should increase with each annual birth season from May to June, and then decrease as deaths occur thereafter, with mortality peaking during the winter months, and additional slight changes due to migration in and out of the state. The result is usually, but not always, that the population will grow from May of one year to May of the next--except in years when humans cause an unusual decrease in the population, such as through public hunting or poaching.

A healthy wolf population is one in which pups survive to independence in the fall; breeders find each other to mate and rear pups; and packs maintain the cohesion and teamwork needed to defend territories, cooperatively raise pups, and hunt together in a way that fits within

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[8] Treves, A., F.J. Santiago-Ávila, and K. Putrevu, Quantifying the effects of delisting wolves after the first state began lethal management. PeerJ, 2021. 9: e11666. https://doi.org/10.7717/peerj.11666 .

[9] Santiago-Ávila, F.J., R.J. Chappell, and A. Treves, *Liberalizing the killing of endangered wolves was associated with more disappearances of collared individuals in Wisconsin, USA.* Scientific Reports, 2020. 10: 13881. /10.1038. | https://doi.org/10.1038/s41598-020-70837-x

[10] See http://faculty.nelson.wisc.edu/treves/archive_BAS/Treves_Public_comment_2021.pdf , Appendices http://faculty.nelson.wisc.edu/treves/archive_BAS/Treves_Public_comment_2021_Appendices.pdf and references cited http://faculty.nelson.wisc.edu/treves/archive_BAS/Public_comment_2021.zip .

evolved adaptations given the bounds of socio-ecological conditions. Together, these identifying traits are called ecological effectiveness or functionality.[11]

To maintain a population of any wildlife species in the state, one has to be highly certain that breeding individuals are present and have bred successfully. For wolves, that means breeding pairs outside of tribal reservations have to have bred successfully in May or June 2021.

Shockingly, DNR's Recommendation contains no information about the reproductive success of the wolf population following the February 2021 hunt. Because DNR decided not to collect and examine carcasses from the February hunt, we do not know the number of pregnant females that were killed, or even whether hunters may have selectively targeted breeding pairs of wolves. DNR correctly cautions that "Hunting during the breeding season leads to uncertainty in terms of the impacts to reproduction and overall population response." However, it does not respond to this uncertainty in a "conservative" way, but instead recommends a hunting quota that (in light of these significant uncertainties) could lead to an unsustainable wolf-hunt, and even create a population crash below the state listing level of 250.

Given the massive disruption potentially caused by the February 2021 wolf hunt on breeding wolves, any independent and reputable scientific analysis of the status of the population would need to include evidence of successful breeding with pups surviving to the age of independence this fall. Without such an estimate, a responsible scientist would not purport to set a "sustainable" quota for the upcoming hunting season, because it is impossible to know the health and size of the wolf population before that hunting season began, or its ability to withstand additional losses.

The fact that DNR neglected to collect wolf carcasses and conduct necropsies to estimate how many breeding females were killed is only one gap in the data. Peter David of the Great Lakes Indian Fish & Wildlife Commission, reported to me in a personal communication that pregnant females were among those killed in the February hunt--although we have no way of knowing how many pregnant females were killed. Other gaps include the shortage of summer howl surveys at present; the difficulty of knowing how many pups will survive to independent travel in September and October; an estimate of the level of lethal control by the state; and the background mortality rate from now until November 1, 2021.

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[11] Even if pups were born in May and June, they may not survive to October 31 given the high mortality of wolf pups. The only study of Wisconsin wolf pup survival to November revealed that under the best of conditions, including Endangered Species Act protections for a recolonizing wolf population, an average of 72% (57-89%) of wolf packs produce pups, with a summer litter size averaging 4.8 (3-6 pups), but the pup survival rate to 3-9 months of age averages only 20% (5-72%). *See* Thiel, R.P., W. Hall, E. Heilhecker, and A.P. Wydeven, *A Disjunct Gray Wolf Population in Central Wisconsin, in Recovery of Gray Wolves in the Great Lakes Region of the United States: an Endangered Species Success Story,* A.P. Wydeven, T.R. Van Deelen, and E.J. Heske, Editors. 2009, Springer: New York. 107-118. DNR does not cite to this study, led by DNR's former head of wolf recovery (R. Thiel), but I believe it stands as the best basis to model 2021 wolf reproduction.

These are vast gulfs in our understanding of the health of the state wolf population. Based on my experience, I believe any scientific analysis done with this much uncertainty is wholly unreliable, and a decision to initiate another wolf hunt under these conditions could not be considered based on reliable science. Currently DNR is only speculating that wolves in Wisconsin bred successfully this year, and that the population could thus sustain another hunt this fall. Sheer speculation is not science.

3. DNR Does Not Have Reliable Information on Background Mortality

To reasonably model the potential impact of any recommended quota, DNR must have a reliable estimate of background wolf mortality, since such an estimate is critical to the use of the "Adams model" on which DNR largely relies to determine the likely effect of its recommended quota.

However, rather than using a careful scientific estimate of background mortality, DNR uses an unscientific "consensus" opinion that reflects the mortality rate *preference* of a narrow collection of unscientific interest groups. DNR's Recommendation states that "suggestions from committee members ranged from 10%-15% and ultimately moved forward with an estimate of 13%." There is no scientific merit to such a process: the opinions of the interest groups convened are not reproducible, transparent, objective, or informed by independent review or peer-reviewed science. Background mortality is not subjective, it is objective. We cannot take a vote on what we want that number to be--it is not a variable we can prefer, choose, oppose, or deny. The credibility of DNR's entire process is undermined by its decision to use a consensus opinion of this key variable.

The Board should be aware that several peer-reviewed studies have estimated the annual mortality rate in Wisconsin's wolves,[12] so there is no justification for DNR to ignore this established science in favor of polling interest groups for their uninformed opinions of such a critical fact.

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[12] *See Treves, A., J.A. Langenberg, J.V. López-Bao, and M.F. Rabenhorst, Gray wolf mortality patterns from 1979 to 2012.* Journal of Mammalogy, 2017. **98**(1): p. 17-32. 10.1093/jmammal/gyw145; **and**

Santiago-Ávila, F.J., R.J. Chappell, and A. Treves, *Liberalizing the killing of endangered wolves was associated with more disappearances of collared individuals in Wisconsin, USA.* Scientific Reports, 2020. **10**: p. 13881. /10.1038. | https://doi.org/10.1038/s41598-020-70837-x; **and**

Schmidt, J.H., D.S. Johnson, M.S. Lindberg, and L.G. Adams, *Estimating demographic parameters using a combination of known-fate and open N-mixture models.* Ecology, 2015. **56**(10): p. 2583–2589. http://dx.doi.org/10.1890/15-0385.1.

This annual mortality rate is also a factor that is to some degree within DNR's control. If DNR wants to propose a "sustainable hunting quota, it is incumbent upon it to outline the steps it is going to take to stop unregulated and illegal wolf killing--which our studies have shown for years is the major cause of Wisconsin wolf mortality, and which DNR systematically underestimates.[13] Likewise, DNR must explain how it will prevent the hunting methods used in the November hunt from indirectly harming wolves and leading to increased mortality, such as by wounding with sublethal gunshots, crippling wolves in traps, maiming wolves with hound bites, and running them over with vehicles such as snowmobiles--all of which were documented during hunting seasons from 1980 to 2012.[14]

DNR not only fails to control these additional sources of mortality; it chronically under-reports them. The data in DNR's Table 1[15] isnot representative of the number of wolves killed by humans which must include cryptic poaching (i.e. the "shoot, shovel, and shut up" ethic of wolf management) If the DNR wishes to follow the Adams et al. 2008 model properly, it must calculate every wolf death caused by humans, or come up with an unbiased estimate of such deaths, based on a scientific sample (such as a sample of radio-collared wolves).

For a science-based approach to Table 1, the DNR should have separated radio-collared wolves from all others and reported the causes of deaths and the number of disappearances of those radio-collared wolves including time on the air. Table 1 fails to do so, as does Table 2 which is both confusing and misleading by including only one statement about radio-collared wolves.

Uncollared wolves can be presented separately but one has to take substantial care to analyze their data because different causes of death are detected with different success rates. For example, most vehicle collisions with wolves are reported but few poaching incidents are reported.[16] Traditionally scientists ignore it when uncollared wolves are found dead, because it is difficult to use that data as it is a non-random sample with variable biases in detection probability. DNR should draw conclusions only from marked (collared) wolves because they can understand better where death and disappearances occur and which are legitimate and which

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[13] Treves, A., K.A. Artelle, C.T. Darimont, and D.R. Parsons, Mismeasured mortality: correcting estimates of wolf poaching in the United States. Journal of Mammalogy, 2017. 98(5):1256–1264. 1 https://doi.org/10.1093/jmammal/gyx052 .

[14] Treves, A., J.A. Langenberg, J.V. López-Bao, and M.F. Rabenhorst, Gray wolf mortality patterns in Wisconsin from 1979 to 2012. Journal of Mammalogy, 2017. 98(1):17-32. https://doi.org/10.1093/jmammal/gyw145 .

[15] I do not know why the table indicates data is "not available" for 2011-2012, because data was gathered for that year.

[16] Treves, A., J.A. Langenberg, J.V. López-Bao, and M.F. Rabenhorst, Gray wolf mortality patterns in Wisconsin from 1979 to 2012. Journal of Mammalogy, 2017. 98(1):17-32. https://doi.org/10.1093/jmammal/gyw145 ; and Stenglein, J.L., T.R. Van Deelen, A.P. Wydeven, D.J. Mladenoff, J. Wiedenhoeft, J.A. Langenberg, and N.J. Thomas, Mortality patterns and detection bias from carcass data: An example from wolf recovery in Wisconsin. Journal of Wildlife Management, 2015. 7: 1173-1184; and
Stenglein, J.L., A.P. Wydeven, and T.R. Van Deelen, Compensatory mortality in a recovering top carnivore: wolves in Wisconsin, USA (1979–2013). Oecologia, 2018. 187(1): 99–111. https://doi.org/10.1007/s00442-018-4132-4.

are illegal. Instead, the DNR mixes together marked (collared) and unmarked (uncollared) wolves and ignores the disappearances of collared wolves.

Table 2 presents deaths of uncollared wolves as if these could be used in a straightforward manner as inputs to the Adams et al. 2008 model. In June 2021, I explained to the DNR's Dr. J. Price Tack[17] why this method is misleading and will not yield meaningful results. I used the Adams et al. 2008 model to explain how DNR had misinterpreted the model by using an unscientific sample to estimate mortality rate. Also, I explained this biasing error to the DNR's Dr. David Macfarland in 2014. He seemed to agree in 2014, and we published two articles in 2017 that made the point algebraically and passed peer review.[18] Nevertheless, DNR continues to publish the same sort of incomplete information (such as in Tables 1 and 2), which present misleading information on mortality. As a result, DNR's use of the Adams Model is unscientific and could not pass peer review in a scientific journal, because the data that DNR puts into the model has a strong, systematic bias leading to under-reported mortality rates.

Had DNR presented only collared deaths and disappearances, it would have presented a more accurate estimate of background human-caused mortality. Indeed, DNR revealed during the 2021 Wolf Harvest Committee meeting on April 8, 2021, and to the public via Zoom® that 17 out of 43 collared wolves had disappeared. Even assuming DNR had a typo in that presentation and meant 17 out of 60 wolves, the disappearance rate alone would correlate to approximately a 28-39% mortality rate, without even considering known mortalities. This demonstrates that the 13% human-caused, "non-harvest" mortality "consensus" is a dramatic underestimate. Putting such bad data into the Adams Model leads to bad data coming out, meaning the recommended quota a risky over-estimate.

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17 http://faculty.nelson.wisc.edu/treves/archive_BAS/To%20Jennifer%20Price%20Tack%20re%20Adams%20et%20al%202008.pdf

18 Treves, A., J.A. Langenberg, J.V. López-Bao, and M.F. Rabenhorst, Gray wolf mortality patterns in Wisconsin from 1979 to 2012. Journal of Mammalogy, 2017. 98(1):17-32. https://doi.org/10.1093/jmammal/gyw145 ; and Treves, A., K.A. Artelle, C.T. Darimont, and D.R. Parsons, Mismeasured mortality: correcting estimates of wolf poaching in the United States. Journal of Mammalogy, 2017. 98(5): p. 1256–1264. 10.1093/jmammal/gyx052 https://doi.org/10.1093/jmammal/gyx052 .

In fact, DNR's estimate of disappearances of 28-39% of collared wolves actually accords with two peer-reviewed studies of Wisconsin wolf mortality from 1979-2012, which used different methods.[19] Indeed, from DNR's own garbled data presented in the above slide, I suggest we should interpret disappearances as deaths, because so few wolves are ever found alive with non-functioning collars (approximately 7% are later found dead). That assumption is supported by Loucharn et.al..[20] which is the most rigorous study ever conducted on this question and concluded that disappearing collared wolves are virtually always poached. In sum, DNR's Dr. David Maxcfarland oral testimony to the NRB on 15 February 2021 that estimated 14.5% annual rate of human-caused mortality appears from their own slide above to be less than half of the recent rate of disappearances alone. The discrepancy is unexplained, as is the decision to use 13% by public consensus I discussed above.

On 15 February 2021, the DNR asserted that annual human-caused mortality was 14-14.5% {WDNR, 2021 #3110}. Although no estimate of uncertainty was provided for that estimate and the DNR provided no data or citations, we believe they were citing [21], which estimated annual mortality rates for radio-collared wolves at 24% during the period 1979-2013. To get to 14%, we believe the WDNR took the latter study and subtracted nonhuman and unknown causes of

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[19] Santiago-Ávila, F.J., R.J. Chappell, and A. Treves, Liberalizing the killing of endangered wolves was associated with more disappearances of collared individuals in Wisconsin, USA. Scientific Reports, 2020. 10: 13881. /10.1038. | https://doi.org/10.1038/s41598-020-70837-x; and
Treves, A., J.A. Langenberg, J.V. López-Bao, and M.F. Rabenhorst, Gray wolf mortality patterns in Wisconsin from 1979 to 2012. Journal of Mammalogy, 2017. 98(1): p. 17-32. https://doi.org/10.1093/jmammal/gyw145 .

[20] Louchouarn, N.X., F.J. Santiago-Ávila, D.R. Parsons, and A. Treves, Evaluating how lethal management affects poaching of Mexican wolves Open Science, 2021. 8 (registered report):200330. https://doi.org/10.1098/rsos.200330 .

[21] Stenglein, J.L., A.P. Wydeven, and T.R. Van Deelen, Compensatory mortality in a recovering top carnivore: wolves in Wisconsin, USA (1979–2013). Oecologia, 2018. 187(1): p. 99–111. 10.1007/s00442-018-4132-4. https://doi.org/10.1007/s00442-018-4132-4 .

death estimated by the latter study at 9.5%, which would yield 14.5%. Although that study improved on prior work, by adding wolf-hunting to the estimate when extending the study period to 2013, and by including disappearances of collared wolves as recommended by my work cited above, it introduced new errors or unjustified methods.

First, the step in Stenglein et al. 2018 that led to adding together unknown causes of death with nonhuman causes was done in error. Unknown causes of death in this dataset are known to have different timing since collaring than nonhuman causes, different survival curves (meaning wolves die at different rates from nonhuman causes than they do from causes that are ultimately deemed unknown by necropsy), and necropsy information indicates a mix of human and nonhuman causes [22]. Therefore, the WDNR estimate of 14.5% human-caused mortality is also an under-estimate for every unknown cause that actually pertains to human actions, and applies only to collared wolves.

Peer-reviewed scientific journals have published two additional estimates of mortality rates for Wisconsin wolves from analyses of the same dataset spanning 1979-2012. One estimated mortality rates as a weighted average of the radio-collared adults and the non-radio-collared adults annually at 38-41% (SD 10%)[23] — which coincidentally perhaps, resembles the rate of disappearance of collared wolves reported by the DNR in the above slide. Higher mortality in non-radioed wolves was also reported in Alaska [24] using the same dataset as collected by Adams et al. 2008.

The latest study used a competing risks framework to estimate cumulative incidence of all endpoints (death or disappearance) for 513 radio-collared wolves as a function of time since collaring.[25] It estimated 52% of all radio-collared adults died or disappeared within one year after collaring during periods like this one, absent federal ESA protections for wolves (e.g., November 2020-November 2021). The mortality rate would be higher for those collared prior to November 2020 and lower for those collared after November 2020. However, there is

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[22] Treves, A., J.A. Langenberg, J.V. López-Bao, and M.F. Rabenhorst, Gray wolf mortality patterns in Wisconsin from 1979 to 2012. Journal of Mammalogy, 2017. 98(1): p. 17-32. 10.1093/jmammal/gyw145. http://doi.org/10.1093/jmammal/gyw145 ; also see a study of red wolf mortality with unknown causes: Agan, S.W., A. Treves, and E.L. Willey, Estimating poaching risk for the critically endangered wild red wolf (Canis rufus). PLoS One, 2021. 16(5): p. e0244261. 10.1371. https://doi.org/10.1371/journal.pone.0244261 .

[23] Treves, A., J.A. Langenberg, J.V. López-Bao, and M.F. Rabenhorst, Gray wolf mortality patterns in Wisconsin from 1979 to 2012. Journal of Mammalogy, 2017. 98(1): p. 17-32. 10.1093/jmammal/gyw145. http://doi.org/10.1093/jmammal/gyw145 .

[24] Schmidt, J.H., D.S. Johnson, M.S. Lindberg, and L.G. Adams, Estimating demographic parameters using a combination of known-fate and open N-mixture models. Ecology, 2015. 56(10): 2583–2589. http://dx.doi.org/10.1890/15-0385.1 .

[25] Santiago-Ávila, F.J., R.J. Chappell, and A. Treves, Liberalizing the killing of endangered wolves was associated with more disappearances of collared individuals in Wisconsin, USA. Scientific Reports, 2020. 10: p. 13881. /10.1038. | https://doi.org/10.1038/s41598-020-70837-x .

currently little scientific consensus on past wolf mortality rates even for radio-collared wolves, and little or no data on mortality since 2013.

Even if the WDNR relied solely on Stenglein et al. papers (see footnotes on prior page), those studies have not yet explained to scientific peers why they used an unjustified pooling of nonhuman and unknown causes of death in the 2018 paper, which, as above, the preponderance of evidence rebuts. Nor has that study justified the inclusion of a break in the data at 2004. That year was only a break in their time series by virtue of a changing census method and the addition of Dr. T. van Deelen (representative of an interest group on the Wisconsin Wolf Management Planning Committee 2021, UW-Madison, professor, ex-DNR) into the state wolf management team[26]. Furthermore, Stenglein et al. do not consider the time-varying coefficients acting on legal causes of wolf death. Therefore, the DNR should never rely on Stenglein's work without independent scientific review of the above methods, as it persistently omits the facts of four changes in wolf census methods and other significant factors in wolf mortality and population growth [27].

The DNR recommendation includes other misleading passages on wolf mortality. "…particularly given the recent report of heartworm in 38% of wolves necropsied from the February hunt (n=24) which will require further study and analysis to understand the impacts." Most importantly they do not cite their source here which I think is GLIFWC and tribal necropsies. But they also do not show that heartworm is a credible threat to the variables that concern them in this paragraph (reproductive uncertainty, survival uncertainty, population status uncertainty) so it is misleading. When we consider the relative risks faced by wolves from illegal death by hound (same necropsy results) and illegal killing compared to heartworm, which one is worth mentioning in a document like this one? We have shown algebraically that agencies were under-estimating poaching systematically, including WI DNR, and specifically that the WI DNR was not gleaning as much information from necropsy as the veterinary pathologists were providing. That seems like willful blindness.

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[26] Treves, A., P.C. Paquet, K.A. Artelle, A.M. Cornman, M. Krofel, and C.T. Darimont, Transparency about values and assertions of fact in natural resource management. Frontiers in Conservation Science: Human-Wildlife Dynamics, 2021. 2:e631998. https://doi.org/10.3389/fcosc.2021.631998 ; and
Treves, A., Peer review of the proposed rule and draft biological report for nationwide wolf delisting, U.S.F.W.S. Department of Interior, Editor. 2019, Department of Interior, U.S. Fish & Wildlife Service: Washington, D.C. https://www.fws.gov/endangered/esa-library/pdf/Final%20Gray%20Wolf%20Peer%20Review%20Summary%20Report_053119.pdf .

[27] See studies of mortality above by Santiago-Ávila et al 2020 and Treves et al. 2017a,b; for omission of information on wolf census methods see Treves, A., Peer review of the proposed rule and draft biological report for nationwide wolf delisting, U.S.F.W.S. Department of Interior, Editor. 2019, Department of Interior, U.S. Fish & Wildlife Service: Washington, D.C. https://www.fws.gov/endangered/esa-library/pdf/Final%20Gray%20Wolf%20Peer%20Review%20Summary%20Report_053119.pdf .; and Treves, A., P.C. Paquet, K.A. Artelle, A.M. Cornman, M. Krofel, and C.T. Darimont, Transparency about values and assertions of fact in natural resource management. Frontiers in Conservation Science: Human-Wildlife Dynamics, 2021. 2: e631998. https://doi.org/10.3389/fcosc.2021.631998 .

In summary, DNR continues to make the same errors in calculating wolf mortality that I have pointed out to its scientists since 2014 (and published analyses from 2017-2021), by interpreting observed mortality as an annual rate without considering the systematic under-estimating biases that observation and detection produce. Therefore, DNR's Recommendation is severely compromised by a systematic under-estimate of background mortality, leading to an overestimate of the sustainable quota, with risk consequences for the wolf population.

4. DNR Misuses One Model to Determine the Impact of its Quota, and Dismisses Alternatives

As discussed above, DNR's use of the Adams et al. 2008 Model is not scientifically defensible, because it inputs knowingly inaccurate data on wolf population numbers and background mortality. Even the best model will produce poor results if it is used incorrectly--if incorrect data goes into the model, then it will certainly produce unreliable results.

However, there are also concerns with DNR's insistence on using the Adams Model [28] for predicting a sustainable quota, despite the existence of three other models that are more conservative. DNR justifies this choice as "it works" rather than "it is better," despite the fact that the Adams Model failed to accurately predict the impact in 20% of the years Wisconsin had a wolf-hunt. The Adams Model was not designed for the purpose for which DNR uses it (planning wolf-hunting), nor is it the only model, the most recent, or the most conservative scientifically.

The Board should also understand that the Adams Model is retrospective (it looks back at prior studies from other populations to generalize across wolf populations. When scientists use such a model to predict future events, as DNR does to predict the effect of its quota, they must be careful not to go beyond the limits of the model nor over-generalize from the model.

One example of over-generalizing from the Adams Model is not to carefully juxtapose it to more recent models [29]; more conservative models the latter two and Fuller model [30]; and more carefully constructed models (Vucetich model). DNR's recommendation seems to indicate that

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[28] Adams, L.G., R.O. Stephenson, B.W. Dale, R.T. Ahgook, and D.J. Demma, Population dynamics and harvest characteristics of wolves in the Central Brooks Range, Alaska Wildlife Monographs, 2008. 170: p. 1-25.

[29] Creel, S. and J.J. Rotella, Meta-analysis of relationships between human offtake, total mortality and population dynamics of gray wolves (Canis lupus). PLoS ONE, 2010. 5(9):1-7 ; and
Vucetich, J.A., Appendix: The influence of anthropogenic mortality on wolf population dynamics with special reference to Creel and Rotella (2010) and Gude et al. (2011) in the Final peer review of four documents amending and clarifying the Wyoming gray wolf management plan. Federal Register, 2012. 50: 78-95.
https://www.federalregister.gov/documents/2012/05/01/2012-10407/endangered-and-threatened-wildlife-and-plants-removal-of-the-gray-wolf-in-wyoming-from-the-federal .

[30] Fuller, T.K., L.D. Mech, and J.F. Cochrane, Wolf population dynamics, in Wolves: Behavior, ecology, and conservation, L.D. Mech and L. Boitani, Editors. 2003, University of Chicago Press: Chicago. p. 161-191.

it is presenting the only two viable models. This is not accurate, and shows that DNR has not even considered the others.

DNR justifies its continued use of the Adams Model by claiming it is right four out of five times. But DNR does not disclose how often the Fuller model was correct by the same measure, much less the other two models, by Creel & Rotella and Vucetich, which DNR simply ignores. In June, I discussed these unjustified dismissals of better models with Dr. Price Tack and others at DNR, and I published on the topic in 2017 [31].

Also, the 80% prediction interval is a very weak standard because It means that one out of five times, the Adams Model will fail to predict the state wolf population response to the given level of hunting. If that happens this year, what are the consequences? By failing to explain the relative success of the other models and failing to explain the consequences of being wrong, DNR's Recommendation treats the Adams Model as the *de facto* best alternative, without justifying that claim.

DNR's Recommendation reads, "In order to use the Adams model to evaluate the impacts of potential quotas, two pieces of information are required: a starting population size and an estimate of the anticipated non-harvest human caused mortality to occur in the year ahead." I have already commented on their inflated population size estimate in section 1 above. Now, their phrase "an estimate" seems like any estimate is good enough but that distorts the methods for estimating human-caused mortality used by Adams et al. 2008, which would be required for the DNR recommendation to use it to predict anything.

From my public comment dated July 1, 2021: Adams et al. 2008 Table 7[32] presents values from 41 studies, most (or all) of which have a scientific sample to estimate human-caused mortality, not a sample based on "all observations of collared and uncollared dead wolves," which I explained was biased in section 3. How do I know Adams et al. 2008 relies ons scientific samples of marked (collared) wolves?

First, Adams et al. 2008's analysis of their own data from Alaska reported a rate of mortality of 0.12 based only on 47 radio-collared wolves, "Twenty of the 50 radio collared wolves died during our study; an additional 3 wolves were censored ….annual survival rate for wolves ≥1 year old was 0.791 …" (p.11-12) [33]. On p.12 they state, "We estimated a total population-wide harvest rate of 0.116 annually.", after combining the adult and pup harvest rates. Therefore, Adams et al. 2008 did NOT include another 181 additional human-hunted wolves that Adams et

[31] Treves, A., G. Chapron, J.V. López-Bao, C. Shoemaker, A. Goeckner, and J.T. Bruskotter, Predators and the public trust. Biological Reviews, 2017. 92: 248-270.

[32] Adams, L.G., R.O. Stephenson, B.W. Dale, R.T. Ahgook, and D.J. Demma, Population dynamics and harvest characteristics of wolves in the Central Brooks Range, Alaska Wildlife Monographs, 2008. 170: p. 1-25.

[33] Adams, L.G., R.O. Stephenson, B.W. Dale, R.T. Ahgook, and D.J. Demma, Population dynamics and harvest characteristics of wolves in the Central Brooks Range, Alaska Wildlife Monographs, 2008. 170: 1-25.

al. 2008 acquired and described starting on p.14 of their paper (which one might claim were "observed").

Second, Adams et al. 2008 presents their model graphically with a caption that reads, "Figure 19. Relationship between exponential rate of increase (r) and annual human-caused mortality rates..." not "observed mortality". Therefore, the DNR recommendation presents Figure 2 erroneously, because the x axis value of 13% is fictitious, not an annual rate of human-caused mortality.

Finally, several other studies in Table 7 of Adams et al. 2008 were reporting only radio-collared wolves, not all recovered carcasses. Although there was a footnote that statied, "[a] Only natural mortality rates based on radio telemetry are provided.", one cannot presume that the other column of mortality rates headed by "Human-caused" represents all records of mortality.

"However, because harvest occurred immediately following the monitoring period, estimating the post-hunt population size with the model is impossible." p.3. In science impossible is different from difficult, so what they are actually saying is their model is not capable. Yet we published a model that was capable as judged by peer review and scientific criteria [34].

Had DNR's recommendations transparently presented the four peer-reviewed studies I cite in the start of this section, the public and the Board would have seen that the Adam's Model predicts a sustainable annual rate of human-caused mortality higher than the Fuller et al. 2003 model (23%), higher than the Creel & Rotella 2010 model (22.5%), and higher than the Vucetich 2012 models (high teens). Therefore the Adams Model is the opposite of "conservative," and was misused by the DNR to make it even less conservative, by overestimating the wolf population and underestimating annual mortality rates. I have alerted DNR to these issues multiple times, most recently on 2 July 2021. I received no reply.

DNR's Recommendation seems to have thrown up its hands about the uncertainty in this year's estimates, without trying to grapple with them scientifically. A science-based approach to uncertainty is to communicate it clearly (bounds around numerical values, clear statements when critical information is missing, etc.) and then describe the end result, i.e. the quota, with an appropriate, degree of confidence that is modified to compensate for that uncertainty. Moreover, a conservative approach to science and management and a precautionary approach to killing wildlife is to err on the side of not killing wildlife if you are unable to determine what the effect of doing so might be.

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[34] Treves, A., F.J. Santiago-Ávila, and K. Putrevu, Quantifying the effects of delisting wolves after the first state began lethal management. PeerJ, 2021. 9:e11666. https://doi.org/10.7717/peerj.11666 .

5. DNR's Recommendation Fails to Discuss Other Crucial Information

In addition to presenting incomplete and incorrect facts, and failing to compensate for the uncertainties in its modelling, DNR's Recommendation omits significant additional information that the Board should know before it makes a decision on the fall 2021 quota.

Most importantly, DNR's recommendation fails to grapple with what went wrong with the February 2021 hunt, and how it is going to prevent those same problems from recurring.

For example, , DNR should have discussed the fact that hunters killed 82% more wolves than allocated in the February 2021 quota, and lower, but still worrisome, over-kill rates from previous hunts. DNR should have laid out the steps that it has taken to ensure that such an over-kill does not recur in fall 2021. For example, DNR should have described how it would step up enforcement and close zones earlier, had it been concerned with overkill. But any such concerns hunter compliance, poacher activity (the major cause of wolf death), and slow or lax closure of zones are completely missing from DNR's Recommendation. If DNR is not going to take aggressive steps to prevent another significant over-kill of wolves this fall, then it needs to account for the fact that it was likely to recur, and compensate for it in its modeling.

Similarly, DNR's Recommendation fails to discuss or review evidence for how hounds, snowmobile pursuit, night-time hunting, baiting, or trapping methods used in February 2021 contributed to problems with the February 2021 wolf-hunt and may have cascading effects today.

Because it failed to confront these issues, DNR's Recommendation implies that the February 2021 hunt was acceptable, and that we should expect similar results from additional hunts.

Finally, when an agency recommends that wolves be killed during a public hunting season, it should answer several scientific questions about the effects of killing those wolves. DNR's recommendation does not address most of these questions, but they are questions that any responsible wildlife manager, and public trustee for wildlife, must grapple with before authorizing a hunt of a species with such complex social relationships and such a profound impact on the ability to maintain healthy ecosystems.
These questions, which I discuss in more detail in Appendix 1, go to the core of what DNR and the Board must consider when determining how to manage the upcoming wolf hunting season:

1. What effect does killing (or not killing) one wolf have on surviving wolves, the ecosystem, and society?
2. What effect does killing (or not killing) the entire quota have on surviving wolves, the ecosystem, and society?
3. Is the health of the wolf population only a question of numbers or are other ecological factors worth considering?

4. What constitutes significant under-kill or over-kill?
5. Will the numbers of permits sold result in the quota being met, under- or over-shot?
6. Will the methods for hunting, trapping, hounding and related modes of pursuit or luring wolves result in the quota being met, under- or over-shot?

Before the Board makes a decision to authorize any quota for the fall 2021 wolf season, I hope that it will think carefully about these questions, and grapple with the consequences of the decision it is making.

Appendix 1: Important scientific questions an agency should ask and answer before recommending a wolf hunt or a quota for a wolf hunt.

1. **What effect does killing (or not killing) one wolf have on surviving wolves, the ecosystem, and society?** A scientist answering that question is bound to consider the social unit of that wolf, which is a cooperative family unit averaging 4 adults in late winter structured around a single pair of breeding alpha female and alpha male in our region. A pack is a family that sometimes adopts unrelated members.. Packs in our region are numerically and structurally stable for long periods because of the social cohesion created by the single breeding pair of the alpha male and alpha female. Wolf packs cooperatively defend a territory from neighboring wolf packs or other predators including domestic dogs, cooperatively hunting wild white-tailed deer (their preferred prey). The death of a single member of this cooperative, family unit may harm the survivors' defense of territory, hunting capabilities, and care of any young. The death of an alpha has led in the past to pack dissolution or pack members living alone or losing their territory to a neighbor. Depending on the timing, the death of an alpha, even an alpha male, can lead to the loss of reproduction in that pack. A scientist is also bound to consider the effects on neighboring packs that may gain a competitive advantage, on the prey of wolves that face one less predator, on the other species that interact ecologically with wolves and their prey (many of which benefit from wolves), including people whose paths or properties might be crossed by the wolf. I have addressed the broader ecological effects of the death of a wolf in prior comments.[35] **DNR's Recommendation did not show that the agency had considered any of these ecological or social consequences of killing or not killing a wolf.**

2. **What effect does killing (or not killing) the entire quota have on surviving wolves, the ecosystem, and society?** A scientist answering this question should consider the aggregated effects described above, and also the effects of multiple deaths occurring in a short period relative to the lifespan of wolves. The aggregated effects of filling the quota would be elimination of entire wolf packs either directly through killing all members of a pack or indirectly through the collapse of the family unit when alphas are killed, or the disintegration of a pack and its territory if sufficient wolves are killed from one pack to allow neighbors to take territory away from the first pack. Another emergent aspect of killing an entire quota is the cessation of reproduction even if alphas survive the hunting. Because wolves and other wild members of the dog family reproduce cooperatively, a pack of 2 (only alphas) are known to reproduce less successfully than a pack with helpers to protect and provision the pups and the alphas. Furthermore, when hunting is intense — widespread, concentrated, prolonged, efficient, or uses methods novel to the wolves — even the

[35] http://faculty.nelson.wisc.edu/treves/CCC.php

survivors may face lasting effects. Alpha females may abort pregnancies or have stillborn litters or smaller pups that do not survive the already-high mortality of the pup period (averaging 80% mortality). A scientist must then consider the likelihood of nearly complete or complete pack removal and indirect harms for wolves that survive the hunting. The scientist must consider the vacant territories left by wolf packs that are eliminated by killing some residents and the dispersal of survivors and what those vacant territories mean for the species that benefit from wolves (understory plants, small predators, and competitors of the main prey of wolves) and what-those vacancies mean for the species that compete and or ar prey to wolves (e.g., main prey of wolves and meso-predators such as coyotes). Likewise, the scientist must consider the people that benefit from wolves (aesthetically, vehicle operators who collide with fewer deer, and the crop farmers who suffer less herbivore damage because wolves scare the herbivores in their area) and the people who suffer costs from wolves (some livestock owners and some hound hunters). I have commented previously to DNR on the many interactions with other species and with people that characterize the full range of interactions in wolf ecology.[36] However, DNR's Recommendation does not quantify or discuss in depth any of these ecological effects.

3. **Is the health of the wolf population only a question of numbers or are other ecological factors worth considering?** A scientist must go beyond the numbers of the wolf population, because one wolf is not equivalent to any other wolf. Wolf biologists know that wolves are intelligent, sociable, and gregarious, and that they are integrated in family units or broader social networks with differentiated relationships. In short, wolves have individual personalities. Therefore, killing one or more entails the loss of that personality and that individual's unique experiences and role in its social network. In addition, the reproductive unit of the wolf population is the pack not the individual female, so the manner in which DNR and many commentators discuss numbers of wolves is unscientific and biased in a scientific sense (meaning it will lead an observer to inaccurate or highly imprecise assumptions, measurements, and inferences about wolves and the effects of hunting for example). Beyond sheer numbers of individuals or packs, populations have unique characteristics derived from their separate evolutionary trajectories. [37] **DNR does not appear to have considered any of these factors, but rather treats wolves merely as numbers: interchangeable, non-individual, and not worthy of consideration as individuals.[38]**

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[36] http://faculty.nelson.wisc.edu/treves/CCC.php

[37] Carroll, C., D.J. Rohlf, B.M. von Holdt, A. Treves, and S.A. Hendricks, Wolf Delisting Challenges Demonstrate Need for an Improved Framework for Conserving Intraspecific Variation under the Endangered Species Act. Bioscience, 2021. 71(1):73–84. https://doi.org/10.1093/biosci/biaa125 .

[38] Santiago-Avila, F.J., W.S. Lynn, and A. Treves, Inappropriate consideration of animal interests in predator management: Towards a comprehensive moral code, in Large Carnivore Conservation and Management: Human Dimensions and Governance, T. Hovardos, Editor. 2018, Taylor & Francis: New York. p. 227-251.

4. **What constitutes significant under-kill or over-kill?** A scientist is bound to answer this as a function of the aggregated costs and benefits of each extra wolf and then evaluating if the aggregated under- or over-kill is significant compared to some benchmark or standard. Reams of scientific literature have been written but I will provide one recent example to illustrate the far-reaching effects of wolves. A 2021 study published in Proceedings of the National Academies of Science reported that counties with wolves experienced significantly fewer deer-vehicle collisions than counties without wolves.[39] And if one traced the history of a county before and after wolf recolonization, that county's deer-vehicle collisions changed. The economists who conducted that study aggregated the benefits of wolves across the state of Wisconsin and over time, and concluded that wolves were responsible for tens of millions of dollars and dozens of lives saved. The hypothesized biological mechanism behind this finding is that wolves keep deer vigilant and on the move predominantly and to a lesser extent reduce the number of deer, so the result is fewer deer being hit by vehicles. Although a finer-resolution study with more control over potentially confounding variables would be useful, this study presents the benefit-cost of a single pack of wolves in a county as the highest net benefit ever claimed for or against wolves (and I am summarizing their results conservatively in my opinion). **DNR's Recommendation does not begin to confront these sorts of questions, but treats wolves as if their only value to society is accrued through a hunter's purchase of a permit.**

5. **Will the methods for hunting, trapping, hounding and related modes of pursuit or luring wolves result in the quota being met, under- or over-shot?**
   DNR's Recommendation tries to answer these by summarizing the past four wolf-hunts held in Wisconsin, which is one basis for prediction. But as we know, the February 2021 wolf-hunt was unparalleled in speed with which hunters killed wolves and unparalleled in over-shooting the legal quota by 82%. Should we extrapolate from 2012-2014 when making predictions about the November 2021 hunt, because it will occur in the fall like those hunts, or should we extrapolate from the February 2021 wolf-hunt because the methods of hunting are more similar and the hunters have learned how to kill (and poach) wolves more effectively? The answer is we don't know.

   We could fill in these gaps of information if DNR funded independent social scientific research that could pass peer review. Unfortunately, DNR has a history of ignoring the results of such research and preferring instead its own flawed surveys that over-sample rural areas, do not transparently present methods or ambling frame, and lead to exaggerated claims like this one, which the Washington Post recently quoted from DNR's

[39] Raynor, J.L., C.A. Grainger, and D.P. Parker, Wolves make roadways safer, generating large economic returns to predator conservation. Proceedings of the National Academy of Sciences, 2021. 118(22): p. e2023251118. https://doi.org/10.1073/pnas.2023251118 .

website: "In a 2014 survey, nearly a third of respondents who live near wolves said they would prefer as few of them as possible. Among deer hunters, who often claim wolves reduce herds, almost two-thirds said they wanted fewer wolves."

Social scientific data would be needed to answer these questions accurately and comprehensively. Peer-reviewed social science is needed because so many so-called common-sense explanations for how humans think and behave are inaccurate. Common sense is a poor guide because we live in bubbles or echo chambers. Or, at best, we hear from the extreme views in public communications that attempt to influence us or present an establishment view of human-wolf interactions. Two examples should suffice.

The first indicates that scientists whether agency or academic or other are not free of bias derived from their social identities or employment. Karns et al. [40]measured responses of 593 authors who had published grizzly bear science to examine "how belonging to different social groups may be associated with the scientists' perceived norms amongst peers, their personal wildlife value orientations, and ultimately, listing status judgments for [a] population of grizzly bears… Scientists' professional affiliation (government agency vs. academia) was strongly associated with listing status recommendations; agency experts were 7.3 times more likely to recommend delisting grizzlies. Additionally, identifying strongly as 'hunter' or 'animal rights advocate' and membership in certain professional societies (e.g., The Wildlife Society) were significantly related to listing status judgments. These results indicate that expert judgment regarding imperiled species may not always be determined solely by the best scientific data available. The simplest way to counteract these potential biases in conservation decision-making is to ensure scientific experts are (a) aware that such social and professional biases exist, and (b) construct groups with decision-making authority so that they have a more heterogeneous composition." (excerpt from abstract from latter study) Therefore, even a handful of scientist's views of grizzlies or wolves may be slanted by the composition of that subgroup.

The second example comes from my own work on wolves. Years of being told that "blood buys goodwill" or "kill a few wolves legally so would-be poachers desist" had me convinced, until my colleagues and I measured the attitudes of people and inclination to kill wolves illegally among Wisconsin residents from 2001-2013 using two different methods. Six colleagues and I published measures of attitudes, focus group results, population change in wolves and survival studies that all point the same way (see comment to DNR in June 2021:

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[40] Karns, G.R., A. Heeren, E.L. Toman, R.S. Wilson, H.K. Szarek, and B. J.T., Should Grizzly Bears Be Hunted or Protected? Social and Organizational Affiliations Influence Scientific Judgments. Canadian Wildlife Biology & Management, 2018. 7(1): p. 18-30.

http://faculty.nelson.wisc.edu/treves/data_archives/June%204%202021.pdf), explaining why "blood does not buy goodwill," and inclinations to poach increase when legal killing is allowed. With 7 different first authors, I don't think anyone can convincingly claim I have persuaded so many others of a preconceived notion. Rather, DNR (and many other agencies) simply cherish their preconceived notions, and are reluctant to change them in the face of contrary evidence.