State of Washington
DEPARTMENT OF FISH AND WILDLIFE
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July 1, 2022

Dear Interested Parties:

The Washington Department of Fish and Wildlife (WDFW) has issued a Final Supplemental Environmental Impact Statement (Final SEIS) for the Wolf-Livestock Conflict Deterrence Rule Making proposal. The Final SEIS includes a summary of the public comments received on the Draft SEIS with responses (Appendix D), adds wolf population and conflict data throughout the Final SEIS provided from WDFW's Washington Gray Wolf Conservation and Management 2021 Annual Report, provides scientific literature review previously conducted by WDFW (Appendices A and B), and adds 35 citations to supplement the analysis. WDFW has prepared this Final SEIS in compliance with the State Environmental Policy Act (SEPA) and other relevant state laws and regulations.

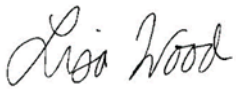
This Final SEIS supplements the July 2011 Final Environmental Impact Statement for the Wolf Conservation and Management Plan for Washington. The Final SEIS provides additional information and specifically addresses alternatives and potential impacts related to this rule making.

The purpose and need for rule making is instituting practices that will avoid the repeated loss of livestock to wolf depredation and wolves to subsequent agency removal in Washington. This Final SEIS analyzes four alternative rule making options that encompass a broad range of varying approaches that could meet the purpose and need of this rule making. The described alternatives in this Final SEIS could have significant impacts on one primary SEPA environmental element not specifically examined in detail in the 2011 Final EIS: Animals, specifically wolves and the impacts of measures to mitigate wolf-livestock conflict, and this document explores those potential impacts.

See the Fact Sheet included at the beginning of the Final SEIS for more information.

The complete document and supporting materials is available for review on the project website: https://wdfw.wa.gov/about/regulations/development/wolf-livestock-conflict-deterrence or the WDFW SEPA page: https://wdfw.wa.gov/licenses/environmental/sepa.

Sincerely,



Lisa Wood
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Wolf-Livestock Conflict Deterrence Rule Making

Final Supplemental Environmental Impact Statement

Washington Department of FISH and WILDLIFE

Date of publication: July 1, 2022

Fact Sheet

Title: Final Supplemental Environmental Impact Statement (Final SEIS) for the Wolf-Livestock Conflict Deterrence Rule Making

Description: The Washington Department of Fish and Wildlife (WDFW) initiated new rule making in response to a decision by Governor Jay Inslee in September 2020 to grant a petition for rule making directed to the Washington Fish and Wildlife Commission relating to wolf management with the goal of instituting practices that will avoid the repeated loss of wolves and livestock in Washington.

The purpose and need for rule making is instituting practices that will avoid the repeated loss of livestock to wolf depredation and wolves to subsequent agency removal in Washington. Under the umbrella of the 2011 Wolf Conservation and Management Plan goals, WDFW has identified two objectives for adopting new rules related to wolf management in Chapter 220-440 WAC:

1. Establish procedure for identifying WDFW expectations for use of non-lethal tools to mitigate wolf-livestock conflict in areas of chronic conflict, while recognizing the use of non-lethal tools is encouraged statewide.
2. Establish criteria for the use of WDFW's lethal removal authority in areas of chronic wolf-livestock conflict.

The Final SEIS analyzes four alternative rule making options that encompass a broad range of varying approaches that could meet the objectives of this rule making: Alternative 1: Develop a rule based on the 2017 Wolf-Livestock Interaction Protocol to establish general criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict; Alternative 2: Develop a rule that uses area-specific conflict mitigation plans to establish criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict in areas of chronic conflict; Alternative 3: Develop a rule similar to the "Petition to amend the Washington Administrative Code to require use of nonlethal techniques to reduce livestock-wolf conflict" sent to the Fish and Wildlife Commission on May 11, 2020, which would establish criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict both generally and with specific criteria for areas with chronic conflict; and Alternative 4: No Action (Status Quo). The alternatives address specific options for analysis that are not specifically addressed in the Final Environmental Impact Statement (Final EIS) for the Wolf Conservation and Management Plan for Washington (July 28, 2011).

The final action taken by the WDFW Fish and Wildlife Commission may not be identical to any single alternative; the WDFW Fish and Wildlife Commission may choose a hybrid approach that combines components of different alternatives, and/or more and less restrictive expressions of the components to best meet the environmental, social, economic, and political needs of the rule making.

Rule making progress and documents can be viewed at:
https://wdfw.wa.gov/about/regulations/development/wolf-livestock-conflict-deterrence

Location of Proposal, including street, if any: The Wolf-Livestock Conflict Deterrence Rule(s) will apply statewide.

Proponent/Applicant:

Washington State Department of Fish and Wildlife (WDFW)

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Authors and Principal Contributors: Washington Department of Fish and Wildlife (WDFW)

Date of Issue: February 22, 2022 (Draft SEIS); July 1, 2022 (Final SEIS)

Date Comments were Due: April 11, 2022

Date Final Action is Planned: The Wolf-Livestock Conflict Deterrence rule making proposal will be provided to the WDFW Commission for action on July 8, 2022. If adopted, the rule or rules are tentatively scheduled to be implemented in January 2023.

Availability: A link to the Draft SEIS (https://wdfw.wa.gov/publications/02312) was posted on WDFW's SEPA website and the wolf-livestock conflict deterrence rule making website: https://wdfw.wa.gov/about/regulations/development/wolf-livestock-conflict-deterrence. The Final SEIS is available at https://wdfw.wa.gov/licenses/environmental/sepa/closed-final and https://wdfw.wa.gov/about/regulations/development/wolf-livestock-conflict-deterrence.

Title and Date of Document Being Adopted:

Final Environmental Impact Statement (Final EIS) for the Wolf Conservation and Management Plan for Washington (July 28, 2011).

Agency that Prepared Document Being Adopted: Washington Department of Fish and Wildlife (WDFW)

Description of Document (or Portion) Being Adopted: The entire contents of the 2011 Final EIS for the Wolf Conservation and Management Plan for Washington.

WDFW completed the Final EIS, in conjunction with a Preferred Alternative Recommended Wolf Conservation and Management Plan for Washington, in 2011. The purpose of the Wolf Conservation and Management Plan, adopted with revisions by the Fish and Wildlife Commission in December 2011, is to ensure the reestablishment of a self-sustaining population of gray wolves in Washington and to encourage social tolerance for the species by addressing and reducing conflicts. The plan serves as the state recovery plan for the species per WAC 220-610-110(11.1).

The 2011 Final EIS evaluated four alternatives, including the revised Preferred Alternative. The alternatives varied in how conservation of wolves in Washington could be accomplished and how conservation and management would be balanced. These included differences in the geographic distribution of recovery objectives, numbers of recovery areas, management options to address conflicts, and compensation for livestock depredation. Alternative 2, the wolf conservation and management plan, was the Preferred Alternative because it met the goals and objectives for establishing a long-term viable wolf population in Washington while at the same time addressing wolf-livestock conflicts and interactions between wolves and wild ungulates. The Final Preferred Alternative was modified from its previous version in the Draft EIS based on the public, scientific, and agency reviews and input.

If the Document Being Adopted has been Challenged, Please Describe: N/A

Lead Agency and Name of Agency Adopting the Document: WDFW

The Documents are Available to be Read at: The 2011 Final EIS is available at: https://wdfw.wa.gov/publications/01355.

After independent review, we have identified and adopted the referenced 2011 Final EIS as being appropriate for this proposal. The document meets some, but not all, of our environmental review needs for the current proposal and will accompany the proposal to the decision maker along with a draft Supplemental EIS that specifically addresses alternatives and potential impacts related to this rule making.

Individuals who need to receive this information in an alternative format, language, or who need reasonable accommodations to participate in WDFW-sponsored public meetings or other activities may contact the Title VI/ADA Compliance Coordinator by phone at 360-902-2349, TTY (711), or email (Title6@dfw.wa.gov).

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Tables and Figures

Executive Summary

This Final Supplemental Environmental Impact Statement (SEIS) to the Final Environmental Impact Statement (2011 Final EIS) for the 2011 Wolf Conservation and Management Plan for Washington (Wolf Plan) analyzes potential environmental impacts of alternative rule making options as a part of the Washington Department of Fish and Wildlife (WDFW) rule making proposal. This proposal was initiated in response to a decision by Governor Jay Inslee in September 2020 to grant a petition for rule making directed to the Washington Fish and Wildlife Commission relating to wolf management with the goal of instituting practices that will avoid the repeated loss of wolves and livestock in Washington.

Background

The range of the gray wolf (*Canis lupus*) historically covered the state of Washington. Following nearly eight decades of extirpation from Washington, gray wolves began naturally recolonizing the state in the 1990s from populations in surrounding states and provinces. The first breeding pair was documented in Okanogan County in 2008, and Washington's wolf population has grown at an average rate of 25 percent annually since then. Conflict between wolves and livestock has been documented everywhere the two coexist but is generally low and not uniform across the landscape. In Washington, 76 percent of known wolf packs were not involved in any documented livestock depredation in 2021 (average 86 percent from 2008 – 2021). When conflict between wolves and livestock does occur, it has the potential to become chronic and have significant economic impacts on individual livestock operations. WDFW focuses on promoting the proactive use of non-lethal deterrents to minimize wolf-livestock conflict and considers lethal removal as a last resort when those tools have not mitigated conflict.

The alternatives considered in the 2011 Final EIS include both lethal and non-lethal measures to mitigate wolf-livestock conflict. The alternatives presented for lethal control of wolves involved in repeated livestock depredations specify that lethal control is allowed consistent with state and federal law under all state-listed statuses, but do not provide or analyze criteria for use of lethal removal beyond a few general provisions.

Purpose and need for and objectives of wolf-livestock conflict deterrence rule making

The purpose and need for rule making is instituting practices that will avoid the repeated loss of livestock to wolf depredation and wolves to subsequent agency removal in Washington. Under the umbrella of the 2011 Wolf Conservation and Management Plan goals, WDFW has identified two objectives for adopting new rules related to wolf management in Chapter 220-440 WAC:

1. Establish procedure for identifying WDFW expectations for use of non-lethal tools to mitigate wolf-livestock conflict in areas of chronic conflict, while recognizing the use of non-lethal tools is encouraged statewide.

2. Establish criteria for the use of WDFW's lethal removal authority in areas of chronic wolf-livestock conflict.

Alternatives considered

The alternative rule making options considered below (including the no-action alternative) encompass a broad range of varying approaches that could meet the objectives of this rule making. The proposed alternatives in this Final SEIS address specific options for analysis that are not specifically addressed in the 2011 Final EIS for the Wolf Plan. The final action taken by the WDFW Fish and Wildlife Commission may not be identical to any single alternative; the WDFW Fish and Wildlife Commission may choose a hybrid approach that combines components of different alternatives, and/or more and less restrictive expressions of the components to best meet the environmental, social, economic, and political needs of the rule making.

Alternative 1: Develop a rule based on the 2017 Wolf-Livestock Interaction Protocol (Protocol) to establish general criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict.

Under Alternative 1, WDFW would use the criteria outlined in the Protocol to codify in rule the use of non-lethal and lethal measures to mitigate wolf-livestock conflict. The components of the rule based on the Protocol would include expectations for non-lethal deterrence measures, examples of deterrence measures, range rider roles and responsibilities, the depredation investigation process, criteria for lethal removal of wolves, and implementation of lethal removal of wolves. There are no special provisions for areas of chronic conflict in this alternative.

Alternative 2 (WDFW preferred): Develop a rule that uses area-specific conflict mitigation plans to establish criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict in areas of chronic conflict.

Under Alternative 2, WDFW would develop a rule based on the use of area-specific conflict mitigation plans through which WDFW would establish area-specific criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict in areas of chronic conflict. WDFW would author the conflict mitigation plans in consultation with willing, affected livestock producers. The rule would focus WDFW resources to areas of Washington where most wolf depredations on livestock and related wolf removals take place, specifically pack territories (or a portion thereof) where wolf depredations of livestock occurred and lethal removal of wolves was authorized in two of the last three years. The components of the rule based on this concept would include designation of chronic conflict areas, components and provisions of area-specific conflict mitigation plans, criteria for lethal removal of wolves in chronic conflict areas, and expectations for lethal removal authorizations.

Alternative 3: Develop a rule similar to the "Petition to amend the Washington Administrative Code to require use of nonlethal techniques to reduce livestock-wolf conflict" sent to the Fish and Wildlife Commission on May 11, 2020 (Petition), which would establish criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict both

generally and with specific criteria for areas with chronic conflict.

Under Alternative 3, WDFW would develop a rule similar to the proposed rule attached to the Petition, which would codify in rule criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict. This alternative would be the most prescriptive of the four alternatives and would include the most specific expectations for use of non-lethal and lethal measures to mitigate wolf-livestock conflict. The rule based on the Petition would include expectations for non-lethal deterrence measures, examples of deterrence measures, specific expectations for range riders, criteria for lethal removal of wolves, expectations for lethal removal authorizations, and components and provisions of area-specific conflict mitigation plans.

Alternative 4: No Action. WDFW would not develop rule changes related to wolf-livestock conflict deterrence.

WDFW wolf-livestock conflict management and expectations for non-lethal and lethal measures would continue to operate under the non-binding guidance of the Wolf Plan and Protocol. The components of Alternative 4 would be similar to Alternative 1, but the use of non-lethal and lethal measures to mitigate wolf-livestock conflict would not be codified in rule.

Summary of impacts

Impacts to wolves include direct effects of lethal removal (i.e., loss of individual wolves) and indirect effects of lethal removal (e.g., changes to pack size, composition, and resilience, as well as associated effects on pup survival and recruitment). Data from wolf metapopulations in the western United States and Great Lakes states show that where wolves have been subject to lethal removal in response to livestock depredation at all stages of recovery, the wolf populations have continued to thrive. This data indicates that Washington's wolf population is likely to continue to grow under all of the alternatives considered. Lethal control actions, as long as they are targeted to specific wolf packs implicated in livestock depredation and limited, are not likely to have significant effects on recovery or continued viability of Washington's wolf population.

None of these alternatives would preclude the consideration of lethal removal of wolves entirely. Because many components of the proposed alternatives are already current practice for WDFW, levels of wolf mortality associated with agency lethal removal and associated impacts are likely to be similar to the current conditions under all alternatives. All alternatives will likely result in levels of lethal removal comparable to previous years in Washington and no alternative is likely to have negative effects on the recovery, population growth, and long-term sustainability of wolves in the state.

There is an inherent aspect of uncertainty about the environmental impacts of each alternative given the fact-specific nature of wolf-livestock conflicts. Because Alternatives 2 and 3 require the development of area-specific, proactive conflict mitigation plans in areas where wolf-livestock conflict has repeatedly occurred in Washington, these alternatives may result in fewer wolf removals than Alternative 1 and the No Action Alternative. Alternative 3 is the most prescriptive of the four alternatives and would include the most specific expectations for use of non-lethal and

lethal measures to mitigate wolf-livestock conflict, but broadly prescribed measures (outside of area-specific conflict mitigation plans) that are not scenario-specific may not actually result in less wolf-livestock conflict and resultant wolf removals. Higher thresholds at which lethal removal of wolves can be considered in Alternative 3 may result in fewer wolf removals in the short-term, but may ultimately allow wolf-livestock conflict to escalate (ODFW 2021) and not reduce wolf removals in the long-term. Alternative 2 may result in lethal removal of wolves more quickly than what is considered in other alternatives, but could result in fewer wolf removals long-term if depredations are addressed quickly.

Mitigation measures

Wolf-livestock conflict scenarios involve multiple sources of uncertainty about factual circumstances that make concrete analysis of impacts and outcomes challenging. Because of this uncertainty, all alternatives include a provision that lethal removal of wolves would be considered only if it is not expected to harm the wolf population's ability to reach recovery objectives statewide or within individual wolf recovery regions. This measure is already in practice by WDFW using empirical and predictive data each time lethal removal of wolves is considered.

Documented wolf mortality in Washington is generally low and has not occurred at levels that have stymied wolf population growth. However, in a worst-case scenario, the potential exists that WDFW may discover a higher level of wolf mortality (e.g., from causes such as disease, poaching, or tribal harvest) than was known by WDFW at the time that a decision to lethally remove wolves was made. This could result in agency lethal removal of wolves unintentionally adding to a disproportionate impact on the wolf population due to unknown mortality. The uncertainty of this worst-case scenario exists under all alternatives.

SEPA process

Following the publication of the Draft SEIS on February 22, 2022, there was a 49-day public comment period, during which reviewers had the opportunity to comment on the accuracy and completeness of the environmental analysis, the methodology used in the analysis, and the need for additional information and/or mitigation measures, so that improvements to the SEIS could be made before it was finalized. WDFW received over 7,500 SEPA-associated comments in response to the Draft SEIS (Appendix D).

The SEPA EIS process informs Washington's rule making process and corresponds with the development and decision-making of the proposed rule. WDFW's preferred rule making alternative is expected to be proposed to the WDFW Commission for action on July 8, 2022. The Commission will decide on whether to adopt a final rule, which would become effective no less than 31 days after it is filed with the Code Reviser. If adopted, the rule or rules are tentatively scheduled to be implemented in January 2023.

1. Introduction

This Final Supplemental Environmental Impact Statement (SEIS) to the Final Environmental Impact Statement (2011 Final EIS) for the 2011 Wolf Conservation and Management Plan for Washington (Wolf Plan) analyzes potential environmental impacts of alternative rule making options as a part of the Washington Department of Fish and Wildlife (WDFW) rule making proposal. This proposal was initiated in response to a decision by Governor Jay Inslee in September 2020 to grant a petition for rule making directed to the Washington Fish and Wildlife Commission relating to wolf management with the goal of instituting practices that will avoid the repeated loss of wolves and livestock in Washington.

The range of the gray wolf (*Canis lupus*) historically covered the state of Washington. Following nearly eight decades of extirpation from Washington, gray wolves began naturally recolonizing the state in the 1990s from populations in surrounding states and provinces. The first breeding pair was documented in Okanogan County in 2008, and Washington's wolf population has grown at an average rate of 25 percent annually since then. Conflict between wolves and livestock has been documented everywhere the two coexist but is generally low and not uniform across the landscape. In Washington, 76 percent of known wolf packs were not involved in any documented livestock depredation in 2021 (average 86 percent from 2008 – 2021). When conflict between wolves and livestock does occur, it has the potential to become chronic and have significant economic impacts on individual livestock operations. WDFW focuses on promoting the proactive use of non-lethal deterrents to minimize wolf-livestock conflict and considers lethal removal as a last resort when those tools have not mitigated conflict.

The alternatives considered in the 2011 Final EIS include both lethal and non-lethal measures to mitigate wolf-livestock conflict. The alternatives presented for lethal control of wolves involved in repeated livestock depredations specify that lethal control is allowed consistent with state and federal law under all state-listed statuses, but do not provide or analyze criteria for use of lethal removal beyond a few general provisions.

The proposed alternatives in this Final SEIS address specific options for analysis that are not specifically addressed in the 2011 Final EIS. The final action taken by the WDFW Fish and Wildlife Commission may not be identical to any single alternative; the WDFW Fish and Wildlife Commission may choose a hybrid approach that combines components of different alternatives, and/or more and less restrictive expressions of the components to best meet the environmental, social, economic, and political needs of the rule making.

2. Background, Purpose, and Objectives

2.1. Rule making background

2.1.1. Overarching goals in WDFW wolf conservation and management

The 2011 (Wolf Plan) was developed to guide recovery and management of gray wolves as they naturally disperse into the state and reestablish a breeding population.

The purpose of the Wolf Plan is to ensure the reestablishment of a self-sustaining population of gray wolves in Washington and to encourage social tolerance for the species by addressing and reducing conflicts. Goals of the plan are to:

- Restore the wolf population in Washington to a self-sustaining size and geographic distribution that will result in wolves having a high probability of persisting in the state through the foreseeable future (>50-100 years).
- Manage wolf-livestock conflicts in a way that minimizes livestock losses, while at the same time not negatively impacting the recovery or long-term perpetuation of a sustainable wolf population.
- Maintain healthy and robust ungulate populations in the state that provide abundant prey for wolves and other predators as well as ample harvest opportunities for hunters.
- Develop public understanding of the conservation and management needs of wolves in Washington, thereby promoting the public's coexistence with the species.

The first two goals listed above are specifically pertinent to this rule making. Balancing the goals outlined above is one of the most important yet controversial challenges wildlife managers face, and every state that has wolf populations must make these difficult management decisions. One of the keys to successful wolf conservation is bridging the chasm of values between people whose livelihoods are impacted by wolves and people who advocate for wolves. WDFW has worked with diverse stakeholders for years to develop guiding documents both to address livestock depredations and to promote overall wolf recovery efforts. It is WDFW's intent to prioritize the proactive use of non-lethal deterrents to mitigate wolf-livestock conflict statewide. WDFW seeks to promote practices to minimize livestock depredations to reduce the need for lethal removal of wolves.

RCW 77.04.012 mandates that wildlife, fish, and shellfish are the property of the state, and declares that the Fish and Wildlife Commission, Director, and Department of Fish and Wildlife shall preserve, protect, perpetuate, and manage the same in a manner that does not impair the resource. WDFW's wildlife management authority includes the authority to "authorize the removal or killing of wildlife that is destroying or injuring property, or when it is necessary for wildlife management…." RCW 77.12.240(1). The Fish and Wildlife Commission may also promulgate rules that allow landowners (and some related persons) to trap or kill wildlife that is threatening human safety or causing

property damage without a WDFW permit, subject to limitations and conditions established in such rules. RCW 77.36.030. These statutory authorities extend to lethal removal of wolves. However, while WDFW's enabling statutes authorize broad discretion to manage wildlife, they do not generally authorize WDFW to mandate, regulate, or enforce animal husbandry practices.

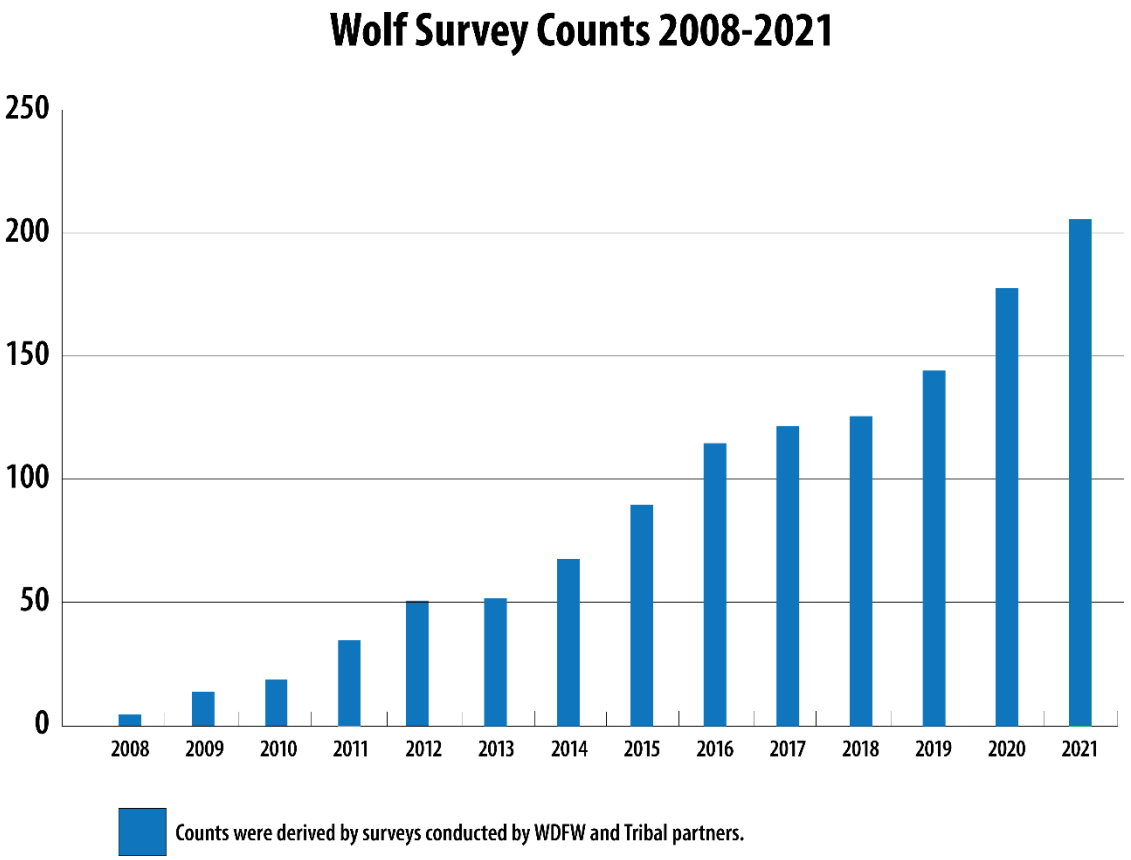
2.1.2. Wolf recolonization and population growth in Washington

Gray wolves were formerly common throughout most of Washington, but they declined rapidly between 1850 and 1900. The primary cause of this decline was the killing of wolves by Euro-American settlers as ranching and farming activities expanded. Wolves were essentially eliminated as a breeding species from the state by the 1930s. Following the recovery of wolves in Idaho, Montana, and Wyoming, the first fully documented breeding pack in Washington was confirmed in 2008. As of July 2011, there were five confirmed packs in the state: two in Pend Oreille County, one in Pend Oreille/Stevens counties, one in Kittitas County, and one in Okanogan/Chelan counties. As of December 31, 2021, WDFW counted a minimum of 206 wolves in 33 packs with at least 19 successful breeding pairs occupying 12 counties (Table 1, Figure 1). Human-related mortality, particularly illegal killing, legal control actions to resolve conflicts, and tribal harvest, is the largest source of mortality for the species.

Table 1. Wolf population growth trends in Washington, 2008-2021.

Year	Minimum count	Packs	Breeding pairs	Annual growth rate (%)	Documented mortality
2008	5	1	1	-	0
2009	14	2	2	-	0
2010	19	3	1	36	2
2011	35	7	5	84	0
2012	51	9	5	46	9
2013	52	13	5	2	5
2014	68	16	5	31	10
2015	90	18	8	32	7
2016	115	20	10	28	14
2017	122	22	14	6	14
2018	126	27	15	3	12
2019	145	26	10	14	21
2020	178	29	16	24	16
2021	206	33	19	16	30

Figure 1. Minimum wolf population count in Washington, 2008-2021.



2.1.3. The Wolf Plan, Wolf-Livestock Interaction Protocol, and prioritization of non-lethal conflict mitigation tools

WDFW focuses on promoting the proactive use of non-lethal deterrents to minimize wolf-livestock conflict and considers lethal removal as a last resort when those tools have not mitigated conflict. WDFW's spending reflects that commitment, with more than 80% of the budget for wolf-livestock conflict spent on non-lethal approaches. WDFW encourages the use of non-lethal measures to deter wolf-livestock conflict, and the number of livestock producers in Washington implementing proactive, non-lethal deterrence measures has markedly increased (WDFW 2017). Mitigating livestock depredation by wolves is critical to acceptance of wolves by local communities (Carter and Linnell 2016, Gosling et al. 2019).

Non-lethal measures, when context-specific, subject to adaptive management, and implemented proactively, can be effective in mitigating wolf-livestock conflict (Miller et al. 2016, Treves et al. 2016, Bergstrom 2017, Eklund et al. 2017, Moreira-Arce et al. 2018, van Eeden et al. 2018, Haswell et al. 2019, Khorozyan and Waltert 2019a, Bruns et al. 2020). In 2017 and 2018, WDFW reviewed and discussed a large body of recent science (see Appendices A and B) focused on the effectiveness

of non-lethal and lethal measures for mitigating wolf-livestock conflict. A common theme among the studies on the effectiveness of non-lethal deterrence measures is that no single deterrence measure or combination of deterrence measures can guarantee there will be no wolf-livestock conflict. Another common theme from the studies is that proactive, non-lethal methods are recommended, with lethal removal being a last resort, and that if lethal removal is implemented, it should be deployed within a short period of time of the most recent depredation.

WDFW's recovery efforts for wolves are guided principally by the Wolf Plan. Although the Wolf Plan prioritizes use of non-lethal tools, it expressly recognizes the potential use of lethal removal to resolve repeated livestock depredations. WDFW subsequently developed non-binding guidance to address the use of non-lethal conflict deterrents and lethal removals – the most recent version is the 2017 Wolf-Livestock Interaction Protocol (Protocol).

The Protocol restates the lethal removal guidance contained in the Wolf Plan but includes more details to inform the implementation of the Wolf Plan. The Protocol provides a list of example conflict deterrence measures, including range riding (Barnes 2015, Parks 2015, Louchouarn and Treves 2021), human presence, protection of calving/lambing areas (Breck et al. 2011), avoidance of wolf activity centers (Bradley and Pletscher 2005), use of scare devices (Shivak et al. 2003, Stone et al. 2017, Khorozyan and Waltert 2019b), use of guardian or herding dogs (Rigg et al. 2011), carcass sanitation (Fritts et al. 1992, Gese et al. 2021), permanent and portable fencing including fladry/turbofladry (Davidson-Nelson and Gehring 2010, Lance et al. 2010, van Liere et al. 2013), and delayed turnout of livestock. This list is also captured in WDFW's Livestock-Wolf Mitigation Measures document for livestock producer and WDFW use. The Protocol also provides guidance on working with livestock owners to proactively implement non-lethal measures and expectations for their use, how to confirm a wolf depredation event, the number of livestock killed or injured before WDFW would typically consider lethal removal, communications with the public, and potential implementation of lethal removal of wolves.

Notably, most wolf packs in Washington are not implicated in livestock depredation (86% on average over 14 years). The level of documented depredations (ranging from four to 45 individual animals injured or killed in confirmed or probable wolf depredation incidents annually, with an average of 24 per year from 2012 through 2020) has remained relatively low compared with the number of livestock on the landscape, despite an increasing wolf population. Depredation incidents occur almost evenly across public and private land (including private industrial timber land), with an average of 51% of incidents occurring on public land from 2012 – 2021.

2.1.4. Agency lethal removal of wolves

Lethal removal is perhaps the most contentious issue in wolf management, but WDFW consistently works to bridge the gap of different perspectives and cultures. Many Washington citizens would prefer earlier action to kill wolves that attack livestock; conversely, other citizens would prefer deferred (or no) lethal action. Although use of lethal control as a strategy to promote wildlife conservation is difficult considering the history of wolf eradication in the United States, "short, selective removal of problem animals by government agents may be necessary to protect wildlife from extinction via widespread, illicit retaliation" (Treves and Naughton-Treves 2005, pg. 105) and

"when highly endangered species kill livestock or take human lives, the best form of lethal control is highly accurate, selective removal of 'problem' animals by formally appointed and trained agents" (Treves and Naughton-Treves 2005, pg. 103).

WDFW has repeatedly considered the experiences of other states supporting wolf recovery, numerous scientific studies, and diverse (often divergent) perspectives of individuals directly affected by or generally concerned about lethal removal decisions. WDFW's Wolf Plan and Protocol reflect compromises between these different interests and the number of wolves in Washington has continued to increase every year since resident wolves were first documented in the state.

WDFW has used lethal removal in an attempt to resolve conflicts with livestock in eight of 14 years of wolf recovery in Washington, and annually since 2016. All of the affected livestock operations and pack territories were in Ferry and Stevens counties in northeast Washington, with the exception of Columbia and Grouse Flats in southeast Washington (Table 2). WDFW only considers lethal removal of wolves in the area of the state where the gray wolf is not listed as endangered or threatened under the federal Endangered Species Act (as of February, 10, 2022, wolves are federally delisted in Washington east of Highway 97 from the British Columbia border south to Monse, Highway 17 from Monse south to Mesa, and Highway 395 from Mesa south to the Oregon border, and are federally listed west of these highways).

Table 2. WDFW wolf lethal removal actions, 2008-2021.

Year	Packs with lethal removal authorized	Wolves removed by WDFW	Percentage of minimum wolf population removed[2]
2008	-	0	0
2009	-	0	0
2010	-	0	0
2011	-	0	0
2012	Wedge	7	14
2013	-	0	0
2014	Huckleberry	1	1.5
2015	-	0	0
2016	Profanity Peak[1]	7	6
2017	Sherman[1], Smackout	3	2.5
2018	Smackout, OPT[1], Togo	4	3
2019	Grouse Flats, OPT[1], Togo	9	6
2020	Leadpoint, Wedge, Togo	3	2
2021	Togo, Columbia	2	1

[1] Profanity Peak, Sherman, and OPT packs occupied the same geographic pack territory.
[2] Derived by dividing the number of wolves removed by WDFW by the minimum annual wolf count.

2.1.5. The Wolf Advisory Group and focus on areas of chronic conflict

The Protocol was developed in consultation with the Wolf Advisory Group (WAG), a citizen stakeholder group made up of citizens of Washington State who provide a broad range of perspectives to help inform management efforts for wolves. Participants range from livestock producers to wolf conservation groups and animal activists to land managers and outdoor recreation organizations to hunting advocates. Despite their differences in geography, experiences, and ideology, WAG members have learned to bridge gaps in understanding and culture. Although they may not always agree on certain topics, the group works as a team toward successes for people, wolves, and livestock.

Although the implementation of the Wolf Plan and Protocol have resulted in successful wolf-livestock conflict mitigation in most occupied wolf territory, no document or rule can or does account for every scenario in which WDFW must exercise discretion. Areas that have experienced recurrent and significant levels of livestock depredation and subsequent wolf removals do not neatly fit the guidance set out in the Protocol. The Protocol does not provide guidance in a situation where chronic depredations and lethal removals have occurred in the same territory for multiple years.

Starting in December 2018, the WAG began dedicating time during their meetings to discussing areas where conflict between wolves and livestock appeared to be focused and recur annually. Some members started to question whether the guidance provided in the Protocol resulted in the desired outcome of fewer depredations in certain areas that seemed prone to wolf-livestock conflict. The elimination of the Profanity Peak pack in 2016, followed by the subsequent recolonization and removal of the Old Profanity Territory (OPT) pack in 2018 and 2019, followed by the recolonization of the Kettle pack in 2019, all in the same geographic pack territory, underscored this question.

The WAG decided to create a new section of the Protocol specifically dedicated to areas of chronic conflict and spent all or portions of their meetings from 2019 through April 2021 working on this subject. Some of the topics WAG members wrestled with include issues of shared goals, root causes of depredation, proactive conflict mitigation plans, how to get reluctant parties involved in decision making, roles and responsibilities of involved parties, and compliance with commitments made by WDFW staff and livestock producers. Despite investing significant time in the section and developing several drafts, the WAG has not come to consensus on the guidance provided by this section to date.

2.1.6. Petitions for rule making and litigation about lethal removal of wolves

Environmental organizations filed a petition for rule making in July 2013 to codify the Wolf Plan and then withdrew it after discussions with WDFW. The withdrawal was predicated on WDFW working with the WAG to develop rules to address key issues in the Wolf Plan. WDFW did work with the WAG on those issues for several months after the May 2014 meeting and was preparing to file WDFW's proposal.

Prior to the filing, WDFW received several communications from WAG members and a couple of the petitioners expressing concern about the process leading to the development and the draft proposal itself. They asked WDFW to consider using a mediated process to develop a rule proposal for Commission consideration. WDFW also received a letter from several legislators requesting consideration of a mediated process.

During this same timeframe, WDFW received a second petition (June 2014) from the petitioners. With the concerns that had been expressed, WDFW postponed filing a rule proposal (CR-102) until after the Commission considered that petition. The Commission denied the June 2014 petition. The petitioners appealed the Commission's decision in 2014, and Governor Jay Inslee denied the appeal at that time.

In late 2014, the Department contracted with Human-Wildlife Conflict Collaboration (HWCC) to assess the social conflict around the subject. In March 2015, Francine Madden of HWCC completed her report (Madden 2015) that discussed in detail the levels of conflict in Washington around this subject and strategies to transform the conflict into opportunities for social change. In spring 2015, WDFW contracted with HWCC and Ms. Madden for strategic guidance, to facilitate the WAG process, and increase the WDFW's capacity to resolve deep rooted and identity-based conflict.

Environmental organizations challenged several of WDFW's lethal removal actions from 2017 through 2019 in litigation; all of these lawsuits were either dismissed or the court ruled in favor of WDFW.

Environmental organizations followed up these decisions by filing another petition for rulemaking in May 2020, which was denied by the Fish and Wildlife Commission. In September 2020, following appeal by the petitioners, Governor Jay Inslee directed WDFW to initiate a new rule making relating to wolf management with the goal of instituting practices that will avoid the repeated loss of wolves and livestock in Washington.

The Governor asked that the Department include clear and enforceable measures in the proposed rule to achieve the following management outcomes:

- Standardized definition and requirements for the use of range riders;
- Requirements for use of non-lethal deterrents most appropriate for specified situations (wolf population and range, size and location of livestock operation, terrain and habitat, history of depredation);
- Action plans in areas of chronic depredation to end the need for annual lethal removal; and,
- Compliance measures where livestock operators do not implement the required non-lethal measures.

2.1.7. Considerations and limitations for rule making

- WDFW recognizes that repeated livestock loss and wolf removals are likely to cause significant hardship for livestock producers and their animals, as well as their communities, wolf packs, the wolf advocate community, and WDFW staff.

- Livestock depredation by wolves is not uniform across the landscape and multiple confounding factors make it difficult to predict where and when depredations by wolves will occur. Each calendar year from 2012 – 2021 (excluding 2013 and 2015 when no lethal removals of wolves occurred), wolf depredations on livestock have escalated to the point of lethal removal authorization by the WDFW Director in 15 pack territories, 13 of which were located in Ferry and Stevens counties.

- Washington state has more than 9,000 beef cattle livestock operations alone (not to mention dairy cattle, sheep, and other livestock operations), and it is neither feasible nor sustainable for WDFW to oversee and document the implementation of non-lethal conflict mitigation tools on an individual basis for each livestock operation in occupied wolf territory.

- Although WDFW's enabling statutes authorize broad discretion to manage wildlife, they do not authorize WDFW to mandate, regulate, or enforce animal husbandry practices or the management of livestock operations.

2.2. Purpose and need for and objectives of wolf-livestock conflict deterrence rule making

The purpose and need for rule making is instituting practices that will avoid the repeated loss of livestock to wolf depredation and wolves to subsequent agency removal in Washington. In light of the limitations discussed above and under the umbrella of the Wolf Plan goals, WDFW has identified two objectives for adopting new rules related to wolf management in Chapter 220-440 WAC:

1. Establish procedure for identifying WDFW expectations for use of non-lethal tools to mitigate wolf-livestock conflict in areas of chronic conflict, while recognizing the use of non-lethal tools is encouraged statewide.

2. Establish criteria for the use of WDFW's lethal removal authority in areas of chronic wolf-livestock conflict.

3. Alternatives

3.1. Description of alternatives

The alternative rule making options considered below (including the no-action alternative) encompass a broad range of varying approaches that could meet the objectives of this rule making (listed above on page 1 and 13). The alternatives considered in the 2011 Final EIS include both lethal and non-lethal measures to mitigate wolf-livestock conflict. The alternatives presented for proactive measures to reduce depredation specify personnel who would provide technical assistance to livestock producers to implement proactive measures to reduce conflicts, but do not analyze criteria for use of these measures (e.g., the number of measures in place, timeline of implementation, appropriateness of the measure for the specific scenario, expectation of use). The alternatives presented for lethal control of wolves involved in repeated livestock depredations specify that lethal control is allowed consistent with state and federal law under all state-listed statuses, but do not provide or analyze criteria for use of lethal removal beyond the following (which are also repeated in the Protocol):

> "Lethal removal may be used to stop repeated depredation if it is documented that livestock have clearly been killed by wolves, non-lethal methods have been tried but failed to resolve the conflict, depredations are likely to continue, and there is no evidence of intentional feeding or unnatural attraction of wolves by the livestock owner. Situations would have to be evaluated on a case-specific basis, with management decisions based on pack history and size, pattern of depredations, number of livestock killed, state listed status of wolves, extent of proactive management measures being used on the property, and other considerations. If it is determined that lethal removal is necessary, it would likely be used incrementally, as has been done in other states, with one or two offending animals removed initially. If depredations continue, additional animals may be removed" (2011 Final EIS, pg. 34).

The following proposed alternatives for the supplemental EIS address specific options for analysis that are not specifically addressed in the 2011 Final EIS. The final action taken by the WDFW Fish and Wildlife Commission may not be identical to any single alternative; the WDFW Fish and Wildlife Commission may choose a hybrid approach that combines components of different alternatives, and/or more and less restrictive expressions of the components to best meet the environmental, social, economic, and political needs of the rule making.

The provisions allowing for lethal removal of wolves in each alternative apply only to the area of the state where the gray wolf is not listed as endangered or threatened under the federal Endangered Species Act.

Alternative 1: Develop a rule based on the Protocol to establish general criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict.

Under Alternative 1, WDFW would use the criteria outlined in the Protocol (corresponding sections listed below) to codify in rule the use of non-lethal and lethal measures to mitigate wolf-livestock conflict.

- The components of the rule based on the Protocol would include expectations for non-lethal deterrence measures (section 3), examples of deterrence measures (section 4), range rider roles and responsibilities (section 4, pg. 8-9), the depredation investigation process (section 5), criteria for lethal removal of wolves (section 6), and implementation of lethal removal of wolves (section 7).

- This alternative includes specific thresholds of depredation at which WDFW would consider lethal removal (specifically, at least three depredation events within a 30-day rolling window of time, or at least four depredation events within a 10-month rolling window of time, and at least one depredation must be a confirmed mortality event).

- To consider lethal removal, this alternative requires that at least two proactive deterrence measures and/or responsive deterrence measures appropriate for the scenario and time of year have been implemented and are in place a sufficient amount of time; depredations are expected to continue; and the lethal removal of wolves is not expected to harm the wolf population's ability to reach recovery objectives statewide or within individual wolf recovery regions. The specific proactive deterrence measures and/or responsive deterrence measures are not prescribed.

- Lethal removal would be predicated on the use of non-lethal conflict deterrence measures as set out in rule.

- Lethal removal authorizations would not have specific expiration dates, but instead be discontinued at the discretion of the Director or Director's designee.

- This alternative provides examples of effective nonlethal deterrence measures but does not prescribe specific methods that should be in place prior to the consideration of lethal removal.

- There are no special provisions for areas of chronic conflict in this alternative.

Alternative 2 (WDFW preferred): Develop a rule that uses area-specific conflict mitigation plans to establish criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict in areas of chronic conflict.

Under Alternative 2, WDFW would develop a rule based on the use of area-specific conflict mitigation plans through which WDFW would establish area-specific criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict in areas of chronic conflict. WDFW would author the conflict mitigation plans in consultation with willing, affected livestock producers. The rule would focus WDFW resources to areas of Washington where most wolf depredations on livestock and related wolf removals take place, specifically pack territories (or a portion thereof) where wolf depredations of livestock occurred and lethal removal of wolves was authorized in two of the last three years.

- The components of the rule based on this concept would include designation of chronic conflict areas, components and provisions of area-specific conflict mitigation plans, criteria for lethal removal of wolves in chronic conflict areas, and expectations for lethal removal authorizations.

- This alternative does not include specific thresholds of depredation at which WDFW would consider lethal removal; rather, thresholds may be established in each area-specific conflict mitigation plan.

- This alternative would not broadly establish specific non-lethal deterrence measures that would be required before WDFW would consider lethal removal; rather, expectations for the use of specific non-lethal deterrence measures would be established in each area-specific conflict mitigation plan.

- Under this alternative, the rule would state that in order to consider lethal removal in chronic conflict areas, WDFW and livestock producers must substantially comply with the expectations established within the conflict mitigation plan. The rule would outline the subject matter that must be addressed in a conflict mitigation plan and the processes WDFW would use in adopting a conflict mitigation plan. The rule may establish minimum substantive requirements that would be contained in a conflict mitigation plan.

- Lethal removal would be predicated on the use of non-lethal conflict deterrence measures as set out in rule and the provisions of each conflict mitigation plan.

- Lethal removal of wolves would be considered only if it is not expected to harm the wolf population's ability to reach recovery objectives statewide or within individual wolf recovery regions.

- The lethal removal authorization will have an expiration date specified at the time of issue. Once issued, the authorization may be revised or terminated by WDFW if on-the-ground conditions or state of knowledge changes.

- Under this alternative, if a livestock producer within a chronic conflict area chooses not to participate in or adhere to the expectations outlined in a conflict mitigation plan, the Director (or Director's designee) may consider lethal removal within the area only if other livestock producers in the same wolf pack area are experiencing wolf depredations and they have deployed appropriate deterrence measures meeting expectations outlined by the Department.

Alternative 3: Develop a rule similar to the "Petition to amend the Washington Administrative Code to require use of nonlethal techniques to reduce livestock-wolf conflict" sent to the Fish and Wildlife Commission on May 11, 2020 ("Petition" or "Pet."), which would establish criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock

conflict both generally and with specific criteria for areas with chronic conflict.

Under Alternative 3, WDFW would develop a rule similar to the proposed rule attached to the Petition, which would codify in rule criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict. This alternative would be the most prescriptive of the four alternatives and would include the most specific expectations for use of non-lethal and lethal measures to mitigate wolf-livestock conflict.

Some components proposed in the Petition have been omitted from Alternative 3 because WDFW lacks the requisite statutory authority to implement the component, some components may place requirements on land managers over which WDFW does not have authority, and/or the element would be difficult or impossible to implement due to operational limitations and/or limited resources.[1] Below are the components of Alternative 3 for consideration in rule making:

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[1] Specific components of the Petition not considered in Alternative 3, and the rationale for not including them, are as follows:

1. "…the department must: (i) Confirm the presence of any den or rendezvous site; and (ii) In conformance with all applicable rules and policies regarding sharing of sensitive information, instruct livestock operators to move salt blocks away from the den or rendezvous site(s), clean up the area around the salt block, and move and keep cattle at least one mile away from the known den or rendezvous site(s) until the department can confirm those sites are no longer being used." (Pet. at 15)

2. "Livestock killed within 1000 yards of a known den or rendezvous site on public lands will not count toward the lethal removal thresholds…" (Pet. at 17)

- WDFW currently encourages livestock producers to avoid wolf high-use areas, such as den and rendezvous sites, and communicates these locations to affected livestock producers when known. However, as written, a requirement to "confirm the presence of any wolf den or rendezvous site" would require WDFW staff to guarantee the ability to collar wolves in every known pack to definitively "confirm" a den site, which is neither possible to guarantee nor desirable in the interest of minimizing capture, handling, and harassment of wolves. "Confirming" den and rendezvous sites would also require WDFW staff to visit and inspect these sites, which is not currently standard practice in Washington. Visiting den and rendezvous sites may cause undue disturbance to wolves and often results in wolves moving pups to a different site (Fritts et al. 2003, Frame et al. 2007, Argue et al. 2008).

- Because den and rendezvous sites change often, and visits by humans may cause wolves to move these sites, the requirement causes practical issues for understanding wolf proximity to livestock at the level of accuracy required in the Petition language. The requirement also makes it impractical to measure with accuracy whether livestock were killed within 1000 yards of a known den or rendezvous site.

- Because wolves typically consume and disarticulate (i.e. separate and scatter bones) kills quickly (Peterson and Ciucci 2003), knowing precisely where a kill occurred is not always possible. The

- The rule based on the Petition would include expectations for non-lethal deterrence measures, examples of deterrence measures, specific expectations for range riders, criteria for lethal removal of wolves, expectations for lethal removal authorizations, and components and provisions of area-specific conflict mitigation plans.

- Under this alternative, certain non-lethal deterrence measures would be prescribed, including delaying turnout of livestock calves to forested/upland grazing pastures until calves reach at least 200 pounds and after wild ungulates are born in mid-June (Pet. at 14); ensuring sanitation (removal, burying, burning, liming, or fencing off of livestock carcasses) is being conducted (Pet. at 14); and range riding if wolf-livestock conflict occurs on public land (Pet. at 16).

- This alternative outlines specific expectations for range riders, including specific numbers of range riders; an expectation to spend a certain number of hours in the field including at night if necessary; a requirement to carry a GPS; and daily logs for Department-contracted range riders (Pet. at 15).

- This alternative includes specific thresholds of depredation at which WDFW would consider lethal removal (specifically, at least three depredation events within a 30-day rolling window of time, or at least four depredation events within a six-month rolling window of time, all of which must be confirmed events) (Pet. at 16).

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requirement to measure with accuracy whether livestock were killed within 1000 yards of a known den or rendezvous site (or on public or private land in the case of patchwork land ownership, which is common in wolf-occupied areas of Washington) is not a practicable regulatory requirement.

- Although WDFW coordinates with other land managers to mitigate wolf-livestock conflict where possible, WDFW does not have statutory authority to change other land managers' grazing operating instructions or instruct livestock producers to move salt sites or livestock except in limited circumstances on WDFW-owned lands.

3. "Lethal removal will not orphan or jeopardize the survival of any pups under a year and a half old." (Pet. at 16)

- Wolf pup survival is influenced by a multitude of factors, and depending on the specific scenario, lethal removal of certain pack members could reduce, enhance, or have no effect on pup survival (see section 4.2.2. of this document for further discussion). WDFW does not have the ability to know or predict definitively if lethal removal would jeopardize the survival of wolf pups.

- By the time wolf pups reach 6 months old, they closely resemble adults; when wolf pups are 10-12 months old, visually distinguishing between juvenile and adult wolves is difficult or impossible at a distance (Mech 1970). As written, the language quoted above is not a workable regulatory requirement and cannot be practicably applied.

- To consider lethal removal, this alternative requires the following:
    - At least two Department-approved appropriate non-lethal techniques are in place (Pet. at 16);
    - The non-lethal techniques are applied to the specific group of livestock involved in the conflict and used for at least two weeks prior to the conflict occurring (Pet. at 16);
    - Carcass sanitation is carried out at all times separate from the use of other non-lethal techniques (Pet. at 16);
    - Range riding is used as one of the non-lethal measures if the depredations occur on public land (Pet. at 16);
    - WDFW does not believe other available non-lethal techniques exist that could reasonably be employed in the specific situation to mitigate further conflict (Pet. at 16);
    - Depredations are expected to continue (Pet. at 16);
    - The wolf or wolves identified for removal are those the Department reasonably believes to be associated with the qualifying livestock depredations (the removal of which the Department reasonably believes will decrease the risk of repeated predation in the affected locale) (Pet. at 16);
    - The lethal removal of wolves is not expected to harm the wolf population's ability to reach recovery objectives statewide or within individual wolf recovery regions (Pet. at 16); and
    - Livestock producers are operating pursuant to all relevant applicable laws, all terms and conditions of any applicable federal or state grazing permits, and all notification, investigation and reporting requirements of the Department (Pet. at 16).
- Lethal removal would be predicated on the use of non-lethal conflict deterrence measures as set out in rule.
- Lethal removal authorizations would expire when the wolf or wolves identified in the authorization are removed or after 30 days, whichever comes first. No more than two wolves would be lethally removed in any given removal action to allow time to assess the impacts of removal (Pet. at 17).

- Under this alternative, there would be special provisions for areas of chronic conflict (including development of area-specific conflict mitigation plans), defined in this alternative as areas where wolf-livestock conflict has occurred for at least two consecutive years, or two out of five years in the same area or with the same livestock operator. No lethal action would be taken against wolves on public lands grazing allotments or for livestock depredations which occurred on public lands grazing allotments if there have been repeated wolf-livestock conflicts and wolf lethal removals on that same allotment for two consecutive years or in two out of five years (Pet. at 17).

Alternative 4: No Action. WDFW would not develop rule changes related to wolf-livestock conflict deterrence.

WDFW wolf-livestock conflict management and expectations for non-lethal and lethal measures would continue to operate under the non-binding guidance of the Wolf Plan and Protocol. The components of Alternative 4 would be similar to Alternative 1, but the use of non-lethal and lethal measures to mitigate wolf-livestock conflict would not be codified in rule.

3.2. Summary and comparison of SEIS alternatives

Table 3. The components of four alternatives for wolf rule making to establish criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict.

Element	Alternative 1	Alternative 2 (Preliminarily assessed as agency preferred)	Alternative 3	Alternative 4 (No Action, current management)
General expectations for non-lethal deterrence measures	Yes	Yes	Yes	Yes (in Protocol), but not codified in rule
Expectations for range riding	Yes	Yes, in area-specific conflict mitigation plans in chronic conflict areas if applicable	Yes	Yes (in Protocol), but not codified in rule
Prescribes specific proactive non-lethal measures that should be in place prior to the consideration of lethal removal	No	Yes, in area-specific conflict mitigation plans in chronic conflict areas	Yes	No
Area-specific proactive conflict mitigation plans	No	Yes	Yes	No
Depredation thresholds for consideration of lethal removal of wolves specified in rule	Yes - at least three depredation events within a 30-day rolling window of time, or at least four depredation events within a 10-month rolling window of time, and at least one depredation must be a confirmed event	No - thresholds would be established in area-specific conflict mitigation plans in chronic conflict areas	Yes - at least three depredation events within a 30-day rolling window of time, or at least four depredation events within a six-month rolling window of time, all of which must be confirmed events	No
Lethal removal predicated on use of nonlethal tools	Yes	Yes	Yes	Yes, but not codified in rule
Lethal removal considered only if not expected to harm the wolf	Yes	Yes	Yes	Yes, but not codified in rule

population's ability to reach recovery objectives statewide or within individual wolf recovery regions				
Expiration dates on lethal removal authorizations	No	Yes	Yes	No
Geographic scope	Statewide, but could be applied solely to chronic conflict areas	Chronic conflict areas with statewide provision for use of non-lethal measures	Statewide with special provisions for chronic conflict areas	Statewide

4. Affected Environment, Impacts, and Mitigation Measures

4.1. Affected environment

Recognizing that wolves are likely to eventually colonize all suitable habitat in the state and through dispersal may be present anywhere in Washington (including areas not considered preferred wolf habitat), the affected natural environment for all four alternatives is statewide. The affected built environment for all four alternatives includes areas of livestock production in Washington, regardless of land ownership (excluding tribal and National Park Service land).

SEPA rules provide a list of 16 environmental elements to be considered in an EIS analysis; however, the EIS must evaluate only the elements that apply to the proposal (WAC 197-11-440(6)(a). The 2011 Final EIS evaluated the following elements with respect to consideration of possible environmental effects of implementing conservation and management strategies in the Wolf Plan:

(1) Natural Environment (Plants and Animals)

a. Habitat for and numbers or diversity of species of plants, fish, or other wildlife (wolves, other carnivores, ungulates, ecosystem effects)
b. Unique species (listed species, candidate species, and species of concern)

(2) Built Environment (Land and Shorelines Use)

a. Recreation (hunting, wildlife watching, other types of backcountry recreation)
b. Agricultural crops (livestock)
c. Land use

The described alternatives in this SEIS could have significant impacts on one primary SEPA environmental element not specifically examined in detail in the 2011 Final EIS: **Animals**, specifically wolves and the impacts of measures to mitigate wolf-livestock conflict. Environmental elements considered, but not likely to be impacted by the described alternatives, are discussed in section 4.6.

4.2. Impacts on Animals: Wolves

4.2.1. Effects of lethal removal on wolf population growth and viability

Limited lethal control for effective depredation management has been a central component of the recovery strategy for wolves across the United States and has been practiced regularly by all states with increasing or stable wolf populations (with the exception of California where lethal take is prohibited while wolves are listed as state endangered [Kovacs et al. 2016]) to ensure that recovering wolves are not having an outsized adverse impact on the communities coexisting with wolves (Fritts et al. 2003, Bangs et al. 2006, Ruid et al. 2009).

As stated in the 2011 Final EIS, "Human-caused mortality is the largest source of wolf mortality in the western United States (Mitchell et al. 2008) and is the only factor that can significantly affect the recovery of populations" (pg. 48). However, wolves can withstand high anthropogenic mortality rates (22-48%) if reproduction and immigration are high (Hayes and Harestad 2000, Larivière et al. 2000, Fuller et al. 2003, Adams et al. 2008, Creel and Rotella 2010, Gude et al. 2012). Wolves can rebound and recolonize territory even following intensive lethal control (e.g., following intensive aerial reduction in the Yukon, Canada, the wolf population increased 88% in six years (Hayes and Harestad 2000). In most locations, sustainable mortality rates range from about 22-24% (Creel and Rotella 2010). The factors most influential to the percentage of a wolf population that can be killed by humans annually without reducing the population are its productivity and the rate of immigration from source populations (Fuller et al. 2003). If productivity is low and immigration limited, human-caused mortality can have a larger impact on population growth; if productivity is average or high, higher mortality rates can be sustained, especially if the controlled population is near a source population providing dispersers (Fuller et al. 2003).

Both the western United States (comprised of Idaho, Montana, Wyoming, Oregon, Washington, and California) and Great Lakes (comprised of Michigan, Minnesota, and Wisconsin) wolf metapopulations are connected to large and expansive populations of wolves in western Canada (estimated about 15,000 wolves) and eastern Canada (estimated about 12,000-14,000 wolves), respectively. The wolf populations within the states listed above are not discrete; in fact, they are extensions of the large populations in Canada and effective dispersal has been documented across state and international boundaries (USFWS 2020b).

Despite relatively high levels of mortality due to liberal harvest and lethal removal in response to livestock depredation, Idaho, Montana, and Wyoming have maintained stable wolf populations without federal protections for over a decade (Table 4, USFWS 2020a). From 2009 – 2015, Idaho removed an average of 10% of its wolf population in lethal control actions with total annual mortality from all causes averaging 45%; from 2009 – 2017, Montana removed an average of 14% of its wolf population in lethal control actions with total annual mortality from all causes averaging 47%; from 2009 – 2017, Wyoming removed an average of 15% of its wolf population in lethal control actions with total annual mortality from all causes averaging 30% (Table 4, USFWS 2020a). The most current estimates indicate approximately 1,000 wolves occurring in Idaho and 819 wolves in Montana; the most recent year-end minimum count shows at least 311 wolves in Wyoming (USFWS 2020b).

In the Great Lakes region of the United States (Michigan, Minnesota, and Wisconsin), 2,773 wolves were killed in response to depredations over a 33-year period during which this population was federally protected (Ruid et al. 2009). Despite lethal control actions during this recovery phase, wolves in the Great Lakes region have since increased to roughly 4,200 animals and now occupy most suitable habitat in the region (Ruid et al. 2009, USFWS 2020b). The annual percentage of each of the three states' wolf populations removed for depredation management ranged from 1-7% while their wolf populations were increasing and is currently about 5% annually with no evidence of jeopardizing population viability (Ruid et al. 2009).

Despite substantial public controversy surrounding lethal removal of wolves in response to livestock depredations, these control actions have not had significant effects on recovery or continued viability of wolves in the western United States and Great Lakes wolf metapopulations, likely due to normal or high productivity levels and genetic connectivity of these wolf populations with those in Canada (USFWS 2020b).

Additional information about lethal removal of wolves is provided in the 2011 Final EIS (pg. 73-74) and Wolf Plan (pg. 80-81).

Table 4. Percentage and number of individuals of the minimum population lethally removed, percentage and number of individuals included in total mortality, and minimum population counts of wolves in Idaho, Montana, and Wyoming, 2009 – 2017 (USFWS 2020a).

Year	Idaho			Montana			Wyoming		
	% min. pop. lethally removed (# individuals)[1]	% total mortality (# individuals)[1]	Min. pop. count	% min. pop. lethally removed (# individuals)[1]	% total mortality (# individuals)[1]	Min. pop. count	% min. pop. lethally removed (# individuals)[1]	% total mortality (# individuals)[1]	Min. pop. count
2009	11 (93)	31 (272)	870	28 (145)	49 (258)	524	10 (32)	18 (57)	320
2010	10 (78)	19 (144)	777	25 (141)	32 (179)	566	12 (40)	20 (69)	343
2011	8 (63)	39 (296)	768	10 (64)	33 (216)	653	11 (37)	20 (64)	328
2012	10 (73)	59 (425)	722	17 (108)	28 (324)	625	16 (43)	49 (136)	277
2013	14 (94)	72 (473)	659	12 (75)	53 (335)	627	11 (33)	36 (109)	306
2014	9 (67)	47 (360)	770	10 (57)	55 (306)	554	11 (37)	23 (78)	333
2015	10 (75)	45 (357)	786	7 (39)	51 (276)	536	14 (54)	22 (84)	382
2016	NA	NA	NA	11 (52)	70 (334)	477	30 (113)	35 (132)	377
2017	NA	NA	NA	9 (57)	48 (305)	633	18 (62)	48 (168)	347

[1] Derived by dividing the number of individuals by the minimum population count.

4.2.2. Effects of lethal removal on pack dynamics and social behavior of wolves

(Some of the text in this section has been adapted and updated from the 2011 Final EIS and Wolf Plan)

Wolves are highly social and live in packs (Mech and Boitani 2003). The fundamental unit of wolf social structure is the male and female breeding pair (Mech 1970, Mech and Boitani 2003). Packs are formed when male and female wolves develop a pair bond, breed, and produce pups. The pack typically consists of a socially dominant breeding pair, their offspring from the previous year, and new pups. Other breeding-aged adults may be present, but they may or may not be related to the others (Mech and Boitani 2003). The pack hunts, feeds, travels, and rests together. Maintaining the pack social unit is important for acquiring food (Stahler et al. 2006, Sand et al. 2008) and enhancing pup survival (Brainerd et al. 2008, Stahler et al. 2020). The pack also shares pup-rearing responsibilities, including hunting and tending pups at the den or at a series of rendezvous sites.

Several studies show numerous advantages of living in packs and maintaining larger pack sizes, such as better success hunting elk (MacNulty et al. 2012), ability to adapt to prey size (Barber-Meyer et al. 2016), higher pup production (Stahler et al. 2013, Stahler et al. 2020), better success in defending against territorial attacks from other wolves (Cassidy et al. 2015), greater ability to compete with scavengers (Wilmers et al. 2003, Vucetich et al. 2004), and more successful recovery from mange infestation (Almberg et al. 2015). Mech and Boitani (2003) state, "Wolves maintain a complex social structure and therefore measures of abundance do not capture all impacts of harvest or the interactions between effects at the population, pack, and individual levels."

Pack size and breeder presence and turnover have been shown to be important factors in pup survival and recruitment as well as maintenance of the pack social unit. Mitchell et al. (2008) show that larger packs of 10 or more wolves in Idaho, Montana, and Wyoming have a 90% or greater chance of successfully rearing two or more pups through December of a given year, whereas smaller packs are much less likely to do so. For example, depending on location within these states, packs of four to five animals had only a 20-73% chance of successfully raising at least two pups to year's end. The unexploited wolf packs in Yellowstone National Park have maintained a long-term average of 10 individuals per pack and sometimes support larger numbers (Stahler et al. 2020), providing additional evidence that this pack size may be advantageous. Ausband and Mitchell (2021) found that reproductive rates were generally lower for wolves in small groups (1–4 adults) compared to those in large groups (≥8 adult wolves). Pup survival, however, was slightly higher for wolves in small groups compared to large groups except at very high densities. Large pack size resulted in less birthing failure, more female breeders per group, larger litter sizes, and ultimately more pups recruited per group.

In Brainerd et al.'s (2008) study of the impacts of the loss of breeding wolves from a pack, they found that at least one pup survived in 84% of cases regardless of the sex of the remaining breeder. In packs of six or more, pups survived more frequently compared with smaller groups; non-

breeding wolves in the pack benefited pup survival. The number of adult-sized wolves remaining after breeder loss, along with pup age, had the greatest influence on pup survival. Wolves holding the territory reproduced the following season about half the time, and a greater proportion reproduced where one breeder was replaced versus cases where both breeders needed to be replaced. Wolf packs dissolved and abandoned their territories following breeder loss in 38% of cases. Where groups dissolved, wolves reestablished territories in over half of cases, with neighboring wolves taking over territories in a few cases. Fewer groups dissolved where breeders remained versus cases where all breeders were lost. Pack size following breeder loss was smaller where packs dissolved compared with cases where packs did not dissolve. Similarly, Borg et al. (2015) found that the loss of a breeder preceded about three quarters of cases of pack dissolution; packs were more likely to dissolve if a female or both breeders were lost and pack size was small. Packs that lost breeders exhibited lower denning and recruitment rates. Although this study showed the importance of breeders in maintaining pack cohesion, breeder loss and pack dissolution had no significant effects on short- or long-term population dynamics, similar to findings of Brainerd et al. (2008).

Ausband et al. (2017a) also illustrate the importance of breeders to pup survival—in their study of harvest and group effects on wolf pup survival, the number of breeders present when pups reached 15 months of age was a strong predictor of pup survival. Large pack sizes and breeder stability increased pup survival in harvested wolf populations, but turnover of breeding males and the presence of older, non-breeding males decreased pup survival. In years where harvest occurred, the average effect of one additional adult in a pack was associated with a 1.14 times increase in pups reaching 15 months old. At 15 months of age for pups, increasing the number of breeders present by one was associated with a nearly four times increase in the probability of survival during years with harvest. Turnover of breeding males was associated with more than three times decrease in the probability of pup survival. Although increasing pack size generally had a positive effect on pup survival, each additional two-year-old or older non-breeding male present when pups reached 15 months of age was associated with a nearly three times decrease in the probability of pup survival. Ausband et al. (2017b) further elucidate how breeder turnover affects breeding opportunities of subordinates and the number and sex ratios of subsequent litters of pups. Breeder turnover led to shifts in the reproductive hierarchies within groups and the resulting changes to group composition were highly variable and depended on the sex of the breeder lost. Harvest had no effect on the frequency of breeder turnover, suggesting that even in unexploited wolf populations, breeder turnover may be common.

Although targeted lethal removal of wolves in response to livestock depredations is not likely to have a significant effect on recovery or viability of a wolf population as long as control actions are limited and populations are sufficiently large (Brainerd et al. 2008, Borg et al. 2015), lethal removal is correlated with physiological stress responses in wolves (Bryan et al. 2014) and may fracture

packs and affect pup survival and recruitment depending on which pack members are removed (Mech and Boitani 2003). However, pack social structure is adaptable and resilient. Typically, the loss of offspring (young of the year, yearlings, or older offspring) does not result in the disruption of the pack because the breeding pair continues to hold the territory (Mech and Boitani 2003). A wolf pack will generally maintain its territory if both members of the breeding pair are not killed, and even if one member of the breeding pair is killed, the pack may hold its territory until a new breeder arrives (Mech and Boitani 2003). If both members of the breeding pair are killed, the remaining members of the pack may disperse, starve, or remain in the territory until an unrelated dispersing wolf arrives and mates with one of the remaining pack members (Mech and Boitani 2003, Brainerd et al. 2008). If breeders are killed, they can typically be quickly replaced from either within or outside the pack, and pups can be reared by another pack member if their parents die (Packard 2003, Mech 2006, Brainerd et al. 2008, Borg et al. 2015).

4.2.3. Wolf mortality, lethal removal, and population growth in Washington

Agency lethal removal in response to conflicts with livestock and legal harvest on tribal reservations account for 63% of Washington's known wolf mortality from 2008 – 2021. All human-caused mortality during this time period constitutes 89% of known wolf mortality. Documented mortality ranged from 8-15% and averaged 9% of the known population over this time period (Table 5). With this level of documented mortality, Washington's wolf population has grown at an average rate of 25% annually since breeding wolves were first documented in the state (Table 1).

Table 5. Causes of documented wolf mortality in Washington, 2008 – 2021.

Year	Minimum wolf count	Natural	Under investigation	Other human-caused	Caught-in-the-act	Vehicle collision	Unknown	Legal harvest	Agency removal	Total known mortalities
2008	5	0	0	0	0	0	0	0	0	0
2009	14	0	0	0	0	0	0	0	0	0
2010	19	0	0	0	0	0	2	0	0	2
2011	35	0	0	0	0	0	0	0	0	0
2012	51	0	0	1	0	0	1	0	7	9
2013	52	1	0	3	0	0	0	1	0	5
2014	68	3	0	4	0	0	2	0	1	10
2015	90	0	0	3	0	0	1	3	0	7
2016	115	0	2	2	0	0	0	3	7	14
2017	122	0	4	0	2	2	0	3	3	14
2018	126	0	2	0	0	0	0	6	4	12
2019	145	1	1	1	2	0	1	6	9	21
2020	178	2	0	1	0	1	1	8	3	16
2021	206	0	2	0	0	4	0	22	2	30
Total	-	7	11	15	4	7	8	52	36	140

Individual wolves lethally removed by WDFW (2012-2021) have represented an average of 3.6% of the population each year and has never exceeded 14% (2012) of the minimum population count in a single year (Table 2). No wolves were lethally removed by WDFW from 2008-2011, 2013, and 2015 (Table 2).

4.3. Comparison of impacts on wolves associated with each alternative

Common to all alternatives: It is difficult to differentiate among potential impacts from the alternatives. All alternatives, including the No Action Alternative, allow for lethal control of wolves to mitigate depredation of livestock under specific criteria and provisions. Because many components of the proposed alternatives are already current practice for WDFW, levels of wolf mortality associated with agency lethal removal are likely to be similar to the current conditions (described below under the No Action Alternative) under all alternatives. Although wolf-livestock conflict scenarios are notoriously difficult to predict (Wydeven et al. 2004, Mabille et al. 2015), multiple studies show that depredation risk may increase after a wolf pack has learned to prey on livestock and there is a predictable pattern of recurrence of depredations in areas with prior conflicts (Harper et al. 2005, Sime et al. 2007, Karlsson and Johansson 2010, Bradley et al. 2015, DeCesare et al. 2018, Hanley et al. 2018, ODFW 2021). Development and implementation of area-specific, proactive conflict mitigation in areas of Washington that have experienced the most wolf-caused livestock depredation and subsequent wolf removals may reduce the recurrence of these

events and impacts associated with wolf removal. Alternatives 2 and 3 both include provisions to develop area-specific, proactive conflict mitigation plans in areas where wolf-livestock conflict has repeatedly occurred; the No Action Alternative and Alternative 1 do not include this provision.

None of these alternatives would preclude the consideration of lethal removal entirely, but all would likely result in levels of lethal removal comparable to previous years in Washington and not be likely to have effects on the recovery, population growth, and long-term sustainability of wolves in the state. As discussed in the 2011 Final EIS (section 4.1.4.) and Wolf Plan (pg. 34-36), wolves play a role in ecosystems and have important ecosystem effects. Levels of removal projected under all alternatives are not likely to have a measurable impact on those effects provided that levels of lethal removal are not expected to harm the wolf population's ability to reach recovery objectives statewide or within individual wolf recovery regions (a provision included in all alternatives, including the No Action alternative).

No Action Alternative:
WDFW wolf-livestock conflict management and expectations for non-lethal and lethal measures currently operate under the guidance of the Wolf Plan and Protocol. The existing environmental conditions under the No Action alternative may serve as a baseline for understanding levels of agency lethal removal that could potentially occur under Alternatives 1-3. From 2012-2021, wolves lethally removed by WDFW have represented an average of 3.6% of the population each year and have ranged from 0-14% of the minimum population count in a single year (Table 2). This range and average percentage of lethal removal is expected under the No Action Alternative.

Alternative 1: The use of lethal measures to mitigate wolf-livestock conflict under Alternative 1 is expected to be similar to the No Action Alternative, because Alternative 1 would largely be based on the criteria outlined in the Protocol (current guidance). Levels of lethal removal may be more similar to the average from 2012-2021 (3.6%) rather than the high end of the range (14%), because the year that 14% of the wolf population was removed (2012) involved a full pack removal in early stages of recovery when there were relatively few wolves on the landscape and no wolf-livestock interaction protocol in place.

Alternative 2: Because of the dynamic and fact-specific nature of wolf-livestock conflict scenarios, it is uncertain how the use of lethal measures to mitigate wolf-livestock conflict under Alternative 2 would compare to the baseline level of lethal removal described in the No Action Alternative. Alternative 2 could potentially result in lower levels of lethal removal of wolves than the baseline level in two ways:

1. Because Alternative 2 would establish proactive, area-specific criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict in areas of Washington where most wolf depredations on livestock and related wolf removals take place, levels of conflict that typically lead to wolf removal may be prevented. The individual circumstances of each conflict scenario could be taken into account and planned for accordingly, rather than spending time and resources on broadly prescribed practices that may not be most critical

for the situation at hand. Areas that have historically been hotspots for wolf-livestock conflict in Washington would have more attention and focus for resources that may proactively mitigate conflict, and the documented history of conflict would inform proactive planning (as suggested in Musiani et al. 2005).

2. Alternative 2 is aimed at preventing escalation of depredation behavior that could lead to higher levels of lethal removal of wolves in the long-term if not curtailed in the short-term. Targeted lethal removal of wolves in response to livestock depredations, as long as it occurs shortly after depredations are discovered, can reduce the probability of depredation recurrence (Bradley et al. 2015, Poudyal et al. 2016, DeCesare et al. 2018). If depredation thresholds for consideration of lethal removal of wolves are specified in each conflict mitigation plan, WDFW would potentially be able to remove wolves in early stages of conflict before high numbers of livestock depredations occur. Although this might result in lethal removal of wolves more quickly than what is considered in other alternatives, it might result in removing fewer wolves overall if conflict can be stopped with early incremental removal rather than waiting for conflict to escalate to the point where it can only be stopped through full pack removal. The potential to remove wolves in early stages of conflict may provide incentive for a higher standard of proactive, non-lethal measures implemented before any depredation occurs.

Alternative 3: Similar to Alternative 2, it is uncertain how the use of lethal measures to mitigate wolf-livestock conflict under Alternative 3 would compare to the baseline level of lethal removal described in the No Action Alternative because of the dynamic and fact-specific nature of wolf-livestock conflict scenarios. Alternative 3 could potentially result in lower levels of lethal removal of wolves than the baseline level in two ways:

1. Like Alternative 2, Alternative 3 would also establish proactive, area-specific criteria for the use of non-lethal and lethal measures to mitigate wolf-livestock conflict in areas of Washington where most wolf depredations on livestock and related wolf removals take place. This provision could potentially result in lower levels of lethal removal than the baseline level for the same reasons described above for Alternative 2.

2. Alternative 3 specifies that WDFW could only consider lethal removal of wolves if at least three depredation events occurred within a 30-day rolling window of time or four events within a six-month rolling window of time, and that all must be confirmed events. This provision would likely lead to WDFW considering lethal removal of wolves less often than under the thresholds specified in Alternative 1 and the current guidance followed under the No Action Alternative (at least three depredation events within a 30-day rolling window of time, or at least four depredation events within a 10-month rolling window of time, and only one depredation must be a confirmed mortality event). The more restrictive threshold of Alternative 3 could potentially result in fewer lethal removals of wolves.

Although Alternative 3 is the most prescriptive of the four alternatives and would include the most specific expectations for use of non-lethal and lethal measures to mitigate wolf-livestock conflict, general expectations that are not scenario-specific do not always mitigate conflict that leads to lethal removal of wolves. This alternative prescribes certain non-lethal deterrence measures including delaying turnout of livestock calves to forested/upland grazing pastures until calves reach at least 200 pounds and after wild ungulates are born in mid-June; ensuring sanitation (removal, burying, burning, liming, or fencing off of livestock carcasses) is being conducted; and range riding if wolf-livestock conflict occurs on public land. These are excellent, basic livestock husbandry practices that WDFW supports and encourages in areas occupied by wolves. However, recent examples of wolf-livestock conflict scenarios in Washington provide evidence that general practices prescribed on a broad scale may not account for the specifics of each situation or lessen depredation and resultant lethal removal of wolves:

- The first example involves the Wedge pack in 2020, a scenario in which the pack was implicated in 16 depredation incidents over 83 days, resulting in agency removal of the entire pack. The scenario started with the pack injuring two calves and killing one in approximately a week. The calves were in a private pasture, where stipulations about turnout and range riding would not have applied. The affected operation had never previously been affected by wolf depredation and had been implementing standard husbandry practices such as carcass sanitation, treating injured livestock, and providing daily human presence because the livestock were in a pasture next to the house.

- The second example involves the Leadpoint pack in 2020, a scenario in which the pack was implicated in 12 depredation incidents over 57 days, resulting in attempted lethal removal of pack members. The depredations affected calves over 200 pounds in an open, private pasture where stipulations about turnout and range riding would not have applied or been the most appropriate nonlethal measures for the scenario. The affected livestock producer had implemented several proactive and reactive non-lethal deterrence measures, but trapping activity (although no wolves were trapped or removed) by WDFW staff near the affected pasture likely contributed to the stoppage of depredation by wolves.

- The third example involves the Columbia pack in 2021, a scenario in which the pack was implicated in five depredation incidents over 83 days, resulting in lethal removal of two pack members. The depredations affected calves over 200 pounds in private pastures where stipulations about turnout and range riding would not have applied as well as calves that had already been removed from the range.

General requirements for specific non-lethal measures broadly described would not have prevented the depredations detailed in the examples above or kept the situations from escalating to consideration of lethal removal—it is not possible to predict or account for all variability of each situation and attempts to do so are speculative. It is uncertain how the provisions of Alternative 3 might or might not mitigate conflict that leads to lethal removal of wolves, particularly as wolves

recolonize areas without grazing allotments. Many of the provisions of Alternative 3 are tailored to open, dispersed, public grazing allotments, which largely only applies to the eastern half of the state and does not consider that approximately half of all documented depredations in Washington from 2012 – 2021 occurred on private land.

Further, if a rule imposes too many restrictions on when depredations count toward consideration of lethal removal and/or when lethal removal can occur, it may result in scenarios where livestock depredation cannot be addressed in a timely manner (resulting in fewer lethal removals of wolves in the short-term) and could escalate to the point of full pack removal (resulting in more lethal removals of wolves in the long-term) when removing fewer wolves early on might have mitigated the conflict. Although of all the alternatives, Alternative 3 restricts the circumstances under which lethal removal of wolves can be considered the most, these restrictions have the potential to create long-term livestock depredation problems that could contribute to a hostile environment for wolf recovery (Olson et al. 2015).

Recent conflict situations in Oregon where lethal removal of wolves was not available as a tool provide an example. Statewide, confirmed depredation events increased 94% in 2020 from the previous year. Over half of all depredations was attributed to the Rogue Pack, which depredated 16 times in 2020. Since confirmed depredations were first recorded in 2009, the Rogue Pack (2014 – present) and former Imnaha Pack (2008 – 2016) represent 45% of all confirmed depredations in Oregon. Neither of these packs were subject to lethal control (ODFW 2021).

In Oregon's East Wolf Management Zone (East WMZ), where lethal removal of wolves is available as a tool, Oregon's wolf population has increased significantly while depredation events and livestock losses have increased at a much lower rate. Conversely, in Oregon's West Wolf Management Zone (West WMZ) where lethal removal has not been available as a tool, confirmed depredations in the West WMZ have increased at a rate similar to the increase of the wolf population. In 2019 and 2020, the number of confirmed depredations in the West WMZ exceeded those of the East WMZ, despite the West WMZ only having 13% of the wolf population. The Rogue Pack has depredated since 2016 despite significant non-lethal measures by livestock producers and agency staff, with 40 depredations total (ODFW 2021).

4.4. Summary of impacts

Impacts to wolves include direct effects of lethal removal (i.e., loss of individual wolves) and indirect effects of lethal removal (e.g., changes to pack size, composition, and resilience, as well as associated effects on pup survival and recruitment). Data from wolf metapopulations in the western United States and Great Lakes states show that where wolves have been subject to lethal removal in response to livestock depredation at all stages of recovery, the wolf populations have continued to thrive. This data indicates that Washington's wolf population is likely to continue to grow under all of the alternatives considered. Lethal control actions, as long as they are targeted to specific wolf packs implicated in livestock depredation and limited, are not likely to have significant effects on recovery or continued viability of Washington's wolf population. Lethal control in response to

livestock depredation has not led to long-term elimination of wolves in any areas it has been conducted in Washington; there is no evidence that ecological function, resiliency, or redundancy (Wolf et al. 2015, Akçakaya et al. 2020) of wolves in the state are affected by targeted, limited lethal control actions.

None of these alternatives would preclude the consideration of lethal removal of wolves entirely. Because many components of the proposed alternatives are already current practice for WDFW, levels of wolf mortality associated with agency lethal removal and associated impacts are likely to be similar to the current conditions under all alternatives. All alternatives will likely result in levels of lethal removal comparable to previous years in Washington and no alternative is likely to have negative effects on the recovery, population growth, and long-term sustainability of wolves in the state.

There is an inherent aspect of uncertainty about the environmental impacts of each alternative given the fact-specific nature of wolf-livestock conflicts. Because Alternatives 2 and 3 require the development of area-specific, proactive conflict mitigation plans in areas where wolf-livestock conflict has repeatedly occurred in Washington, these alternatives may result in fewer wolf removals than Alternative 1 and the No Action Alternative. Alternative 3 is the most prescriptive of the four alternatives and would include the most specific expectations for use of non-lethal and lethal measures to mitigate wolf-livestock conflict, but broadly prescribed measures (outside of area-specific conflict mitigation plans) that are not scenario-specific may not actually result in less wolf-livestock conflict and resultant wolf removals. Higher thresholds at which lethal removal of wolves can be considered in Alternative 3 may result in fewer wolf removals in the short-term, but may ultimately allow wolf-livestock conflict to escalate (ODFW 2021) and not reduce wolf removals in the long-term. Alternative 2 may result in lethal removal of wolves more quickly than what is considered in other alternatives, but could result in fewer wolf removals long-term if depredations are addressed quickly.

4.5. Mitigation measures

4.5.1. Provision to prevent harming the wolf population's ability to reach recovery objectives statewide or within individual wolf recovery regions

Wolf-livestock conflict scenarios involve multiple sources of uncertainty about factual circumstances that make concrete analysis of impacts and outcomes challenging. Because of this uncertainty, all alternatives include a provision that lethal removal of wolves would be considered only if it is not expected to harm the wolf population's ability to reach recovery objectives statewide or within individual wolf recovery regions. This measure is already in practice by WDFW using empirical and predictive data each time lethal removal of wolves is considered (see Appendix C for a recent example).

Documented wolf mortality in Washington is generally low (Table 5) and has not occurred at levels that have stymied wolf population growth (Table 1). However, in a worst-case scenario, the

potential exists that WDFW may discover a higher level of wolf mortality (e.g., from causes such as disease, poaching, or tribal harvest) than was known by WDFW at the time that a decision to lethally remove wolves was made. This could result in agency lethal removal of wolves unintentionally adding to a disproportionate impact on the wolf population due to unknown mortality. The uncertainty of this worst-case scenario exists under all alternatives.

4.6. Elements of the environment not likely to be impacted

4.6.1. Air and acoustic environment

The fuel emissions and noise associated with the action of surveying, capturing, or lethally removing wolves by fixed-wing aircraft or helicopter could result in infrequent fuel emission and noise impacts to the affected environment. Impacts associated with management actions that use aircraft are likely to be infrequent and short in duration and would not result in any significant impact to air quality or the acoustic environment. Because management actions using aircraft are typically limited in frequency and duration and represent a fraction of overall air traffic, emissions and noise from aircraft are not likely to have significant effects on the affected environment. Both non-lethal and lethal conflict deterrence measures may involve minor use of fossil fuels to operate vehicles, but likely do not contribute much to the air pollution in the affected environment.

4.6.2. Unique species (listed species, candidate species, and species of concern)

Washington contains a number of state and federal listed species (endangered, threatened, sensitive), candidate species, and species of concern, with some of these occurring in areas occupied by or likely to be eventually occupied by wolves (discussed in sections 4.1.2, 4.1.4, and 4.1.5 of the 2011 Final EIS). The action of trapping and/or lethally removing wolves, if conducted indiscriminately, could have significant impacts on endangered species such as grizzly bears and lynx. However, such impacts are not likely because WDFW's current practice of employing selective lethal removal methods (described below) avoids non-target species, makes operations as safe and effective as possible for both wildlife and people, and reduces trauma, stress, and chances of injury and/or death to captured wildlife. No impacts on non-target species have been documented related to wolf trapping and/or lethal removal conducted by WDFW in Washington to date.

WDFW personnel use three primary methods to lethally remove wolves: 1) shooting via helicopter, 2) shooting from the ground, and 3) trapping and euthanasia. Each method has advantages and disadvantages in terms of environmental impacts, human safety, effectiveness, and utility based on each unique scenario, but all allow for selective lethal removal of specific species and individual wolves (they are not indiscriminate) that mitigate effects on non-target wolves and species. Of the 36 wolves lethally removed by WDFW in response to livestock depredation from 2012 – 2021, three were removed via ground shooting, two via trapping and euthanasia, and the remainder via helicopter.

Shooting via helicopter: Aerial shooting typically involves visually locating suspected depredating individual wolves or wolf packs from either a small single-engine fixed-wing aircraft or a helicopter and shooting them from the helicopter with a shotgun. Shooting typically results in a relatively

quick death. At least one member of a wolf pack needs to be radio-collared in order to effectively locate the pack from the air. Good visibility is required for effective and safe aerial shooting operations, and relatively clear and stable weather conditions are necessary. Summer conditions limit the efficacy of aerial shooting because the increased vegetative cover makes finding the animals more difficult, and the higher ambient air temperatures reduce air density, which affects low-level flight safety. Rugged terrain and forest canopy cover also limit the effectiveness of aerial operations, so much of the success of aerial operations is dependent on the location of the target wolves the day of the operation as well as the weather conditions. If the location of the wolves and weather are favorable, aerial shooting is one of the most effective and selective lethal tools available, and depredation problems can sometimes be resolved very quickly and effectively in the short-term through aerial shooting. There is virtually no risk of injuring or killing a non-target species using this method. However, low-level flying in small aircraft is dangerous and presents significant risk to human safety; it is the leading cause of job-related death for wildlife professionals (Sasse 2003, Conway et al. 2004).

Ground shooting: Shooting from the ground is highly selective for the target species, and may be employed in conjunction with the use of auditory attractants (sounds of prey animals in distress or imitations of wolf vocalizations) and/or shooting over a wolf-killed carcass (with the intent of lethally removing the wolf or wolves responsible for the depredation). Removal of one or two specific wolves by shooting in the area where depredations occurred can sometimes provide immediate relief from further depredation by wolves. Ground shooting offers the potential of solving a problem more quickly and selectively than trapping, but it requires visually sighting the wolf within effective shooting distance. Shooting may sometimes be one of the only management options available if other factors preclude setting traps or aerial operations. There is virtually no risk of injuring or killing a non-target species using this method.

Foot-hold trapping: Trapping is an extremely important tool in wolf management and can be effectively used to live-capture wolves. When wolves are trapped, they are ordinarily physically restrained or chemically immobilized, radio-collared, and released on site, or euthanized on site. Wolves in Washington are captured with modified steel foot-hold traps. These traps have offset jaws with vulcanized rubber inserts that meet international humane trapping standards and meet WAC 220-417-040. Wolf traps are attached to a steel chain approximately 8-10 feet in length with a grapple type drag hook at the end (i.e., a drag). The chain has at least one swivel where the trap attaches to the chain and another one midway down the chain or at the end of the chain at the drag, as well as a shock-absorbing spring in the chain. These modifications reduce chances of injury to captured wildlife. Traps are visually inspected and tested before being used to make sure they operate properly. Effective trap placement, pan-tension devices and the selection and placement of appropriate lures by trained personnel contribute to the foot-hold traps' selectivity and safety of captured wildlife.

Disadvantages of traps include the difficulty of keeping them operational during rain, snow or freezing weather, and the fact that they cannot be 100% selective. Although pan-tension devices are effective in reducing the likelihood of unintentional capture of non-target species smaller than

wolves (e.g., fox, coyote, bobcat), they cannot preclude the occasional capture of larger non-target species such as cougars or bears. However, they do allow for the release of any non-target animals captured. Trapping in the area where wolves have been documented injuring or killing livestock may increase the likelihood of targeting the wolf or wolves responsible for the livestock depredations.

WDFW has the following provisions in place for deploying wolf traps to make operations as safe and effective as possible for both wildlife and people, and to reduce trauma, stress, and chances of injury and/or death to captured wildlife:

- Before trapping session begins, the appropriate landowners, district biologists, USFWS biologists, etc. are contacted and permissions granted prior to trap deployment.
- Biologists involved in wildlife capture consult with the agency wildlife veterinarian on immobilization drugs and treatment recommendations for broken teeth, lacerations, or puncture wounds as well as pain medications.
- The capture crew must include a person certified in chemical immobilization and general wildlife capture and handling through a WDFW approved wildlife capture/immobilization course.
- All members of the team involved with chemical immobilization are educated on the safe handling of the drugs involved, their effects, and emergency human treatment.
- Ideally, the capture crew includes a person experienced in capturing and handling wild canids.
- Whenever WDFW personnel deploy traps for wolves, they post warning signs at access points into the area to alert people to the presence of traps.
- All traps are checked a minimum of once every 24 hours, and all trap checking is completed by 12:00 PM at the latest.
- Staff avoid trapping when weather conditions threaten the survival or well-being of trapped animals unless steps can be taken to mitigate these risks. In general, trapping occurs between late April and late October or when ambient nightly temperatures are above 25° F. If ambient temperatures on the trapline are above 80° F, traps are checked twice a day, once in the morning and once in the afternoon. The trapline may be shut down if daytime temperatures increase too rapidly to be able to check the trapline quickly enough to ensure the well-being of animals that are captured.
- Special protocols, considerations, and risk mitigation measures are in place if biologists are trapping in areas known to be occupied by grizzly bear and lynx (federally endangered species).

Lead ammunition: Lead is toxic and widely banned from household items in most developed countries, but lead ammunition is still widely used for hunting and shooting. It puts at risk the health of waterfowl, raptors, scavengers, and other species in the food web, including humans, when carcasses containing lead are consumed (Arnemo et al. 2016). Although WDFW does use lead shot in aerial lethal removal operations for wolves due to a lack of other suitable options to

humanely conduct this work, all wolf carcasses are retrieved from the field, so there is no risk of lead consumption by scavengers.

4.7. Analysis limitations

The alternative rule making options proposed in Section 3 could potentially result in new or increased implementation of non-lethal conflict deterrence measures that may have effects on elements of the natural environment. For example, range riding using horses and all-terrain vehicles (ATVs) may contribute to soil erosion, damage to vegetation, and spread of invasive plants; livestock guardian dogs could have negative interactions with wildlife, including endangered species. However, many land use activities (including non-lethal conflict deterrence activities) associated with livestock production, grazing, and monitoring already occur at varying scopes and scales in Washington independent of the rule making effort analyzed in this document. Because implementation of non-lethal conflict deterrence measures is highly variable both temporally and geographically, we cannot meaningfully predict or quantify whether impacts to elements of the natural environment (with the exception of direct impacts to wolves) will occur as a result of implementation of any of the alternative rule making options. Based on years of observation in Washington and decades in other states (Bangs et al. 2006, Wilson et al. 2017) of non-lethal deterrence measures in practice, we do not anticipate significant adverse environmental impacts of implementation of non-lethal measures to the extent that we are able to foresee outcomes.

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Appendix A. Scientific literature provided to WDFW Fish and Wildlife Commission in 2017

WDFW Commission meeting February 10-11, 2017

Very little scientific literature has analyzed the actual effectiveness of lethal removal on wolves, but many of the publications that advocacy groups use to show support for it not working are primarily demographic studies or human dimension studies (i.e. opinion surveys) that may or may not have some application when removal efforts are undertaken. Below is a short list of the primary papers that are routinely used to demonstrate support for or against lethal removal. Another big aspect that needs to be discussed is the social tolerance aspect of wolf management (which is not necessarily captured in the below literature because it is so diverse, but it is discussed in some of them).

Lethal Removal Literature Cited

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with associated information and tables can be found at https://www.fws.gov/mountain-prairie/es/grayWolf.php and select "Annual Reports..." then the years you want.

Wielgus, R.B., and K.A. Peebles. 2014. Effects of wolf mortality on livestock depredations. PLoS ONE 9: e113505. doi:10.1371/journal.pone.

Appendix B. Notes from WDFW Wolf Internal Group Science Review, 2018

August 19, 2018, 3:00pm-4:45pm

Conference call on some relevant science on lethal removal of wolves. Call began shortly after 3 p.m. with summary of some of the science pertinent to lethal removal decision making process.

Attendees: Donny Martorello, Stephanie Simek, Andy Woo, Kelly Susewind, Joe Shorin, Mike Grossmann, Ben Maletzke, Ellen Heilhecker, Craig Bartlett, Eric Gardner, Bruce Botka, Dan Brinson, Joey McCanna, Steve Pozzanghera, Bryan Murphie, Trent Roussin.

Overview of the relevant science when considering lethal removal of wolves

Washington Department of Fish and Wildlife's vison is "conservation of Washington's fish and wildlife resources and ecosystems." As a conservation organization, science is the foundation of what the agency does. Most of the staff in Wildlife and Fisheries programs are scientists, and several have advanced degrees in the natural resources arena. The Department conducts its own scientific research studies and collaborates with external scientists. Staff routinely publish their research in a myriad of scientific journals and stay up to speed on published research in their particular field of study.

WDFW has a Wolf Internal Group (WIG) that is comprised of a cross section of the agency who are involved in the implementation of the wolf conservation and management plan. The WIG has 24 members, with representation by wolf biologists, wildlife conflict specialists, wildlife biologists, carnivore manager, wildlife conflict manager, region managers, regional director, public affairs director, law enforcement officers, and wolf policy lead.

WIG members read, discuss, and consider a plethora of published scientific studies on wolf conservation and management, as well as other carnivore species that have similar management challenges. Collectively, the list of publications the WIG has read is around 1,200. These studies help inform the Department in developing policies and on the implementation of those policies. The wolf conservation and management plan references 483 publications. The department's literature review of wolf-livestock non-lethal deterrence measures includes a review of 54 published studies and references another 49 published studies for further reading. For the 2017 protocol, 39 publications were considered and help to inform staff in the development of the protocol. Prior to the completion of the 2017 protocol, department staff also presented summaries of 7 of those 39 studies to the Fish and Wildlife Commission and public. The 2017 protocol cited 5 published studies.

When the department reviews and considers published scientific information, it is with a critical mind. Science does not tell what is the truth or provide a single correct answer, rather it informs us about ecological processes or species. There is a wide array up published science, so much so, that entities can pick and choose the science that supports their point of view. From the department's perspective, we purposefully review and consider a wide array of information. We think critically about the author's hypothesis, the study design, the statistical methods uses, and the results and management implications. Because no study is perfect, we contemplate, "what is the inference from this study for wolf conservation and management is Washington." In some cases, studies may have very low inference for Washington because of the location, design, or assumptions of the research. In other cases, there may be elements of a study that do have strong inference for Washington.

Experience from other jurisdictions

The department read and considered several publications associated with other states', or US Fish and Wildlife's (USFWS), experience in wolf conservation and management. The most relevant are from the recovery of wolves in the Northern Rocky Mountain Distinct Population Segment (NRMDPS) managed my USFWS (https://www.fws.gov/mountain-prairie/es/grayWolf.php/annualreports.htm). These publications have strong relevance to wolf conservation and management in Washington because they are related to wolf recovery in other northwestern states with similar landscapes and challenges. These publications suggested Washington's wolf population would grow and expand at a rate similar to that in NRMDPS, and more importantly, that wolf-livestock conflict would inevitably occur, and there isn't a preventative measure or combination of preventive measures that could guarantee no wolf-livestock conflict. These publications also indicated that, in some situations, lethal removal was need to reduce wolf-livestock conflict in the short term, and that those removals did not hinder the success of, or progress towards, wolf recovery.

Science on non-lethal deterrence measures to reduce wolf-livestock conflict

The department read and considered several publications associated with the use of non-lethal deterrent measures to reduce wolf-livestock conflict. Many of those studies are summarized in the Department's literature review (categories by husbandry practices, non-lethal tools, and wildlife management strategies), are referenced in the plan, or the publications are included in the Agency Record. The Department's 2017 protocol also identifies some of the most effective non-lethal deterrent measures. Some of the deterrence measures are used frequently as a part of livestock producer's "best management practices" (example range riders), while some are used periodically with situation is ideal for that particular deterrence measure (e.g., fladry, strobe (e.g. Fox™ lights)).

A common theme throughout the studies on the effectiveness of non-lethal deterrence measures is that no single deterrence measure or combination of deterrence measures can guarantee there will be no wolf-livestock conflict.

Science on lethal removal to reduce wolf-livestock conflict

The department read and considered several publications associated with the use of lethal removal to reduce wolf-livestock conflict. This collection of information includes studies that found lethal removal to be effective, as well as those that did not find it was conclusively effective. A common theme from the studies is proactive non-lethal methods are recommended, with lethal removal being a last resort. If lethal removal is used it should be deployed within a short period of time since the most recent depredation and it may only be a short-term solution for reducing wolf depredation to livestock.

Note: Included below are the abstracts (as published) for each manuscript.

1. **Bradley, E.H., H.S. Robinson, E.E. Bangs, K. Kunkel, M.D. Jimenez, J.A. Gude, and T. Grimm. 2015. Effects of wolf removal on livestock depredation recurrence and wolf recovery in Montana, Idaho, and Wyoming. The Journal of Wildlife Management; DOI: 10.1002/jwmg.948.**

    - Roussin: Paper looks at different removal options and evaluated effectiveness. Tested between no action, partial pack removal, and full pack removal. Full pack removal had the longest duration effect, followed by partial pack removal. Best if done within 7 days, okay 7-14 days.
    - Martorello: Part that informs us the most is the timing aspect – best within 7 days, but act within 14 days. Actually used empirical data and from similar habitats and environmental conditions in the West. Per personal conversation with lead author, it's 14 days after last depredation was discovered.

Wolf (Canis lupus) predation on livestock and management methods used to mitigate conflicts are highly controversial and scrutinized especially where wolf populations are recovering. Wolves are commonly removed from a local area in attempts to reduce further depredations, but the effectiveness of such management actions is poorly understood. We compared the effects of 3 management responses to livestock depredation by wolf packs in Montana, Idaho, and Wyoming: no removal, partial pack removal, and full pack removal. We examined the effectiveness of each management response in reducing further depredations using a conditional recurrent event model. From 1989 to 2008, we documented 967 depredations by 156 packs: 228 on sheep and 739 on cattle and other stock. Median time between recurrent depredations was 19 days following no removal (n=593), 64 days following partial pack removal (n=326), and 730 days following full pack removal (n=48; recurring depredations were made by the next pack to occupy the territory). Compared to no removal, full pack removal reduced the occurrence of subsequent depredations by 79% (hazard ratio [HR]=0.21, P<0.001) over a span of 1,850 days (5 years), whereas partial pack removal reduced the occurrence of subsequent depredations by 29% (HR=0.71, P<0.001) over the same period. Partial pack removal was most effective if conducted within the first 7 days following depredation, after which there was only a marginally significant difference between partial pack removal and no action (HR=0.86, P=0.07), and no difference after 14 days (HR=0.99, P=0.93). Within partial pack removal, we found no difference in depredation recurrence when a breeding female (HR=0.64, P=0.2) or ≥1-year-old male was removed (HR=1.0, P¾0.99). The relative effect of all treatments

was generally consistent across seasons (spring, summer grazing, and winter) and type of livestock. Ultimately, pack size was the best predictor of a recurrent depredation event; the probability of a depredation event recurring within 5 years increased by 7% for each animal left in the pack after the management response. However, the greater the number of wolves left in a pack, the higher the likelihood the pack met federal criteria to count as a breeding pair the following year toward population recovery goals. Published 2015. This article is a U.S. Government work and is in the public domain in the USA.

2. **Brainerd, S.M., A. Henrik, E.E. Bangs, E.H. Bradley, J.A. Fontaine, W. Hall, Y. Iliopoulos, M.D. Jimenez, E.A. Jozwiak, O. Liberg, C.M. Mack, T.J. Meier, C.C. Niemeyer, H.C. Pedersen, H. Sand, R.N. Schultz, D.W. Smith, P. Wabakken, and A.P. Wydeven. 2008. The effects of breeder loss on wolves. Journal of Wildlife Management 72:89-98.**

   - Roussin: Almost a worldwide look at loss of breeders.
   - 84% of time after breeder loss, at least one pup survived; those with auxiliary, 96% survival. If smaller, pup survival 68%. 64% survival with two pups and both breeders. If removal does occur best if pups > 6 mo old. Togo pups approx. 4.5 months.
   - Martorello: Borg paper tracked similarly. No population level effect for robust (>75 individuals), secure populations.

Managers of recovering wolf (Canis lupus) populations require knowledge regarding the potential impacts caused by the loss of territorial, breeding wolves when devising plans that aim to balance population goals with human concerns. Although ecologists have studied wolves extensively, we lack an understanding of this phenomenon as published records are sparse. Therefore, we pooled data (n=134 cases) on 148 territorial breeding wolves {75 M and 73 F) from our research and published accounts to assess the impacts of breeder loss on wolf pup survival, reproduction, and territorial social groups. In 58 of 71 cases (84%), >1 pup survived, and the number or sex of remaining breeders (including multiple breeders) did not influence pup survival. Pups survived more frequently in groups of >6 wolves (90%) compared with smaller groups (68%). Auxiliary nonbreeders benefited pup survival, with pups surviving in 92% of cases where auxiliaries were present and 64% where they were absent. Logistic regression analysis indicated that the number of adult-sized wolves remaining after breeder loss, along with pup age, had the greatest influence on pup survival. Territorial wolves reproduced the following season in 47% of cases, and a greater proportion reproduced where one breeder had to be replaced (56%) versus cases where both breeders had to be replaced (9%). Group size was greater for wolves that reproduced the following season compared with those that did not reproduce. Large recolonizing (>75 wolves) and saturated wolf populations had similar times to breeder replacement and next reproduction, which was about half that for small recolonizing (<75 wolves) populations. We found inverse relationships between recolonizing population size and time to breeder replacement (r= -0.37) and time to next reproduction {r= - 0.36). Time to breeder replacement correlated strongly with time to next reproduction (r= 0.97). Wolf social groups dissolved and abandoned their territories subsequent to breeder loss in 38% of cases. Where groups dissolved, wolves reestablished territories in 53% of cases, and neighboring wolves usurped territories in an additional 21% of cases. Fewer groups dissolved where breeders remained (26%) versus cases where

breeders were absent (85%). Group size after breeder loss was smaller where groups dissolved versus cases where groups did not dissolve. To minimize negative impacts, we recommend that managers of recolonizing wolf populations limit lethal control to solitary individuals or territorial pairs where possible, because selective removal of pack members can be difficult. When reproductive packs are to be managed, we recommend that managers only remove wolves from reproductive packs when pups are >6 months old and packs contain >6 members (including >3 ad-sized wolves). Ideally, such packs should be close to neighboring packs and occur within larger (>75 wolves) recolonizing populations.

3. **Borg, B.L., S.M. Brainerd, T.J. Meier, and L.R. Prugh. 2014. Impacts of breeder loss on social structure, reproduction and population growth in a social canid. Journal of Animal Ecology; DOI: 10.1111/1365-2656.12256.**

- Martorello: – Paper recommends if doing removals, do later in summer. Largest effect of breeder loss during breeding season or gestation.
- Maletzke: – There could be a higher probability of pack dissolution if the breeding female is removed.
- Simek: Packs that lose one breeder may have lower denning rates and recruitment rates, however no significant impacts on population dynamics; either short or long term.
- Simek: This species may be more resilient to disruption based on their social complexity.
- May be more important in packs on the periphery of expansion areas.

a) The importance of individuals to the dynamics of populations may depend on reproductive status, especially for species with complex social structure. Loss of reproductive individuals in socially complex species could disproportionately affect population dynamics by destabilizing social structure and reducing population growth. Alternatively, compensatory mechanisms such as rapid replacement of breeders may result in little disruption. The impact of breeder loss on the population dynamics of social species remains poorly understood.

b) We evaluated the effect of breeder loss on social stability, recruitment and population growth of grey wolves (Canis lupus) in Denali National Park and Preserve, Alaska using a 26-year dataset of 387 radiocollared wolves. Harvest of breeding wolves is a highly contentious conservation and management issue worldwide, with unknown population-level consequences.

c) Breeder loss preceded 77% of cases (n = 53) of pack dissolution from 1986 to 2012. Packs were more likely to dissolve if a female or both breeders were lost and pack size was small. Harvest of breeders increased the probability of pack dissolution, likely because the timing of harvest coincided with the breeding season of wolves. Rates of denning and successful recruitment were uniformly high for packs that did not experience breeder loss; however, packs that lost breeders exhibited lower denning and recruitment rates. Breeder mortality and pack dissolution had no significant effects on immediate or longer term population dynamics.

d) Our results indicate the importance of breeding individuals is context dependent. The impact of breeder loss on social group persistence, reproduction and population growth may be greatest when average group sizes are small and mortality occurs during the breeding season. This study highlights the importance of reproductive individuals in maintaining group cohesion in social species, but at the population level socially complex species may be resilient to disruption and harvest through strong compensatory mechanisms.

4. **Miller, J.R.B., K.J. Stoner, M.R. Cejtin, T.K. Meyer, A.D. Middleton, and O.J. Schmitz. 2016. Effectiveness of contemporary techniques for reducing livestock depredations by large carnivores. Wildlife Society Bulletin: DOI: 10.1002/wsb.720.**

- Martorello: Authors looked at 56 peer reviewed publications regarding mgmt. techniques.
- No one thing that can stop depredations. We try to match those tools best suited for each case.
- Roussin: Tough to tease out what applies to wolves since paper looked at whole guild of large carnivores.

Mitigation of large carnivore depredation is essential to increasing stakeholder support for human–carnivore coexistence. Lethal and non-lethal techniques are implemented by managers, livestock producers, and other stakeholders to reduce livestock depredations by large carnivores. However, information regarding the relative effectiveness of techniques commonly used to reduce livestock depredations is currently lacking. We evaluated 66 published, peer-reviewed research papers that quantitatively measured livestock depredation before and after employing 4 categories of lethal and non-lethal mitigation techniques (livestock husbandry, predator deterrents and removal, and indirect management of land or wild prey) to assess their relative effectiveness as livestock protection strategies. Effectiveness of each technique was measured as the reported percent change in livestock losses. Husbandry (42–100% effective) and deterrents (0–100% effective) demonstrated the greatest potential but also the widest variability in effectiveness in reducing livestock losses. Removal of large carnivores never achieved 100% effectiveness but exhibited the lowest variation (67–83%). Although explicit measures of effectiveness were not reported for indirect management, livestock depredations commonly decreased with sparser and greater distances from vegetation cover, at greater distances from protected areas, and in areas with greater wild prey abundance. Information on time duration of effects was available only for deterrents; a tradeoff existed between the effectiveness of tools and the length of time a tool remained effective. Our assessment revealed numerous sources of bias regarding the effectiveness of techniques as reported in the peer-reviewed literature, including a lack of replication across species and geographic regions, a focus on Canid carnivores in the United States, Europe, and Africa, and a publication bias toward studies reporting positive effects. Given these limitations, we encourage managers and conservationists to work with livestock producers to more consistently and quantitatively measure and report the impacts of mitigation techniques under a wider range of environmental, economic, and sociological conditions

5. **Wielgus, R.B., and K.A. Peebles. 2014. Effects of wolf mortality on livestock depredations. PLoS ONE 9: e113505. doi:10.1371/journal.pone.**

- Martorello: Covered Wielgus and two rebuttals. He looked at removal and effects in future years at state level and NRM unit. Scale of analysis was off. May be more helpful if at pack level.
- Different mathematicians have reanalyzed same data set and have come up with different conclusions.
- Not incorporated into our mgmt.
- Susewind: Asked if adjustments had been made for a growing baseline population. No, this was one of the shortcomings of the paper that was brought up in the reanalysis by Kompaniyets and Evans, 2017.
- Roussin: Paper looked at a statewide scale in the year following removals, but not in the current year or at the local scale, which is why the mgmt. action is taken.

Predator control and sport hunting are often used to reduce predator populations and livestock depredations, – but the efficacy of lethal control has rarely been tested. We assessed the effects of wolf mortality on reducing livestock depredations in Idaho, Montana and Wyoming from 1987–2012 using a 25 year time series. The number of livestock depredated, livestock populations, wolf population estimates, number of breeding pairs, and wolves killed were calculated for the wolf-occupied area of each state for each year. The data were then analyzed using a negative binomial generalized linear model to test for the expected negative relationship between the number of livestock depredated in the current year and the number of wolves controlled the previous year. We found that the number of livestock depredated was positively associated with the number of livestock and the number of breeding pairs. However, we also found that the number of livestock depredated the following year was positively, not negatively, associated with the number of wolves killed the previous year. The odds of livestock depredations increased 4% for sheep and 5–6% for cattle with increased wolf control - up until wolf mortality exceeded the mean intrinsic growth rate of wolves at 25%. Possible reasons for the increased livestock depredations at #25% mortality may be compensatory increased breeding pairs and numbers of wolves following increased mortality. After mortality exceeded 25%, the total number of breeding pairs, wolves, and livestock depredations declined. However, mortality rates exceeding 25% are unsustainable over the long term. Lethal control of individual depredating wolves may sometimes necessary to stop depredations in the near-term, but we recommend that non-lethal alternatives also be considered.

6. **Poudyal, N., N. Baral, and S.T. Asah. 2016. Wolf lethal control and livestock depredations: counter-evidence from respecified models. PLoS ONE 11:e0148743. Doi:10.1371.**

- Martorello: – Re-analyzed same data set as Wielgus and Peebles but with different approach for time variable. Resulted in different opposite outcome.

We replicated the study conducted by Wielgus and Peebles (2014) on the effect of wolf mortality on livestock depredations in Montana, Wyoming and Idaho states in the US. Their best models were found to be misspecified due to the omission of the time index and incorrect functional form. When we

respecified the models, this replication failed to confirm the magnitude, direction and often the very existence of the original results. Wielgus and Peebles (2014) reported that the increase in the number of wolves culled the previous year would increase the expected number of livestock killed this year by 4 to 6%. But our results showed that the culling of one wolf the previous year would decrease the expected number of cattle killed this year by 1.9%, and the expected number of sheep killed by 3.4%. However, for every wolf killed there is a corresponding 2.2% increase in the expected number of sheep killed in the same year. The increase in sheep depredation appears to be a short term phenomenon.

7. **Kompaniyets, L., Evans M.A. 2017 Modeling the relationship between wolf control and cattle depredation. PLoSONE 12(10):e0187264. https://doi.org/10.1371/journal.pone.0187264**

    - Martorello: Re-analyzed same data set as Wielgus and Peebles but with different model. Resulted in increase in depredation due to growing wolf population, not depredations.

Wolf control to reduce cattle depredation is an important issue to ecology and agriculture in the United States. Two recent papers use the same dataset having wolf population characteristics and cattle depredation, but come to opposing conclusions concerning the link between wolf control and cattle depredation. Our paper aims to resolve this issue by using the same dataset and developing a model based on a causal association that would explain the nature of the relationship between wolf control and cattle depredation. We use the data on wolf population, number of cattle, number of wolves killed and number of cattle killed, from the U.S. Fish and Wildlife Services Interagency Annual Wolf Reports over the period of 1987±2012. We find a positive link between wolf control and cattle depredation. However, it would be incorrect to infer that wolf control has a positive effect on the number of cattle depredated. We maintain that this link comes from a growing wolf population, which increases cattle depredation, and in turn, causes an increase in the number of wolves killed. While the wolf population is growing, we see both wolf removal and cattle depredation simultaneously grow. It is not until the wolf population growth nears the steady state, that removal of wolves has a sufficient negative effect to reduce or stabilize the number of cattle depredated.

8. **Santiago-Avila FJ, Cornman AM, Treves A (2018) Killing wolves to prevent predation on livestock may protect one farm but harm neighbors. PLoS ONE 13(1): e0189729. https://doi.org/10.1371/journal.pone.0189729**

    - Simek: Scale of study much different than in WA
    - Maletzke: Much smaller areas, easier to defend, non-lethals more effective.
    - Grossman: Question on pack size and spillover effect.
    - Martorello: Midwest states (WI) don't have the same pack territory information that WA has. Related to Togo, this is a small pack, so may not relate.
    - Discussion on retrospective research, spill over (i.e. depredations vs dispersal) and natural ecology of wolves (i.e. dispersal and pack splitting), and the lack of information with respect to non-lethal tool deployment prior to lethal action.

Large carnivores, such as gray wolves, Canis lupus, are difficult to protect in mixed-use landscapes because some people perceive them as dangerous and because they sometimes threaten human property and safety. Governments may respond by killing carnivores in an effort to prevent repeated conflicts or threats, although the functional effectiveness of lethal methods has long been questioned. We evaluated two methods of government intervention following independent events of verified wolf predation on domestic animals (depredation) in the Upper Peninsula of Michigan, USA between 1998±2014, at three spatial scales. We evaluated two intervention methods using log-rank tests and conditional Cox recurrent event, gap time models based on retrospective analyses of the following quasi-experimental treatments: (1) selective killing of wolves by trapping near sites of verified depredation, and (2) advice to owners and haphazard use of non-lethal methods without wolf-killing. The government did not randomly assign treatments and used a pseudo-control (no removal of wolves was not a true control), but the federal permission to intervene lethally was granted and rescinded independent of events on the ground. Hazard ratios suggest lethal intervention was associated with an insignificant 27% lower risk of recurrence of events at trapping sites, but offset by an insignificant 22% increase in risk of recurrence at sites up to 5.42 km distant in the same year, compared to the non-lethal treatment. Our results do not support the hypothesis that Michigan's use of lethal intervention after wolf depredations was effective for reducing the future risk of recurrence in the vicinities of trapping sites. Examining only the sites of intervention is incomplete because neighbors near trapping sites may suffer the recurrence of depredations. We propose two new hypotheses for perceived effectiveness of lethal methods: (a) killing predators may be perceived as effective because of the benefits to a small minority of farmers, and (b) if neighbors experience side-effects of lethal intervention such as displaced depredations, they may perceive the problem growing and then demand more lethal intervention rather than detecting problems spreading from the first trapping site. Ethical wildlife management guided by the ªbest scientific and commercial data availableº would suggest suspending the standard method of trapping wolves in favor of non-lethal methods (livestock guarding dogs or fladry) that have been proven effective in preventing livestock losses in Michigan and elsewhere.

Science on the human dimensions related to wolf conservation and management

Chapron, G. and A. Treves. 2016. Blood does not but goodwill: allowing culling increases poaching of a large carnivore. Proceedings of the Royal Society; DOI: 10.1098/rspb.2015.2939

- Martorello: Gave history of wolf research in US; driven by midwest states and USFWS
- State vs. federal jurisdictions and impacts of lethal removals.
- Woo: Asked about mgmt. implication to WA. Issues with retrospective analysis; assumptions on poaching. Didn't design the study before-hand.
- Susewind: Thought it was unique and tough to apply the situation to human behavior is hard. Interesting but not very informative. If any connection, then WDFW failing to act could lead to poaching. Roussin replied about other papers (Olson) along those lines. Consistency in Mgmt has best impact on reduced poaching.

- Chapron and Treves 2016 retrospectively looked at periods when wolves in Michigan and Wisconsin were federally delisted under ESA to periods when wolves were re-listed following court actions. This "delist-relist" scenario occurred six times during the time span the authors examined.
- The authors suggest that the policy "signal" to the public associated with federally delisting wolves and/or state sanctioned wolf culling was substantially more likely to increase poaching compared to reduce it. However, they indicated they could not disentangle the two causal mechanisms (allowing culling or delisting).
- While the publication provides some interesting perspectives on social tolerance of wolves, there are a number of assumptions, which greatly limit the inference for wolf conservation and management in Washington.
- The authors claim the changes in wolf population growth must be due to poaching, yet they had zero data on poach.
- Regardless of the authors claim, in the eastern recovery region of Washington (where the Togo pack is located), wolf population size, number of packs, and number of breeding pairs increased each year after wolves were removed, not decreased as the authors suggested.
- Human behavior is complex and dynamic, making it difficult to understand, let alone predict. Nonetheless, the authors claim the human behavior associated with poaching is primarily driven by allowing culling or delisting. Human needs theory tells us this is an extreme over-simplification of the very complex behaviors of humans.
- In Washington, there have been no "signals" due to changes in listing status since the first pack was detected in 2008.
- There have been no state sanctioned hunting seasons in Washington since the first pack was detected in 2008.

Quantifying environmental crime and the effectiveness of policy interventions is difficult because perpetrators typically conceal evidence. To prevent illegal uses of natural resources, such as poaching endangered species, governments have advocated granting policy flexibility to local authorities by liberalizing culling or hunting of large carnivores. We present the first quantitative evaluation of the hypothesis that liberalizing culling will reduce poaching and improve population status of an endangered carnivore. We show that allowing wolf (*Canis lupus*) culling was substantially more likely to increase poaching than reduce it. Replicated, quasi-experimental changes in wolf policies in Wisconsin and Michigan, USA, revealed that a repeated policy signal to allow state culling triggered repeated slowdowns in wolf population growth, irrespective of the policy implementation measured as the number of wolves killed. The most likely explanation for these slowdowns was poaching and alternative explanations found no support. When the government kills a protected species, the perceived value of each individual of that species may decline; so liberalizing wolf culling may have sent a negative message about the value of wolves or acceptability of poaching. Our results suggest that granting management flexibility for endangered species to address illegal behavior may instead promote such behaviour.

9. **Olson, E.R., J.L. Stenglin, V. Shelley, A.R. Rissman, C. Brown-Nunez, Z. Voyles, A. Wydeven, and T. Van Deelen. 2014. Pendulum swings in wolf management led to conflict, illegal kills, and a legislated wolf hunt. Conservation Letters DOI: 10.1111/conl.12141.**

    - Roussin: Illegal killing declined when state had mgmt. authority and increased when feds had authority.
    - Probability of poaching of collared wolf doubled following seasons without state removals.
    - Martorello: Discussed approach to reduce dramatic swings in social-political pendulum, that's better for wolves and communities.

Rapid change in wildlife populations can challenge managers to promote species conservation while maintaining public support for wildlife. Wolf management during recolonization in Wisconsin, United States demonstrates the complexities of inconsistent management authority, public attitudes, and illegal killing of wolves. State management authority to control depredating wolves oscillated during a period of intense sociopolitical conflict over wolf status under the federal Endangered Species Act. We demonstrate that swings in wolf status led to inconsistent management authority, declining local public support for wolves, and possibly the unintended backlash of more illegal kills and a legislatively mandated public wolf hunt. A new Wildlife Management Matrix illustrates an idealized relationship between lethal control options and perceptions of wildlife. Moderating the sociopolitical drivers of swings in policy over short periods is essential to allow wildlife managers greater flexibility in achieving species-specific goals. To our knowledge, this research provides the first demonstrated link between illegal wildlife killing and management authority under the Endangered Species Act, and suggests that illegal behavior may be moderated with responsible and effective wildlife management programs. We recommend states avoid prescriptive harvest legislation, and we suggest a more incremental shift from federal to state management authority

10. **Chapron, G., and Treves, A. 2017. Reply to comments by Olson et al. 2017 and Stien 2017. Proc. R. Soc. B. 284: 20171743.**
11. **Chapron, G., and Treves, A. 2017. Reply to comment by Pepin et al. 2017. Proc. R. Soc. B. 284: 20162571.**
12. **Redpath, S.M., Linell, J.D.C., Festa-Bianchet, M., Boitani, L., Bunnefeld, N., Dickman, Amy., Gtierrez, R.J., Johansson M., Majic, A., McMahon, B.J., Pooley, S., Sandstrom, C., Sjolander-Lindqvist, A., Skogen, K., Swenson, J.E., Trouborst, A., Young, J., and Milner-Gulland. 2017. Don't forget to look down – collaborative approaches to predator conservation. Biological Reviews. (2017), 92, 2157-2163.**

Finding effective ways of conserving large carnivores is widely recognized as a priority in conservation. However, there is disagreement about the most effective way to do this, with some favouring top-down 'command and control' approaches and others favouring collaboration. Arguments for coercive top-down approaches have been presented elsewhere: here we present arguments for collaboration. In many parts of the developed world, flexibility of approach is built into the legislation, so that conservation objectives are balanced with other legitimate goals. In the developing world, limited resources, poverty and weak

governance mean that collaborative approaches are likely to play a particularly important part in carnivore conservation. In general, coercive policies may lead to deterioration of political legitimacy and potentially to non-compliance issues such as illegal killing, whereas collaborative approaches may lead to psychological ownership, enhanced trust learning and better social outcomes. Sustainable hunting / trapping plays a crucial part in the conservation and management of many large carnivores. There are many different models for how to conserve carnivores effectively across the world, research is now required to reduce uncertainty and examine the effectivess of these approaches in different contexts.

- Martorello: Another rebuttal to Wielgus and Peebles
- Values of collaborative approach vs. command and control
- Communities more receptive to collaboration. Those feeling less powerful have natural tendency to push back when told they have to do something. People want voice and to feel valued. Similarities to conservation conflict transformation messaging on human needs theory.

Finding effective ways of conserving large carnivores is widely recognised as a priority in conservation. However, there is disagreement about the most effective way to do this, with some favouring top-down 'command and control' approaches and others favouring collaboration. Arguments for coercive top-down approaches have been presented elsewhere; here we present arguments for collaboration. In many parts of the developed world, flexibility of approach is built into the legislation, so that conservation objectives are balanced with other legitimate goals. In the developing world, limited resources, poverty and weak governance mean that collaborative approaches are likely to play a particularly important part in carnivore conservation. In general, coercive policies may lead to the deterioration of political legitimacy and potentially to non-compliance issues such as illegal killing, whereas collaborative approaches may lead to psychological ownership, enhanced trust, learning, and better social outcomes. Sustainable hunting/trapping plays a crucial part in the conservation and management of many large carnivores. There are many different models for how to conserve carnivores effectively across the world, research is now required to reduce uncertainty and examine the effectiveness of these approaches in different contexts.

13. Treves, A., Krofel, M., and McMcanus, J. 2016. Predator control should not be a shot in the dark. Front Ecol Environ. 14(7): 380-388. DOI:10.1002/fee1312

- Simek: Author looked at 12 different studies on tools to reduce depredations. Urges for "Gold Standard" before tools, such as lethal removal, are used.
- Martorello: Similar to other papers that review studies, finding that there is no single tool that can 100% eliminate wolf-livestock conflict. Some non-lethal tools work sometimes, and lethal tool works sometimes. Non-lethal is effective more than lethal.

Livestock owners traditionally use various non- lethal and lethal methods to protect their domestic animals from wild predators. However, many of these methods are implemented without first considering experimental evidence of their effectiveness in mitigating predation- related threats or avoiding ecological degradation. To inform future policy and research on predators, we systematically evaluated evidence for interventions against carnivore (canid, felid, and ursid) predation on livestock in North American and

European farms. We also reviewed a selection of tests from other continents to help assess the global generality of our findings. Twelve published tests – representing five non- lethal methods and 7 lethal methods – met the accepted standard of scientific inference (random assignment or quasi- experimental case- control) without bias in sampling, treatment, measurement, or reporting. Of those twelve, prevention of livestock predation was demonstrated in six tests (four non- lethal and two lethal), whereas counterintuitive increases in predation were shown in two tests (zero non- lethal and two lethal); the remaining four (one non- lethal and three lethal) showed no effect on predation. Only two non- lethal methods (one associated with livestock guarding dogs and the other with a visual deterrent termed "fladry") assigned treatments randomly, provided reliable inference, and demonstrated preventive effects. We recommend that policy makers suspend predator control efforts that lack evidence for functional effectiveness and that scientists focus on stringent standards of evidence in tests of predator control.

14. **Eklund, A., Lopez-Bao, J.V., Tourani, M., Chapron, G., and Frank, J. 2017. Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores. http://dx.doi.org/10.1038/s41598-017-02323-w**

- Roussin: Looked at over 500 research papers; looked at experimental design. Only about 4% of papers had experimental design.
- Heilhecker: A lot of data is based on sheep depredations.
- Discussed the difficulty in field studies versus lab studies with respect to having a "control".
- Review of literature where evidence of measuring intervention effectiveness were presented; further supported the difficulty in case-control study designs.

Successful coexistence between large carnivores and humans is conditional upon effective mitigation of the impact of these species on humans, such as through livestock depredation. It is therefore essential for conservation practitioners, carnivore managing authorities, or livestock owners to know the effectiveness of interventions intended to reduce livestock predation by large carnivores. We reviewed the scientific literature (1990–2016), searching for evidence of the effectiveness of interventions. We found experimental and quasi-experimental studies were rare within the field, and only 21 studies applied a case-control study design (3.7% of reviewed publications). We used a relative risk ratio to evaluate the studied interventions: changing livestock type, keeping livestock in enclosures, guarding or livestock guarding dogs, predator removal, using shock collars on carnivores, sterilizing carnivores, and using visual or auditory deterrents to frighten carnivores. Although there was a general lack of scientific evidence of the effectiveness of any of these interventions, some interventions reduced the risk of depredation whereas other interventions did not result in reduced depredation. We urge managers and stakeholders to move towards an evidence-based large carnivore management practice and researchers to conduct studies of intervention effectiveness with a randomized case-control design combined with systematic reviewing to evaluate the evidence

15. **Moreira-Arce, D., Ugarte, C.S., Zorondo-Rodriguez, F., Simonetti, J. 2018. Management tools to reduce carnivore-livestock conflicts: current gap and future challenges. Rangeland Ecol. & Manage. Vol 71 (3):389-394. https://doi.org/10.1016/j.rama.2018.02.005**

- Simek: Discussed some of the key points of the paper.
- Susewind: Asked about statement in summary about study confirms lethal would have no effect on native carnivores. Seems like a large assumption and could impact credibility of the paper.
- Grossmann: Asked about the apparently definitive assertion in the abstract that "our findings confirm lethal control would have no effect in reducing animal predation by native carnivores when compared with nonlethal techniques." We responded that the paper is not specific to wolves, considered control at landscape scales different than for wolves in Washington, and ultimately the paper is overly confident given the data and available analysis. In contrast, on the ground management experience by WDFW demonstrates appreciable reductions in depredations after lethal wolf control, in the same year as the control effort.
- Discussion on the variety of carnivores in the review and that does create some difficulty in making inferences. Also, discussed the review focused on lethal vs nonlethal and lacked information on effect of using of non-lethal measures prior to lethal measures. Additionally, discussed the overlap of the confidence intervals of all measures and that the results were from 30% of the study cases.
- Discussion of validity of inference with retrospective studies.

Predation on domestic animals by carnivores is a persistent problem wherever carnivores and livestock co-occur. A 20 wide range of management tools to reduce predation has been invoked. However, the evidence of their effectiveness is still limited for a broader range of species and conditions. Using a global analysis of domestic animal predation by native carnivores under a "before-after/control-impact" framework, we assessed the effectiveness of management techniques used to reduce domestic animal predation identifying knowledge gaps and research needs. We reviewed 291 predation cases in 149 studies published between 1990 and 2017 involving 47 carnivores. Lethal control is the most common method to reduce predation in comparison with nonlethal techniques. Yet the effectiveness of both approaches remains poorly evaluated (30.1% of study cases) and largely based on producers' perceptions (70% of cases where effectiveness was evaluated). Lethal control and night confinement of domestic animals would have no effect on reducing predation, whereas the use of livestock-guarding dogs, fencing, or herdsmen may significantly reduce domestic animal losses. When the effectiveness of each technique to reduce predation was assessed by large and mesocarnivores, fencing significantly reduced predation of domestic animals by the former. Despite little scientifically published material, our findings confirm lethal control would have no effect in reducing animal predation by native carnivores when compared with nonlethal techniques. Our study also provides novel insights upon this effectiveness may vary depending on the type of carnivore involved in the conflict with livestock activity. The use of an evidence-based framework to measure and assess the differential effectiveness of nonlethal techniques and the use of complementary tools at different spatial and temporal scales must be research priorities to prevent livestock predation while promoting the conservation of carnivores in
production-oriented lands as encouraged by the Convention of Biological Diversity.

16. **Van Eeden, L.M., Crowther, M.S., Dickman, C.R., Macdonald, D.W., Ripple, W.J., Ritchie, E.G., and Newsome, T.M. 2017. Managing conflict between large carnivores and livestock. Conservation Biology, Vol. 00, No. 00, 1-9. DOI:10.111/cobi.12959**

- Martorello: Paper looked at past research, financial incentives.
- Simek: Main difference of this paper is the human dimensions component.

Large carnivores are persecuted globally because they threaten human industries and livelihoods. How this conflict is managed has consequences for the conservation of large carnivores and biodiversity more broadly. Mitigating human–predator conflict should be evidence-based and accommodate people's values while protecting carnivores. Despite much research into human and large-carnivore coexistence strategies, there have been few attempts to document the success of conflict-mitigation strategies on a global scale. We conducted a meta-analysis of global research on conflict mitigation related to large carnivores and humans. We focused on conflicts that arise from the threat large carnivores pose to livestock. We first used structured and unstructured searching to identify replicated studies that used before–after or control–impact design to measure change in livestock loss as a result of implementing a management intervention. We then extracted relevant data from these studies to calculate an overall effect size for each intervention type. Research effort and focus varied among continents and aligned with the histories and cultures that shaped livestock production and attitudes toward carnivores. Livestock guardian animals most effectively reduced livestock losses. Lethal control was the second most effective control, although its success varied the most, and guardian animals and lethal control did not differ significantly. Financial incentives have promoted tolerance of large carnivores in some settings and reduced retaliatory killings. We suggest coexistence strategies be locationspecific, incorporate cultural values and environmental conditions, and be designed such that return on financial investment can be evaluated. Improved monitoring of mitigation measures is urgently required to promote effective evidence-based policy.

Summary:

- Martorello:
  - Consideration of lethal removal informed by, in part, science and management experience from NRM and GL DPS's.
  - Tool box has both non-lethal and lethal tools. Prefer nonlethal tools, may have best effect. Match the non-lethal tools to operation. Plan relies on non-lethal first; lethal as a last resort when warranted.
  - Duration of effect: when we do lethal, it is to change behavior in the current year, understand the effect doesn't last multiple years
  - Timing of implementing lethal. WDFW is not eager to do lethal, but timeliness of tool is important. Removal within 14 days to be effective. Gardner: Question about 14 day – date of actual injury or of discovery? Answer: Date of discovery. Also, act of attempting to remove can also change behavior.

    - Impact of lethal to population may be greater in small, isolated wolf populations. Like populations below the local regional recovery objective.
- Roussin: Weighed in on the resiliency of wolves; removals won't have an impact on the population.
- Susewind: Questions on lethal vs. nonlethal tools. Effectiveness on using multiple methods. Martorello: Yes, combination of nonlethal and lethal is most effective. Non-lethals must be proactive; if implemented after the fact, may be less effective. Our protocol calls for them to be in place ahead of time – more effective.
- Susewind: Does removal affect recovery? Answer seems to be no.
- Maletzke – Correct. The ability to reach recovery should not be impacted as wolf populations are resilient. The reproductive ability combined with the dispersal ability of wolves allow them to achieve a high growth rate while when they recolonize and expand their range. During this phase in Idaho they had an average growth of 36% and in NW Montana it was around 22%. Wolves had exhibited population growth rates as high as 1.79 on Isle Royale, 1.49 in Denali National Park, and 1.54 in Superior National Forest (Mech and Fieberg, 2015).

Appendix C. Analysis of Potential Impacts of Lethal Removal to the Regional or Statewide Wolf Population's Ability to Reach Recovery Objectives

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Analysis of Potential Impacts of Lethal Removal to the Regional or Statewide Wolf Population's Ability to Reach Recovery Objectives

By: Donald A. Martorello and Ben Maletzke

1. Assessment based on predictive model

The wolf population model in Maletzke et al. (2015) was described in WDFW's Wolf Plan in 2011 (appendices G and H), and was published in the peer-reviewed science journal called, "The Journal of Wildlife Management" in 2015. The authors developed a spatially explicit meta-population matrix model using vital rates based on empirical data from other states in the northwestern United States to estimate probability of occurrence, terminal extinction rates, and potential recovery time. They also used the model to project the risk of declining below recovery objectives if management scenarios (mimicking agency lethal removal actions) are considered during recovery.

The authors used the model to assess persistence of the recovery objectives established in the recovery plan (15 successful breeding pairs for 3 consecutive years, with ~4 pairs in each of the recovery regions) by running 9 different scenarios with 100 simulations each for 50 years. Scenarios 6 through 9 evaluated the effects of introducing additional adult mortalities (presumably through lethal removal) and immigration on persistence at a regional and statewide level. The lethal removal management scenario removed 30% of all dispersal and adult age

classes 1 time every 4 years in a recovery region after the delisting goals were met. The removal scenario was additive to the baseline mortality already incorporated in the model, which was conservatively set at 28% based on experience in other states. The lethal management scenarios 6 and 8 assessed whether the recovery goals would be reached on a statewide level if wolves were removed in the Eastern Washington Recovery Region once it had reached the recovery goal. The lethal management scenarios 7 and 9 assessed whether the northeast region would drop below recovery levels with 30% removals to the adult and dispersal population once every 4 years.

Scenario #6:

- Start with recovery objective (5 breeding pairs) met in the EW recovery region, but not in the other 2 recovery regions; assume immigration, conduct management.
- The model indicated that conducting wolf management in the EW recovery region after recovery objectives are met there, but before regional objectives are met in the other 2 regions, will not inhibit the ability to achieve recovery in all 3 regions over time.

Scenario #7:

- Start with recovery objective (5 breeding pairs) met in the EW recovery region, but not in the other 2 recovery regions; assume immigration, conduct management.
- The model indicated that conducting wolf management in the EW recovery region after recovery objectives are met there, but before regional objectives are met in the other 2 regions and with continued immigration, results in a 7% risk of falling below the

recovery objective for Eastern WA; model assumed 1 of 5 pairs established in Blue Mountains.

Table 1. Wolf population information for the eastern recovery region.

De 31 of each year	Min wolf pop in Eastern recovery region	Min SBP in EW recovery region	Min packs in EW recovery region	Scenarios 6 & 7 (Maletzke et al. 2015)	Actual wolf magmt removal from EW recovery region	Comments
2008	--	0	0		0	
2009	--	1	1		0	
2010	--	1	2		0	
2011	18	4	5		0	
2012	43	4	7		7	Removed 7 wolves from Wedge, pack persisted
2013	39	3	10		0	
2014	56	4	13		1	Removed 1 wolf from Huckleberry, pack persisted
2015	77	7	15	23.1	0	EW recovery region first had 5 SBP in Dec 2015
2016	97	8	17		7	Removed 7 wolves from Profanity, pack dissolved
2017	106	13	19		3	Removed 2 wolves from Smackout, pack persisted; removed 1 wolf from Sherman, pack dissolved
2018	NA	NA	NA		3	Removed 1 wolf from Togo, removed 2 wolves from OPT

2. Assessment based on empirical minimum wolf population estimates in annual wolf reports

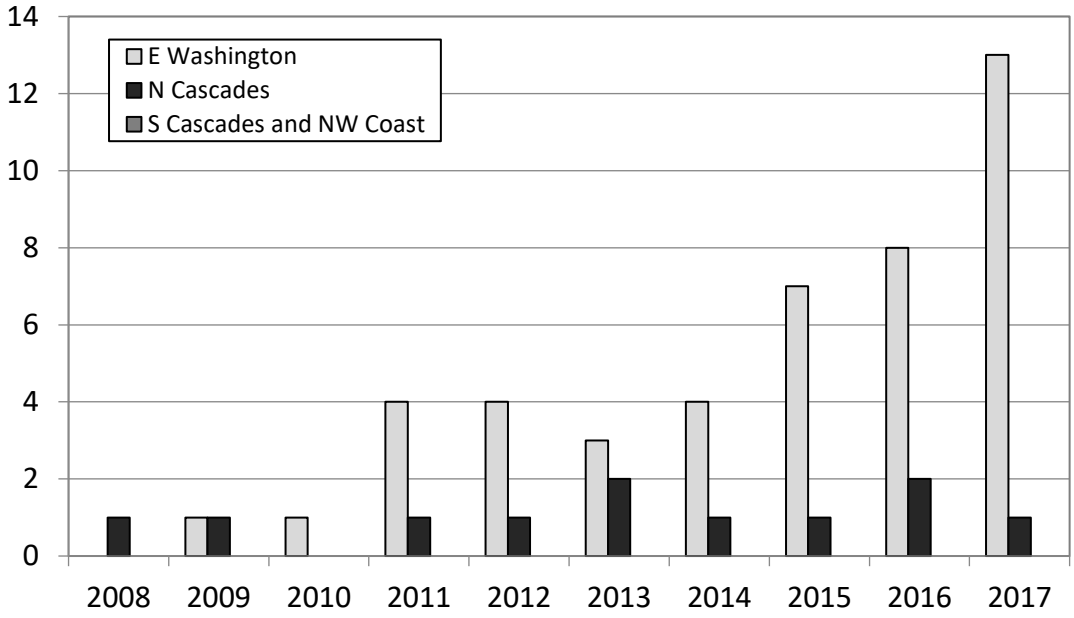
WDFW has implemented lethal removal of one or more wolves from 7 packs since the first pack was documented in 2008. Below is the estimated minimum number of wolves in the EW recovery region before (Dec 31 the prior year) and after (Dec 31 of that year) the removals. The regional and statewide wolf population has increased despite WDFW wolf removal actions.

Table 2. Wolf population size before and after agency wolf removals.

			Min # wolves in EW region		Min # wolves statewide	
		# wolves	January 1		January 1	December 31
Year	Pack	removal		December 31		
2012	Wedge	7	18	43	35	51
2014	Huckleberry	1	39	56	52	68
2016	Profanity	7	77	97	90	115
2017	Smackout	2	97	106	115	122
2017	Sherman	1				
2018	Togo	1	106	NA	122	NA
2018	OPT	2	106	NA	122	NA
ALL	ALL	21				

3. Assessment based on minimum SBP in annual wolf reports

Figure 4. Minimum known number of SBP by recovery area in Washington, 2008 – 2017.



- Based on the wolf management plan adopted in 2011, our metric for monitoring the recovery of the wolf population is successful breeding pairs (SBP). The recovery objective for the Eastern WA recovery area is a minimum of 4 SBP. That region increased by 5 SBP between 2016 and 2017 alone.
- The model explains the risk from a standpoint of when WA was just hovering around the recovery objectives (5 SPB) for the Eastern region. However the wolf population is already more robust than what the model reflected. Any calculations for quasi extinction would be much less than what was predicted in the model because we are so far above the recovery objectives for the eastern recovery region.

- Moreover, eight wolves dispersed from natal packs in the Eastern Recovery region. Based on the distribution of packs, the population is beginning to reach a saturation point and we saw a large increase in number of successful breeding pairs (8 to 13) between 2016 and 2017. Based on the information, trends and evidence available, the population appears be recovering well in the eastern recovery zone where potential lethal removal may take place.

4. Assessment based on WA mortality and population data (from annual reports) and NRMDPS (documented in wolf plan)

	Washington 2011-2017		
Cause	Ave morts (# wolves)	Ave % of pop	ID, MT, WY
Natural	0.6	0.01	0.03
Human	3.0	0.04	0.13
Unknown	0.9	0.01	0.00
Harvest	1.4	0.01	0.00
Removal	2.7	0.04	0.10
	8.6	0.11	0.26

From wolf plan…."Annual survival rates averaged 75% among wolves in Idaho, Montana, and Wyoming during 1982-2004 (Smith et al. 2010). Prior to the legal hunting seasons in 2009-2010, on average, an estimated 10% of the wolves in these states died annually from control actions, 10% from illegal killing, 3% from human-related accidents, and 3% from natural causes (USFWS 2009)"

Summary

The 30% removal rate modeled was in addition to other projected wolf mortalities, including agency removals, legal and illegal human causes, and natural and unknown causes, which the model conservatively assumes would be 28% annually based on experience in other states. In addition to the average annual growth rate of about 30% of the statewide wolf population from 2009-2017, the eastern recovery region has met the regional recovery objective since 2015 and the trend is increasing.

Lethal removal of a modest number of wolves from the in eastern recovery zone is not expected to harm the wolf population's ability to reach recovery objectives statewide or within individual wolf recovery regions, based the predictive model and empirical data.

Appendix D. WDFW Response to State Environmental Policy Act (SEPA) Comments on DS/ADOPTION/DSEIS 22-011: Wolf-livestock Conflict Deterrence Rule Making

Public comments on the Draft SEIS can be viewed at https://publicinput.com/SEPAWolfConflictDeterrence (SEPA comments) and https://publicinput.com/WolfConflictDeterrence102 (CR-102 comments). Names of commenters (as reported) who submitted comments through the SEPA portal during the open public comment period (February 22 to April 11, 2022) are listed in Appendix E (separate document).

1.0. Introduction. The Washington Department of Fish and Wildlife (WDFW) Wildlife Program recently proposed changes to Washington Administrative Code (WAC) 220-440-080 and proposed a new WAC (220-440-260) through a Washington Administrative Procedure Act (APA) rule making process for Fish and Wildlife Commission (FWC) consideration. WDFW issued DS/Adoption/DSEIS 22-011 (hereinafter referred to as "Draft SEIS" or "DSEIS") on February 22, 2022, pursuant to WAC 197-11-330 and WAC 197-11-620. WDFW initiated simultaneous APA rule making and SEPA comment periods for the proposed APA rule change/new rule and the proposed SEPA non-project action, respectively, that ran from February 22 to April 11, 2022. WDFW will respond separately to public comments received in response to the CR-102 and about the substance of the APA proposed rule change/new rule via a "Concise Explanatory Statement" in the event that the FWC votes to approve the proposed WAC amendment/new WAC. The present document (hereinafter the "Response") contains an overview, classification, summary, and set of responses to these SEPA comments.

2.0. Outreach prior to public comment periods. From January through March 2021, the Department conducted more than 30 intake calls with community members representing a diversity of positions and perspectives including those who petitioned the Department to conduct rule making, Fish and Wildlife commissioners, Wolf Advisory Group (WAG) members, those representing environmental interests, livestock producers, and WDFW staff. In the interviews, staff had in-depth discussions with each person or group about their expectations for the rule, their greatest concerns, and their process ideas.[2]

[2] WDFW. 2021. 2021 Wolf Commission Rulemaking – Intakes Summary. Available at https://wdfw.wa.gov/sites/default/files/about/regulations/filings/2020/20210402_rulemaking_intakes_summary.pdf.

The Department compiled this information and presented it to the FWC's Wolf Committee on April 5, 2021.[3] Based on the extensive information gathered from the intake interviews, the Department recommended a process in which 1) a small group of agency staff most experienced with wolves and wildlife conflict would develop rule ideas and draft rule language and 2) the rule would focus primarily on areas of chronic conflict, places in Washington where loss of wolves and livestock repeatedly occurs. The FWC's Wolf Committee supported moving forward with Department staff's process recommendation.

From that point, staff began work on analysis of potential environmental impacts related to different rule making alternatives under the framework of the State Environmental Policy Act and developed draft rule language. During a presentation made at the WAG meeting on July 6, 2021, WDFW staff described the different steps and components of the rule making process as well as a timeline for milestones to the WAG and members of the public.[4] Staff also shared a Preliminary DRAFT Staff Report and SEPA Review Proposal for Wolf-Livestock Conflict Deterrence Rule Making to provide a foundation for discussion with interested stakeholders during the rule development process.[5]

Following this meeting, the Department held nine different meetings with various stakeholders[6] representing numerous perspectives on the issue (and reached out to many more who opted not to participate in meetings[7]) to provide an opportunity for open discussion and time to ask questions of

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[3] WDFW. 2021. Audio recording of April 5, 2021 FWC Wolf Committee meeting. Available at https://sapublicsitedata01.blob.core.windows.net/dfwpublicdata/meetings/2021/04/20210405_01.mp3.

[4] WDFW. 2021. Wolf-livestock Conflict Deterrence Commission Rule making presentation. Available at https://wdfw.wa.gov/sites/default/files/2021-07/20210706_wolf_rule_making_presentation.pdf.

[5] WDFW. 2021. Preliminary Draft Staff Report and SEPA Review Proposal for Wolf-Livestock Conflict Deterrence Rule Making. Available at https://wdfw.wa.gov/sites/default/files/about/regulations/filings/2020/20210706_draft_staff_report_sepa_review_proposal.pdf.

[6] Meetings were held with individuals representing Defenders of Wildlife, Sierra Club, Kettle Range Conservation Group, Inland Northwest Wildlife Council, Center for Biological Diversity, Western Watersheds Project, Ferry County Conservation District, Conservation Northwest, and the USDA Forest Service.

[7] In addition to making the presentation and materials publicly available online, WDFW provided these materials to the Washington Cattlemen's Association, the Washington Farm Bureau, Stevens County Cattlemen, and Cattle Producers of Washington via email to ensure they received them and had the opportunity to distribute them to their respective memberships. WDFW reached out to the Washington Cattlemen's Association, the Washington Farm Bureau, Stevens County Cattlemen, and Cattle Producers of Washington to offer meetings with WDFW staff early in the rule development process to discuss ideas and hear input from the membership of these groups. WDFW did not receive any feedback as a result of this invitation.

Department staff about the rule process and ideas. Department staff used the insights gathered during meetings with stakeholders to inform the rule drafting effort as well as the environmental analysis.

3.0. General overview of comments. WDFW sought SEPA comments through posting of the SEPA determination and supporting documents on its webpage and Ecology's SEPA Register, direct email notification to tribes and agencies with jurisdiction, and news releases, in accordance with WACs 197-11-510 and 220-600-150. The public was also directed in the CR-102 published in the Washington State Register (WSR 22-05-092) to submit written comments applicable to the proposed APA rule change to a specific web portal (https://publicinput.com/WolfConflictDeterrence102, WolfConflictDeterrence102@PublicInput.com), and again provided information on submitting SEPA-related comments to a separate SEPA portal (https://publicinput.com/SEPAWolfConflictDeterrence, SEPAWolfConflictDeterrence@PublicInput.com). Commenters also had an option to present oral comments on the proposed rule at a public hearing on April 8-9, 2022.

Despite the distinction between the SEPA process and the APA-governed process pertaining to proposed rule changes, few responders observed this thematic separation in their comments. Many comments contained general suggestions on what should or should not be permitted in rule. Often commenters did not reference any document to which their comments were directed, and WDFW could not determine whether these suggestions were directed at the proposed WAC amendment, proposed new WAC, DSEIS, or some combination. Therefore, although WDFW has described comments below according to how they were received, WDFW has reviewed all comments received regardless of their mode of submission and considered them as they appear to pertain to the rule change/new rule and/or environmental impacts associated with other aspects of the proposed non-project action, or neither. Following a general summary of the number, mode, and types of comments, this Response reflects WDFW's consideration of these comments at a more granular level.

In sum, WDFW received three types of comments (those indicating some form of agreement or lack thereof and/or detailed written recommendations): 1) SEPA-associated comments (over 7,500 responses); 2) CR-102-associated comments (over 2,600 responses), and 3) FWC briefing-associated comments (25 responses), for a total of over 10,200 submissions. These submissions came from private individuals, non-governmental organizations (NGOs) or advocacy groups, county commissions, county conservation districts, elected officials, and one tribe.

3.1. SEPA-associated comments. WDFW sought comments on the SEPA determination and the DSEIS issued for the proposal. Commenters were advised that comments should be limited to the adequacy of the environmental documents (DS and DSEIS), the merits of the alternatives discussed, or both. WDFW received over 7,500 written submissions. Over 6,700 of these submissions were copies of or slight variations of one form letter and over 700 submissions were copies of or slight variations of another form letter. Both form letters express general support for Alternative 3 as

presented in the DSEIS, followed by suggestions to be incorporated into rule language (but otherwise not responsive to the SEPA determination and/or DSEIS). The remaining submissions were unique, but most content of those comments were responsive to the CR-102 proposal (discussed in section 3.2. below) rather than the SEPA determination and/or DSEIS. Content from the unique comments that were responsive to the SEPA determination and/or DSEIS are summarized below with responses.

3.2. CR-102-associated comments. In the proposed rule code reviser notice, commenters were asked to comment on the proposed rule in four distinct areas: 1) proposed amendments to WAC 220-440-080, 2) new proposed section WAC 220-440-260, 3) inclusion of optional language in WAC 220-440-260 to address range riding, and 4) any general comments regarding the rule proposal. WDFW received over 2,600 written submissions on the proposed rule through the APA rule making process. Few respondents referenced the four distinct categories (or a distinction from SEPA) in their comments, and instead provided general statements of support and opposition. More than 1,800 of these submissions were copies of or slight variations of five different form letters. All five form letters were nearly identical in terms of content. Four of the five form letters expressed general support for Alternative 3 as presented in the DSEIS; all five included suggestions to be incorporated into rule language. The remaining submissions in the APA rule making comment process were unique. Comment themes in support of the rule change/new rule generally stated support for use of non-lethal conflict mitigation measures, desire that wolves and/or wildlife are prioritized, and that livestock loss is a "cost of doing business" to livestock producers. Comment themes in opposition to the rule change/new rule generally stated livestock producers should be able to protect their livestock from wolves, that new rules would place additional regulatory burden/"red tape" on livestock producers, that people and rural communities should be prioritized, and that those who support wolf recovery should be responsible for funding wolf management including non-lethal measures. Some comments also expressed general support or opposition to the inclusion of range riding language. If the FWC votes to approve the proposed WAC amendment/new WAC, WDFW will respond to the APA proposed rule change/new rule comment themes in a "Concise Explanatory Statement" before filing the adopted rule with the code reviser (*see* RCW 34.05. 325(6)).

3.3. Comments received at FWC briefing on April 8-9, 2022. 25 individuals provided oral public testimony at this briefing, which was recorded. WDFW subsequently replayed and summarized this testimony.

4.0. Classification of comments. In light of the voluminous comments related to the Draft SEIS and the alternatives considered, WDFW summarized and grouped comments into 11 general categories, including consideration of scientific literature suggested by commenters (Table 1). WDFW strived to represent comments accurately, but generalizations are inherent in these summaries. WDFW notes additional comment detail in some of its responses, but some of the nuance present in original comments has been simplified for brevity. In summarizing some comments, WDFW included sample comment text that exemplifies a broader group of comments made by other

commenters. Names of commenters (as reported) who submitted comments through the SEPA portal during the open public comment period (February 22 to April 11, 2022) are listed in Appendix E (separate document).

5.0. Comment categories and responses.

5.1. Direction from Governor Jay Inslee to conduct rule making

Comment: Several commenters reference Governor Jay Inslee's September 2020 letter (also referenced by WDFW multiple times in the DSEIS) in which the Governor directed WDFW to initiate a new rule making relating to wolf management with the goal of instituting practices that will avoid the repeated loss of wolves and livestock in Washington.

Response: Multiple commenters conflate the directive to conduct rule making with requirements for specific outcomes (some referring to it as a "mandate"), although the Governor acknowledges in his letter that he "cannot legally prescribe the specific policies that must be included in this new rule."[8]

The stated purpose and need for rule making in the DSEIS, "instituting practices that will avoid the repeated loss of livestock to wolf depredation and wolves to subsequent agency removal in Washington," is in intentional alignment with the Governor's request, and each alternative was developed to meet the stated purpose and need.

WDFW aimed to address the Governor's four requests to the extent that the Department's mandate and statutory authority allows, while maintaining the ability to be nimble and adaptive in dealing with conflict scenarios. The ability to react to the circumstances of reality and the situation at hand are critical for mitigating wolf-livestock conflict.

5.2. WDFW's history of wolf conservation and management

Comment: Some commenters stated that formal rules are required to manage wolf-livestock conflict in a way that will minimize livestock losses while not hindering wolf recovery.

Example: "Washington's Wolf Plan aims for a restored, self-sustaining wolf population across the state. One aspect of this is managing livestock-wolf conflicts in a manner that will minimize livestock losses while not hindering wolf recovery. To appropriately reach this goal, it is required to enact rules to ensure that individuals and businesses across the state know what is required of

[8] Office of the Governor. 2020. Sept. 4, 2020 Letter from Governor Islee to Larry Carpenter. Available at https://www.governor.wa.gov/sites/default/files/Letter%20to%20DFW%20-%20Wolf%20Mgmt%20Appeal%20%28final-signed%29.pdf?utm_medium=email&utm_source=govdelivery.

them, and what deterrence measures to reduce wolf predation are successful as wolves disperse into their area" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: Although all alternatives analyzed in the SEIS are intended to minimize livestock losses and not harm wolf recovery, and this outcome could be achieved through rules, WDFW respectfully disagrees that rules are *required* to achieve the outcome desired both by the Department and the commenters ("minimize livestock losses while not hindering wolf recovery"). Section 2.1.2. describes 13 consecutive years of an average of 25% wolf population growth. A 2022 population model developed by University of Washington scientists to understand present and future population dynamics of wolves in Washington indicated "confidence that the wolf population is growing" and that Washington's wolves would eventually recolonize all suitable habitat in Washington, including the South Cascades and Olympic Peninsula.[9] Compared with other states with wolf populations, Washington has some of the lowest levels of wolf-caused depredations and subsequent wolf removals anywhere in the nation under current management practices, and wolf removals in response to livestock depredation have not hindered wolf population growth in the state.

Comment: Some commenters state that the DSEIS does not examine WDFW's own past management record that demonstrates that WDFW has managed wolves, particularly in the Colville National Forest, in bad faith. A few commenters state that WDFW has decimated the wolf population in the Colville National Forest or more generally express concern about the statewide wolf population in Washington.

Response: The DSEIS includes an extensive background section (Chapter 2) and provides a full history of every wolf lethal removal action undertaken by WDFW (section 2.1.4., Table 2). To the extent the comment generally alleges WDFW manages wolves in bad faith, WDFW respectfully disagrees and asserts that the claim is not supported.

It is inaccurate to characterize the wolf population in the Colville National Forest as "decimated." In fact, the opposite is true. The first wolf pack documented in the Colville National Forest (CNF) following wolf recolonization in Washington was documented in 2009 and consisted of 6 wolves at the end of that year. Since then, Washington's wolf population in the CNF has grown by 93%, to 87 wolves in 17 packs including 10 successful breeding pairs at the end of 2021. These figures represent ~48% of the individual wolves, ~52% of the packs, and ~53% of the breeding pairs documented statewide in the 2021 population survey; wolves in the CNF account for roughly half of all wolves in Washington.

[9] University of Washington. 2022. Present and future population dynamics of grey wolves in Washington State. Available at https://wdfw.wa.gov/sites/default/files/2022-02/11.%20WDFW_slides_Feb19.pdf.

Northeastern Washington, and the CNF in particular, have seen the most consistent and most significant population growth of any area of the state since the first pack in the CNF was confirmed in 2009.

Of note, in contrast, the first pack in the North Cascades recovery region was documented in 2008, a year earlier than the first pack in the CNF. At the end of 2021, the North Cascades recovery region had 37 wolves in 6 packs, far less growth than the wolf population in the CNF, even though those wolves have been federally protected since 2008 and not subject to any agency lethal removal.

To the extent commenters expressed general concerns about the recovery of the wolf population in Washington, those concerns are not well founded. Section 2.1.2. of the SEIS describes 13 consecutive years of an average of 25% wolf population growth. As noted above, a 2022 population model developed by University of Washington scientists to understand present and future population dynamics of wolves in Washington indicated "confidence that the wolf population is growing" and that Washington's wolves would eventually recolonize all suitable habitat in Washington, including the South Cascades and Olympic Peninsula.

5.3. Adoption of the 2011 Final Environmental Impact Statement (2011 EIS) for the Wolf Conservation and Management Plan for Washington

Comment: Some commenters state the 2011 EIS has not been updated in a decade and a "full EIS" should be completed for the proposed rule.

Example: "The Final EIS is a document that is over a decade old. It not only contains science that needs to be updated, but it is also based on conditions that may no longer exist. In order to properly apply the 2011 Final EIS to the document at hand, the Department should have gone through that document in its entirety and updated the science and added any new knowledge based on current conditions of wolf recovery in Washington, research done by the Department in the last decade or other pertinent information. Without these updates the 2011 Final EIS should not be considered entirely relevant to this rulemaking" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: The supplemental EIS adds information and analysis to supplement the information in the 2011 EIS with additional analysis specific to four wolf-livestock conflict rule making alternatives. The process used aligns with the SEPA procedures specifically contemplated in WAC 197-11-600. Adopting an existing EIS and publishing a SEIS for public comment is appropriate under SEPA (WAC 197-11-630(3)(b)). A SEIS is prepared in the same manner as an EIS with the possible exception of scoping (WAC 197-11-620).

The SEIS includes considerable updated information about wolf recovery in Washington post-2011, including wolf recolonization and population growth in Washington (section 2.1.2.), development of the Wolf-Livestock Interaction Protocol and prioritization of non-lethal conflict

mitigation tools (section 2.1.3.), agency lethal removal of wolves (section 2.1.4.), and wolf mortality, lethal removal, and population growth in Washington (section 4.2.3.).

Although multiple commenters stated that the science in the 2011 EIS needed to be updated, they included 22 publications that were older than the 2011 EIS. Thirteen of these had already been included in the 2011 EIS or DSEIS.

5.4. Science about non-lethal measures and lethal removal of wolves to mitigate livestock depredation, "best available science"

Comment: In a letter to the Commission entitled "Washington Needs Policy for Proactive Wolf-Livestock Non-lethal Practices Across Wolf Range," wolf advocates and representatives from academic institutions and environmental NGOs agreed that implementing clear and enforceable use of non-lethal practices to reduce livestock losses to wolves across the state would lead to better conflict mitigation outcomes. Commenters stated that implementing policy involving complex systems requires transparency, goodwill, and consistent governance. Commenters stated that Washington needs a rule that allows for adaptive management to adequately address conflict situations but includes clear and enforceable expectations for the appropriate use of non-lethal practices and specific triggers for lethal removal of wolves.

Example: "We attest that best available science on wolf conservation and management demonstrates the need for statewide policy outlining the use of proactive non-lethal deterrence measures across wolf range to successfully facilitate population recovery and persistence throughout Washington, and to minimize livestock losses most effectively" (Scientist letter, Washington Needs Policy for Proactive Wolf-Livestock Non-lethal Practices Across Wolf Range, April 4, 2022).

Response: WDFW agrees that "successfully implementing policy involving complex systems requires transparency, goodwill, and consistent governance." WDFW also agrees that proactive implementation of non-lethal practices to reduce livestock losses leads to better conflict mitigation outcomes. Although all alternatives analyzed in the SEIS are intended to minimize livestock losses and wolf removals, and this outcome could be achieved through rules, WDFW respectfully disagrees that rules are *required* to achieve this outcome, and that science showing effectiveness of non-lethal conflict mitigation means that regulation is the *only* way to support a proactive, non-lethal approach to wolf-livestock conflict.

Science informs policy; it doesn't dictate it. Washington's successful facilitation of wolf population recovery and expansion in the state and minimization of livestock losses and wolf removals under current practices demonstrate that formal rules are not *required* to achieve outcomes desired both by these commenters and WDFW.

The following is an excerpt from a public comment submitted by Conservation Northwest during the CR-102 open public comment period.[10] It summarizes why formal rules may serve to exacerbate conflict rather than ameliorate it:

"Based on our direct experience working with ranchers and our familiarity with the social science on human conflict over wildlife, we do not think that the imposition of formal rules will result in the best outcome for both people and wolves. In the vast majority of cases in Washington, when ranchers and their employees are provided with the right tools and financial and technical support, the implementation of non-lethal measures occurs in a manner adequate to prevent high levels of livestock loss, and the need for lethal control. Our experience working directly with ranchers has taught us that developing relationships based on trust and respect are key to willingness to try both tried and true as well as novel approaches, and to jointly problem solve when something does not work as anticipated.

While there continues to be room for improvement, we think that the current system of Wolf Advisory Group guidance and decision-making by the Director and staff, has led to a remarkably low overall level of lethal control and livestock loss compared to the Northern Rocky Mountain states and Mexican Gray Wolves in the southwest. This outcome stems from investments of public funds, work of field staff, and partnerships with local non-profits and ranchers, all in the absence of legally enforceable rules.

We recognize and share the frustrations with other conservation organizations of particular instances between 2016 and 2019 of repeated wolf removals and high rates of livestock loss. However, given the general culture of distrust of government in Northeast Washington, and the manner in which the particular situation unfolded and blew up in the press and over social media, we think there will continue to be resistance and controversy when livestock depredations occur again in the same landscape, and that formal rules will not serve to decrease the conflict. This is due to deep-seated identity conflict that is clearly present in this situation (Madden and McQuinn, 2014[11], Madden 2015[12], Zimmerman, 2020[13]). In the absence of concerted efforts among all involved to get at the underlying conflict and repair relationships, we

[10] The full comment is available at https://publicinput.com/WolfConflictDeterrence102#3.

[11] Madden and McQuinn. 2014. Conservation's blind spot: The case for conflict transformation in wildlife conservation. Biological Conservation 178:97-106.

[12] Madden, F. 2015. People and Wolves in Washington: Stakeholder Conflict Assessment and Recommendations for Conflict Transformation. Washington Department of Fish and Wildlife. Available at https://wdfw.wa.gov/sites/default/files/publications/01719/wdfw01719.pdf.

[13] Zimmermann et al. 2020. Levels of conflict over wildlife: Understanding and addressing the right problem. Conservation Science and Practice, 2(10), p.e259.

are concerned that the imposition of formal rules will only serve to exacerbate the situation, regardless of how well intended they are.

Furthermore, social science research has shown that people respond better to conservation initiatives when the systems in which they operate recognize their autonomy, enhance and affirm their competencies, and create mutual respect and trust (e.g., DeCaro and Stokes, 2008,[14] Wilson et al. 2014[15], DeCaro 2015[16], Wilson et al., 2017[13], Salvatori et al., 2020[17]). We are concerned that the imposition of a regulatory approach may result in regression of acceptance and application of proactive, non-lethal tools among ranchers who have been cooperating up to this point" (Conservation Northwest, Comments on CR-102 for Wolf-Livestock Interactions WSR 22-05-092, April 11, 2022).

In addition, a recently published study (Bogezi et al. 2021[18]) highlights barriers that hindered rancher participation in non-lethal wolf-livestock coexistence strategies, including disdain for regulation.

Comment: Some commenters state that WDFW claimed in the DSEIS that lethal control deters wolf-livestock conflict long-term, and that WDFW needs to cite science for these claims.

Examples: "WDFW must cite science for their claims that lethal control deters livestock wolf conflicts long-term must consider all relevant studies and must fully consider the applicability of the studies listed in the SEIS Works Cited" (Washington Wildlife First, Comments on Draft Supplemental Environmental Impact Statement for the Wolf-Livestock Conflict Deterrence Rule Making, April 11, 2022).

"WDFW repeatedly states that removing wolves more quickly could result in fewer removals long term. This assertion is repeated four times in the DSEIS to support the Department's

[14] DeCaro and Stokes. 2008. Social-psychological principles of community-based conservation and conservancy motivation: attaining goals within an autonomy-supportive environment. Conservation Biology 22:1443-1451.

[15] Wilson et al. 2017. Learning to live with wolves: community-based conservation in the Blackfoot Valley of Montana. Human–Wildlife Interactions 11:4.

[16] DeCaro et al. 2015. Synergistic effects of voting and enforcement on internalized motivation to cooperate in a resource dilemma. Judgment and Decision Making 10:511–537.

[17] Salvatori et al. 2020. Applying participatory processes to address conflicts over the conservation of large carnivores: understanding conditions for successful management. Frontiers in Ecology and Evolution 8:182.

[18] Bogezi et al. 2021. Ranchers' perspectives on participating in non-lethal wolf-livestock coexistence strategies. Frontiers in Conservation Science 2:1–12.

proposed alternative, but not once is any citation provided that refers to any science or other material that supports this claim" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: The Draft SEIS did not state that lethal control deters wolf-livestock conflict long-term. WDFW stated in the DSEIS (pg. 31-32), "If a rule imposes too many restrictions on when depredations count toward consideration of lethal removal and/or when lethal removal can occur, it may result in scenarios where livestock depredation cannot be addressed in a timely manner (resulting in fewer lethal removals of wolves in the short-term) and could escalate to the point of full pack removal (resulting in more lethal removals of wolves in the long-term) when removing fewer wolves early on might have mitigated the conflict."

As stated in the DSEIS (pg. 28-29), "Although wolf-livestock conflict scenarios are notoriously difficult to predict, multiple studies show that depredation risk may increase after a wolf pack has learned to prey on livestock and there is a predictable pattern of recurrence of depredations in areas with prior conflicts (Harper et al. 2005, Sime et al. 2007, Karlsson and Johansson 2010, Bradley et al. 2015, DeCesare et al. 2018, Hanley et al. 2018, ODFW 2021)." Once wolves have started depredating livestock, it can be very difficult to change that behavior, even with implementation of non-lethal measures.

Bradley et al. (2015)[19] found that full pack removal reduced the occurrence of subsequent depredations by 79% over a span of five years. Poudyal et al. (2016)[20] also showed that removal of one wolf would decrease the expected number of cattle killed the following year by 1.9%. DeCesare et al. (2018)[21] showed that removing a greater number of wolves through targeted removal in one year significantly decreased the probability of having any depredations the subsequent year.

However, to try to minimize lethal removal of wolves, WDFW practices incremental removal of wolves, typically limited to one to two individuals following a qualifying depredation event.[22] Although less effective than full pack removal, partial pack removal is most effective if conducted within the first seven days following depredation, after which there is only a marginally

[19] Bradley et al. 2015. Effects of wolf removal on livestock depredation recurrence and wolf recovery in Idaho, Montana, and Wyoming. The Journal of Wildlife Management 79:1337-1346.

[20] Poudyal et al. 2016. Wolf lethal control and livestock depredations: counter-evidence from respecified models. PLoS ONE 11(2): e0148743.

[21] DeCesare et al. 2018. Wolf-livestock conflict and the effects of wolf management. The Journal of Wildlife Management 82:711-722.

[22] WDFW. 2017. Wolf-livestock interaction protocol. Available at https://wdfw.wa.gov/sites/default/files/2020-09/20200915_wdfw_wolf_livestock_interaction_protocol.pdf.

significant difference between partial pack removal and no action, and no difference after 14 days (Bradley et al. 2015).[19] In addition, just the act of attempting to lethally remove wolves may result in meeting the goal of changing the behavior of the pack, even if no wolves are killed (Harper et al. 2008)[23]. Thus, quick action in attempting lethal removal is critical in ensuring that lethal removal, if implemented, is as effective as possible.

WDFW does not claim that lethal removal of wolves is a permanent solution to wolf-livestock conflict (indeed, no non-lethal or lethal measure will permanently resolve wolf-livestock conflict). Under current management practices, lethal removal is intended to stop a current, ongoing pattern of depredation *after* non-lethal measures have already been implemented.

Comment: Some commenters stated that implementing lethal removal quickly does not incentivize proper implementation of non-lethal deterrence measures, and that the timing of killing wolves quicker can have impacts on recruitment, pack dissolution, can affect vulnerable pups during breeding season, and can encroach on den and rendezvous sites.

Examples: "WDFW acknowledges that packs that have lost breeders "exhibit lower denning and recruitment rates." In fact, WDFW has removed breeders in at least six out of 10 lethal removal operations from 2017-2021 as reported in their annual reports. However, the unsupported statements about removing wolves more quickly fail to acknowledge the impacts this could have on pack size, pack dissolution, reduced recruitment and how these affect recovery statewide" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

"Moving to incremental lethal control quicker often means killing wolves earlier in the spring and summer which has a higher risk of impacting recruitment and pack dissolution. This puts breeding adults and wolf pups at risk during their most vulnerable denning (mid-April – mid-June) and rendezvous site periods (mid-June – mid-September) before pups are large enough to travel significant distances" (Defenders of Wildlife, RE: Comments for the draft State Environmental Impact Statement amending the Washington Administrative Codes to require use of non-lethal techniques to reduce wolf-livestock conflict, April 4, 2022).

"Moving to lethal control quicker in a conflict situation will not incentivize higher standards for proactive non-lethal measures. Why would a producer put in a significant effort if they only have to experience 1 depredation to receive agency-sponsored lethal control?" (Defenders of Wildlife, RE: Comments for the draft State Environmental Impact Statement amending the Washington Administrative Codes to require use of non-lethal techniques to reduce wolf-livestock conflict, April 4, 2022).

[23] Harper et al. 2008. Effectiveness of lethal, directed wolf-depredation control in Minnesota. The Journal of Wildlife Management 72: 778-784.

Response: No alternative suggests implementing lethal removal after a single depredation. Under current management practices and all alternatives analyzed in the SEIS, lethal removal is only considered *after* non-lethal measures have already been implemented.

"WDFW would potentially be able to remove wolves in early stages of conflict before high numbers of livestock depredations occur" (DSEIS, pg. 30) simply refers to attempting lethal removal within 14 days of a qualifying depredation to maximize effectiveness of a lethal removal action.[9] WDFW is not sure how commenters reached the conclusion that killing wolves within 14 days of a qualifying depredation would have impacts different from those explored in section 4.2. of the DSEIS. Impacts of lethal removal on pack size, pack dissolution, recruitment, and effect on recovery statewide are discussed extensively in section 4.2. of the SEIS.

"Moving to incremental lethal control quicker" is in direct response to when depredations occur, not to a specific time of year. Although depredations have occurred year-round in Washington, most occur in August and September, not in spring or summer.

Comment: A comment stated that an analysis based on Washington's wolf depredation and lethal removal data found that there is no statistically significant difference in the length of time between depredations when the reaction is no lethal removal, partial pack removal, and full pack removal.

Example: "An independent analysis done based on all of Washington's publicly available wolf depredation and lethal removal data, found that statewide there is no statistically significant difference in the length of time between depredations when the reaction is no lethal removal, partial pack removal, and full pack removal. In taking a closer look at the wolf packs in Washington that had multiple instances of depredation and lethal removal, there was only one pack where there was a significant difference in time between depredations between no pack removal and partial pack removal. This was the Togo pack and the time between depredations was longer when there was no lethal removal. Had the Department taken the time to do similar analysis, it would have become clear that significant changes must be made" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: WDFW was unaware of the "independent analysis" referred to by commenters and they did not submit it as public comment or part of the rule making record. Without knowing how the data was analyzed, the information presented by commenters is not informative. Lethal removal as a factor potentially influencing time between depredation events is ultimately only correlative without that context. WDFW finds it difficult to understand how there was a large enough sample size of full wolf pack removals, partial wolf pack removals, and no wolf removal events to constitute a statistically relevant sample size for such an analysis, particularly if all of the potentially confounding factors (e.g., livestock producer, territory, individual wolf pack, season, etc.) are properly accounted for in the analysis. Indeed, this is why studies of the effectiveness of lethal removal events are challenging to conduct and is discussed in further detail in regard to Bradley et al. 2015 (Table 1).

Comment: Commenters believe WDFW should conduct localized research on the effectiveness of non-lethal deterrence measures and lethal removal.

Example: "Additional scientific studies have found that lethal removal has the most variability in success when compared to the implementation of proactive nonlethal measures. Again highlighting the need for a full assessment into whether lethal removal is having the effect that the Department continually claims that it does. By continuing to claim that lethal wolf removal is an important tool based in science without actually having the information to back that up, the Department further alienates the majority of Washingtonians that question why wolves continue to be killed year after year with no substantive on the ground changes" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: WDFW agrees that collecting data on the efficacy of non-lethal measures deployed in Washington is an important step. WDFW is currently a partner and data contributor to two such studies, one evaluating the effectiveness of range riding practices and another on the effectiveness of radio-activated guard (RAG) boxes.

Collecting data on lethal removal is challenging for reasons discussed in regard to Bradley et al. 2015 (Table 1). Robust research on lethal removal events requires a large enough sample size of full wolf pack removals, partial wolf pack removals, and no wolf removal events to constitute a statistically relevant sample size for such an analysis. A large sample size of lethal removal events is not a desired outcome of this rule making.

WDFW reviewed and discussed a large body of recent science (Appendices A and B) focused on the effectiveness of non-lethal and lethal measures for mitigating wolf-livestock conflict. A common theme throughout the studies on the effectiveness of non-lethal deterrence measures is that no single deterrence measure or combination of deterrence measures can guarantee there will be no wolf-livestock conflict. Another common theme from the studies is that proactive, non-lethal methods are recommended, with lethal removal being a last resort, and that if lethal removal is implemented, it should be deployed within a short period of time of the most recent depredation.

Department biologists provided an overview of relevant or recently published peer-reviewed manuscripts related to wolf management to the Fish and Wildlife Commission and the public to increase the awareness of the scientific information available and increase transparency on how science informs the Department. Presenters discussed the body of science, strengths and weaknesses of each publication, and the role that this science plays in WDFW's decision making.

This review included a public briefing for the Fish and Wildlife Commission (summary, presentation, audio recording) on February 10, 2017.[24]

5.5. Alternatives, analysis of alternatives, and consideration of environmental impacts

Comment: Many commenters expressed their preference for a specific alternative(s). Many comments expressed general support for Alternative 2 as presented in the CR-102; many comments (including most copies of form letters) expressed a preference for Alternative 3; many comments expressed support for Alternative 4 (or no action).

Response: WDFW acknowledges and appreciates the wide range of views on what various commenters would consider their own preferred alternative. WDFW continues to view Alternative 2 as the preferred alternative for the reasons set forth in the CR-102:

WDFW's recovery efforts for wolves, guided principally by the 2011 Wolf Conservation and Management Plan (Wolf Plan) and the 2017 Wolf-Livestock Interaction Protocol (Protocol), have resulted in some of the lowest levels of documented livestock depredation and subsequent wolf removals in the nation. Although the implementation of the Wolf Plan and Protocol have resulted in successful wolf-livestock conflict mitigation in most occupied wolf territory, no document or rule can or does account for every scenario in which WDFW must exercise discretion.

Alternative 2 aims to specifically address the challenge of areas that have experienced recurrent and significant levels of livestock depredation and subsequent wolf removals, situations not already addressed by the Wolf Plan or Protocol. This alternative also maintains the flexibility and discretion necessary to remain nimble and adaptive in dealing with ongoing wolf-livestock conflict scenarios as they unfold. Alternative 2 would focus limited WDFW staff time, livestock producer time, and resources to areas where the most livestock and wolf loss has occurred in the state, with the goal of instituting practices that will avoid the repeated loss of wolves and livestock in Washington. Although Alternative 2 has expectations for non-lethal deterrence measures, these measures are not overly prescriptive to the point that funding is not sustainable, the number of agency staff is insufficient to meet standards set forth in rule, or costs are untenable for small businesses.

Regardless of WDFW's preference, decision makers may take action to pursue a rule based on one of the other alternatives or combination of alternatives. As stated in the DSEIS (pg. 14), "The final action taken by the WDFW Fish and Wildlife Commission may not be identical to any single alternative; the WDFW Fish and Wildlife Commission may choose a hybrid approach that

[24] WDFW. 2017. February 10-11, 2017 Fish and Wildlife Commission meeting agenda. Available at https://wdfw.wa.gov/about/commission/meetings/2017/february-10-2017-meeting-agenda.

combines components of different alternatives, and/or more and less restrictive expressions of the components to best meet the environmental, social, economic, and political needs of the rule making."

Comment: Some commenters assert that the analysis of alternatives in the Draft SEIS is inadequate and contains assertions without supporting information and analysis.

Example: "WDFW wrongfully states that each alternative would likely result in the same number of wolves being killed annually, while failing to take responsibility for its part in the killing. The intent of this rulemaking is to yield an outcome that results in fewer wolves killed annually. If no alternatives address the intent of the granted petition for rulemaking then WDFW must provide further alternatives. WDFW must also use its historic records to fully consider the environmental impacts in each alternative" (Washington Wildlife First, Comments on Draft Supplemental Environmental Impact Statement for the Wolf-Livestock Conflict Deterrence Rule Making, April 11, 2022).

Response: WDFW respectfully disagrees that the Draft SEIS did not properly analyze the alternatives. The examination of Washington's 14 years of wolf population data and management actions provided in the SEIS (sections 2.1.2., 2.1.4., and 4.2.3.) show that the percentage of wolves lethally removed in Washington (an average of 3.6% of the population each year) in response to conflicts with livestock has not negatively affected Washington's wolf population growth or sustainability, and that in fact the population has experienced robust growth (averaging 25% annually) and continued expansion across the state. Similarly well-documented in other states and explored in section 4.2.1. of the SEIS, lethal removal of wolves in response to livestock depredations has not had significant effects on recovery or continued viability of wolves in the western United States and Great Lakes wolf metapopulations.

As stated in the DSEIS (pg. 28), "Because many components of the proposed alternatives are already current practice for WDFW, levels of wolf mortality associated with agency lethal removal are likely to be similar to the current conditions (described below under the No Action Alternative) under all alternatives." WDFW has removed an average of 3.6% of the wolf population each year in response to livestock depredation. This baseline is already so low it is unlikely that any alternative will drastically lower that percentage, and the current percentage has had no documented effect on wolf recovery in the state (such that an even lower percentage is not likely to make a discernable difference in population trend). This idea is fully explored in section 4.3. of the SEIS.

Comment: Some commenters state that no alternatives proposed in the DSEIS meet the stated purpose and need for rule making.

Example: "None of the Alternatives presented in this DSEIS meet the objective stated in purpose and need. The proposed WAC, 220-440-260, derived from the DSEIS fails to reduce the need for lethal removal of gray wolves.

The Summary of Impacts, and Section 4.3 Comparison of impacts on wolves associated with each alternative in the Draft SEIS clearly state that none of the current Alternatives meet the purpose and need outlined in the DSEIS and requested by Governor Inslee and the citizens of Washington as outlined in the Petition" (Kettle Range Conservation Group, RE: Comment Wolf-Livestock Conflict Deterrence Rule Making: DRAFT Supplemental Environmental Impact Statement; WAC 220-440-260, April 6, 2022).

Response: WDFW respectfully disagrees with the commenter's interpretation of the analysis of alternatives. The SEIS explains that alternatives 2 and 3 could conceivably result in fewer lethal removals. However, because current frequency of lethal removal is already very low under the no action alternative, any change in frequency of lethal removal associated with the other alternatives will not materially impact the ongoing growth of the wolf population in Washington. As a result, none of the alternatives impose substantial, adverse impacts on the wolf population.

Although section 4.4. of the DSEIS (pg. 32-33) states, "None of these alternatives would preclude the consideration of lethal removal of wolves entirely. Because many components of the proposed alternatives are already current practice for WDFW, levels of wolf mortality associated with agency lethal removal and associated impacts are likely to be similar to the current conditions under all alternatives. All alternatives will likely result in levels of lethal removal comparable to previous years in Washington and no alternative is likely to have negative effects on the recovery, population growth, and long-term sustainability of wolves in the state…" It goes on to state the following:

"There is an inherent aspect of uncertainty about the environmental impacts of each alternative given the fact-specific nature of wolf-livestock conflicts. Because Alternatives 2 and 3 require the development of area-specific, proactive conflict mitigation plans in areas where wolf-livestock conflict has repeatedly occurred in Washington, these alternatives may result in fewer wolf removals than Alternative 1 and the No Action Alternative. Alternative 3 is the most prescriptive of the four alternatives and would include the most specific expectations for use of non-lethal and lethal measures to mitigate wolf-livestock conflict, but broadly prescribed measures (outside of area-specific conflict mitigation plans) that are not scenario-specific may not actually result in less wolf-livestock conflict and resultant wolf removals. Higher thresholds at which lethal removal of wolves can be considered in Alternative 3 may result in fewer wolf removals in the short-term, but may ultimately allow wolf-livestock conflict to escalate (ODFW 2021) and not reduce wolf removals in the long-term. Alternative 2 may result in lethal removal of wolves more quickly than what is considered in other alternatives, but could result in fewer wolf removals long-term if depredations are addressed quickly."

Comment: Some commenters state that WDFW must consider an alternative where no lethal removal of wolves is considered at all, or no lethal removal of wolves on public lands is considered.

Response: The stated purpose and need for rule making in the SEIS, "instituting practices that will avoid the repeated loss of livestock to wolf depredation and wolves to subsequent agency

removal in Washington," is in intentional alignment with the Governor's request, and each alternative was developed to meet the stated purpose and need. An alternative that does not include lethal removal of wolves likely would not avoid repeated loss of livestock (see pg. 32 of the DSEIS for a relevant example from Oregon) and thus would not meet the purpose and need for rule making.

Focusing on public lands would not meet the stated purpose and need of this rule making. Wolves occupy a patchwork landscape of different land ownerships in Washington; a single pack territory in the state likely encompasses both public and private land. As stated in the DSEIS (pg. 9), "Depredation incidents occur almost evenly across public and private land (including private industrial timber land), with an average of 51% of incidents occurring on public land from 2012 – 2021."

In addition, lethal removal is already not considered in most of Washington. As stated in the DSEIS (pg. 9), "WDFW only considers lethal removal of wolves in the area of the state where the gray wolf is not listed as endangered or threatened under the federal Endangered Species Act (as of February, 10, 2022, wolves are federally delisted in Washington east of Highway 97 from the British Columbia border south to Monse, Highway 17 from Monse south to Mesa, and Highway 395 from Mesa south to the Oregon border, and are federally listed west of these highways)." This area comprises most of the state as well as the recolonizing front of Washington's wolf population. Washington's wolf population was recently federally delisted statewide for approximately 13 months, and WDFW did not consider or conduct any lethal removal of wolves in the western two-thirds of the state.

Comment: Some comments state that the 2017 Protocol, the Wolf Advisory Group's work on chronic conflict areas, and/or the no action alternative in the DSEIS do not adequately address areas of chronic conflict.

Example: "The 2017 Protocol and the WAG's subsequent work also does not adequately address areas of chronic conflict. The draft language produced by the WAG does not include any requirements for the implementation of nonlethal deterrents in what the WAG is calling "special focus areas." All it says is that those involved must make a "good faith effort" to implement the conflict mitigation plans. This does not provide any more incentive for livestock producers to implement nonlethal deterrence measures than exists in the rest of the state. As has been repeatedly stated, these areas of chronic conflict exist because something that is being done is not working. The WAG's suggested management for "special focus areas" does not provide any substantive changes and will therefore not result in any different outcomes" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: WDFW agrees that the 2017 Protocol and the WAG's subsequent work also does not adequately address areas of chronic conflict. This topic is discussed in section 2.1.5. of the DSEIS, "The Wolf Advisory Group and focus on areas of chronic conflict." Alternatives 2 and 3 in the SEIS

include provisions for areas of chronic conflict (SEIS section 3.2., Table 3, "Area-specific proactive conflict mitigation plans").

5.6. Comments on SEIS Alternative 2

Comment: Some commenters state that a focus on chronic conflict areas is not adequate to reduce livestock depredation and wolf lethal removals.

Example: "Overall, the proposed rule as presented in the DSEIS has several major flaws. First, the focus on chronic conflict areas is not adequate to reduce livestock depredation and wolf lethal removals. Because conflict can occur anywhere that wolves and livestock both live on the landscape, failing to provide specific expectations for nonlethal deterrence measures outside of chronic conflict areas will undoubtedly result in continued conflicts and subsequent lethal removals, failing to meet the purpose of rulemaking and the request from Governor Inslee" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: The SEIS does not propose a rule; rather, it presents four alternatives for consideration by decision makers. WDFW presumes commenters are referring to Alternative 2, the agency's preferred alternative, as indicated in the SEIS. Specific guidance for nonlethal deterrence measures outside of chronic conflict areas are provided in the 2017 Wolf-Livestock Interaction Protocol as described in section 2.1.3. of the SEIS. In addition, proposed changes to WAC 220-440-080 (which would apply statewide) would require that, to authorize lethal removal of wolves, the WDFW director (or WDFW staff designee) would need to confirm an owner of domestic animals has proactively implemented appropriate non-lethal conflict deterrence measures.

Comment: Some commenters stated that the preferred alternative fails to provide clear parameters for which areas will qualify as areas of chronic conflict.

Response: As stated in the DSEIS (pg. 15), areas of chronic conflict as described in Alternative 2 are defined as "pack territories (or a portion thereof) where wolf depredations of livestock occurred and lethal removal of wolves was authorized in two of the last three years."

Comment: Some commenters preferred specific thresholds of depredation at which WDFW would consider lethal removal of wolves.

Example: "The proposed alternative has no threshold, allowing Department staff to set a lethal removal threshold for each individual chronic conflict area and leaving areas not defined as such with no guidance. In the Draft SEIS, the Department claims that this will allow them to "remove wolves in early stages of conflict," which does not meet the goal of rulemaking and also does not allow for any reactive nonlethal deterrence measures to work. This statement implies that the Department would likely shift tactics to lethal removal after just one or two depredation events, a

drastic shift from current practices. Additionally, this lack of a threshold for lethal removal does not outline expectations OR requirements and does not have a place in a rule" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: There are four alternatives presented in the SEIS, two of which (Alternatives 1 and 3) specify depredation thresholds for consideration of lethal removal of wolves in rule and two of which (Alternatives 2 and 4) specify them as guidance (SEIS section 3.2., Table 3, "Depredation thresholds for consideration of lethal removal of wolves specified in rule").

WDFW presumes commenters in the example are referring to Alternative 2, the agency's preferred alternative, as indicated in the DSEIS. It is not clear why commenters state Alternative 2 "does not meet the goal of rulemaking and also does not allow for any reactive nonlethal deterrence measures to work." As stated in the DSEIS (pg. 15), a rule based on Alternative 2 would state that in order to consider lethal removal in chronic conflict areas, WDFW and livestock producers must substantially comply with the expectations for the use of specific non-lethal deterrence measures established in each area-specific conflict mitigation plan. All alternatives contain the provision that lethal removal would be predicated on the use of non-lethal conflict deterrence measures as set out in rule (SEIS section 3.2., Table 3, "Lethal removal predicated on use of nonlethal tools").

Comment: Some commenters state that Alternative 2 has no requirements for the use of nonlethal deterrence measures, and that it should have requirements.

Example: "There are no requirements for the use of nonlethal deterrence measures. Even within the chronic conflict zones, there are no requirements despite Governor Inslee explicitly requesting that the rule contain, "requirements for use of non-lethal deterrents most appropriate for specified situations." While we agree that having an arbitrary number and kind of nonlethal deterrence measures in place will not achieve the desired outcome of reducing wolf-livestock conflict, we do not agree that completely abandoning any requirements for the use of nonlethal deterrence measures is the better approach" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: As stated in section 2.1.1. of the DSEIS, WDFW's enabling statutes authorize broad discretion to manage wildlife; they do not generally authorize WDFW to mandate, regulate, or enforce animal husbandry practices. As such, WDFW cannot create requirements for livestock producers. WDFW can develop expectations livestock producers are expected to follow if WDFW is going to use its authority to kill wolves in response to livestock depredations. All alternatives provide general expectations for non-lethal deterrence measures; Alternatives 2 and 3 prescribes specific proactive non-lethal measures that should be in place prior to the consideration of lethal removal of wolves; all alternatives predicate lethal removal of wolves on the use of non-lethal tools.

In addition, proposed changes to WAC 220-440-080 (which would apply statewide) would require that, to authorize lethal removal of wolves, the WDFW director (or WDFW staff designee) would need to confirm an owner of domestic animals has proactively implemented appropriate non-lethal conflict deterrence measures.

Comment: Some commenters felt that Alternative 2 did not contain any compliance measures or adequate compliance measures, and in some cases, made specific suggestions for rule language.

Comment: "It would seem that a compliance measure would be simple to include; if a livestock producer has not implemented the appropriate nonlethal measures for at least fourteen days prior to a depredation incident, then the Department will not count that towards the lethal removal threshold" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: As stated in the DSEIS (pg. 15), under Alternative 2, "the rule would state that in order to consider lethal removal in chronic conflict areas, WDFW and livestock producers must substantially comply with the expectations established within the conflict mitigation plan. The rule would outline the subject matter that must be addressed in a conflict mitigation plan and the processes WDFW would use in adopting a conflict mitigation plan. The rule may establish minimum substantive requirements that would be contained in a conflict mitigation plan."

Comment: Some commenters stated that Alternative 2 enables the Department to exclude "unwilling" producers from chronic conflict area designation.

Response: The sentence referenced by commenters in the DSEIS (pg. 15), "WDFW would author the conflict mitigation plans in consultation with willing, affected livestock producers," does not imply that "unwilling" producers are excluded from conflict mitigation plans. It simply means that willing producers will have the opportunity to have input on plan drafting and development, and unwilling producers, by their own choice, will not. Expectations for affected livestock producers, willing or not, would be developed under this alternative.

Comment: Some commenters questioned how WDFW will hold producers accountable to conflict mitigation plans and ensure that the plans include clear and enforceable measures.

Response: As stated in section 2.1.1. of the DSEIS, WDFW's enabling statutes authorize broad discretion to manage wildlife; they do not generally authorize WDFW to mandate, regulate, or enforce animal husbandry practices. As such, WDFW cannot create requirements for livestock producers. WDFW can develop expectations livestock producers are expected to follow if WDFW is going to use its authority to kill wolves in response to livestock depredations, and all alternatives do so.

Comment: Some commenters expressed a preference that WDFW's preferred alternative would not leave discretion to WDFW and the Director in wolf-livestock conflict decision-making.

Response: WDFW believes discretion is critical when addressing dynamic scenarios. The ability to react to the circumstances of reality and the situation at hand are critical for mitigating wolf-livestock conflict effectively and efficiently.

Comment: Some commenters believe Alternative 2 is reactive in nature and will lead to higher wolf mortality.

Example: "Alternative 2 will likely lead to higher wolf mortality because if WDFW waits 2 or 3 years before implementing appropriate non-lethal measure with clear and enforceable stipulations then the different or additional non-lethal measures prescribed by the CMP may not change wolf behavior and lead to full pack removal, particularly if WDFW doesn't wait at least 2 weeks for new non-lethals to work and has a lower threshold for lethal control in the CMP. CMPs are, by definition, reactive. Being truly proactive with the implementation of non-lethals with the CMP, as suggested in Alternative 3, is more likely to prevent depredations from the start and prevent both additional livestock losses to wolves and lethal removal of wolves" (Defenders of Wildlife, RE: Comments for the draft State Environmental Impact Statement amending the Washington Administrative Codes to require use of non-lethal techniques to reduce wolf-livestock conflict, April 4, 2022).

Response: WDFW respectfully disagrees. This comment presumes that implementation of appropriate non-lethal measures would not occur in the absence of a conflict mitigation plan, which does not reflect our experience in most wolf-livestock conflict scenarios in Washington, nor does it reflect the provisions laid out in the DSEIS alternatives. Alternative 2 is intended to focus on scenarios where non-lethal measures have previously been implemented, have not resolved wolf-livestock conflict, and lethal removal has been authorized in prior years (highlighting where WDFW's typical approach has not resulted in the intended outcome). All alternatives provide expectations for non-lethal deterrence measures and consider lethal removal only as a last resort after non-lethal measures have been implemented.

Comment: Some commenters stated that a rule that only applied to areas of chronic conflict areas would not be adequate to address wolf-livestock conflict outside these areas and/or that focusing on chronic conflict areas does not prepare the state for the future of wolf recovery and areas where wolves might be newly establishing will be left vulnerable.

Examples: "The Department must adopt a rule that applies statewide, and the preferred alternative does not include any language to address wolf conflicts beyond chronic conflict areas. The Department must clearly define how it will designate areas of chronic conflict and address the limited geographic scope. And the Department must provide language to address potential and ongoing livestock wolf conflict both proactively and reactively statewide. The preferred alternative also fails to include any proactive deterrence in areas of suitable wolf habitat" (Washington Wildlife First, Comments on Draft Supplemental Environmental Impact Statement for the Wolf-Livestock Conflict Deterrence Rule Making, April 11, 2022).

"Policy and management guidance are equally important in currently unoccupied wolf habitat, since dispersing wolves will soon travel through and establish packs in areas where livestock producers have not lived with wolves for decades" (Scientist letter, Washington Needs Policy for Proactive Wolf-Livestock Non-lethal Practices Across Wolf Range, April 4, 2022).

Response: First, there are four alternatives presented in the DSEIS, three of which have provisions that apply statewide and are not solely focused on chronic conflict areas (DSEIS section 3.2., Table 3, "Geographic scope"). The final action taken by the WDFW Fish and Wildlife Commission may not be identical to any single alternative; the WDFW Fish and Wildlife Commission may choose a hybrid approach that combines components of different alternatives, and/or more and less restrictive expressions of the components.

WDFW agrees that "policy and management guidance are equally important in currently unoccupied wolf habitat, since dispersing wolves will soon travel through and establish packs in areas where livestock producers have not lived with wolves for decades," and WDFW already has such policy and management guidance. A rule focused on chronic conflict areas does not reflect the totality of all wolf conservation and management in the state and does not limit the scope of non-lethal conflict prevention measures. Rather, it would be additional regulation intentionally focused to address the specific scenarios where most wolf-livestock conflict in the state have occurred, namely "a situation where chronic depredations and lethal removals have occurred in the same territory for multiple years" (DSEIS, pg. 10), situations that "do not neatly fit the guidance set out in the Protocol" (DSEIS, pg. 10). WDFW has guiding documents that apply to wolf conservation and management statewide and create expectations for proactive non-lethal conflict deterrence measures, namely the 2011 Wolf Conservation and Management Plan the 2017 Wolf-Livestock Interaction Protocol as described in section 2.1.3. of the DSEIS. WDFW has a Wildlife Conflict program that employs Wildlife Conflict Specialists statewide, including areas that do not yet have wolves but likely will have them in the future, who work with landowners and domestic animal owners both proactively and reactively to prevent and mitigate human-wildlife conflict and on cost-sharing non-lethal conflict prevention strategies.

Third, lethal removal is already not considered in most of Washington. As stated in the DSEIS (pg. 9), "WDFW only considers lethal removal of wolves in the area of the state where the gray wolf is not listed as endangered or threatened under the federal Endangered Species Act (as of February, 10, 2022, wolves are federally delisted in Washington east of Highway 97 from the British Columbia border south to Monse, Highway 17 from Monse south to Mesa, and Highway 395 from Mesa south to the Oregon border, and are federally listed west of these highways)." This area comprises most of the state as well as the recolonizing front of Washington's wolf population. Washington's wolf population was recently federally delisted statewide for approximately 13 months, and WDFW did not consider or conduct any lethal removal of wolves in the western two-thirds of the state.

Comment: "A new wolf pack established in a new area and several depredations occurred, eventually resulting in the lethal removal of two wolves from the new pack. Had more specific statewide standards been in place, the livestock producers operating in the area of new wolf

activity could have been better prepared to begin implementing nonlethal deterrence measures as soon as the new wolves were detected in the area. This scenario is likely to occur anytime wolves move into a new area and livestock producers are unprepared. By moving forward with a rule that does nothing to address this situation - that is more of a likelihood than just a possibility -, the Department is setting the stage for more livestock depredations, more resulting lethal removal actions, and therefore more frustrated people on all sides" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: WDFW respectfully disagrees that "more specific statewide standards" alone would have changed this challenging situation. Although this particular wolf pack newly established, it was not in an area of the state unoccupied by wolves where livestock producers were inexperienced with wolf-livestock conflict. The livestock producer in question has long grazed cattle in wolf territories and is well-versed in implementation of non-lethal conflict deterrence measures. In fact, the livestock producers affected by livestock depredation from this wolf pack deployed several.[25] WDFW already has an expectation of daily to near daily range riding for dispersed grazing operations (Protocol, pg. 8-9). The producer referenced by commenters expressed willingness to use range riders and requested a WDFW-contracted range rider prior to experiencing depredation. Efforts were made by both the producer and WDFW staff to solicit one, but none were available in the affected area. Ongoing labor shortages in southeast Washington made hiring additional hands challenging. In this specific scenario, incremental lethal removal of two wolves, considered as a last resort after non-lethal measures did not prevent additional depredations, stopped the pattern of livestock depredation that was ongoing at that time, and the pack remained in place and was considered a successful breeding pair at the end of 2021.[26]

5.7. Comments on Petition and/or SEIS Alternative 3

Comment: Some commenters stated that WDFW did not adequately consider or assess rule language presented in the "Petition to amend the Washington Administrative Code to require use of nonlethal techniques to reduce livestock-wolf conflict" ("Petition") sent to the Fish and Wildlife Commission on May 11, 2020.

Response: WDFW incorporated Petition ideas and language in Alternative 3. As stated and explored in the DSEIS (pg. 16), "Under Alternative 3, WDFW would develop a rule similar to the proposed rule attached to the Petition, which would codify in rule criteria for the use of non-

[25] WDFW. 2021. WDFW Director authorizes lethal permits in new wolf pack territory in Columbia County. Available at https://wdfw.wa.gov/species-habitats/at-risk/species-recovery/gray-wolf/updates/wdfw-director-authorizes-lethal-permits.

[26] WDFW. 2021. Washington Gray Wolf Conservation and Management 2021 Annual Report. Available at https://wdfw.wa.gov/publications/02317.

lethal and lethal measures to mitigate wolf-livestock conflict. This alternative would be the most prescriptive of the four alternatives and would include the most specific expectations for use of non-lethal and lethal measures to mitigate wolf-livestock conflict.

Some components proposed in the Petition have been omitted from Alternative 3 because WDFW lacks the requisite statutory authority to implement the component, some components may place requirements on land managers over which WDFW does not have authority, and/or the element would be difficult or impossible to implement due to operational limitations and/or limited resources."

Comment: Some commenters stated that they support Alternative 3 being adopted as rule and that it is the only alternative that meets the stated purpose and goal of the DSEIS.

Response: As stated in DSEIS, "The alternative rule making options considered (including the no-action alternative) encompass a broad range of varying approaches that could meet the objectives of this rule making. The proposed alternatives in this Draft SEIS address specific options for analysis that are not specifically addressed in the 2011 Final EIS for the Wolf Plan. The final action taken by the WDFW Fish and Wildlife Commission may not be identical to any single alternative; the WDFW Fish and Wildlife Commission may choose a hybrid approach that combines components of different alternatives, and/or more and less restrictive expressions of the components to best meet the environmental, social, economic, and political needs of the rule making."

Comment: Some commenters stated that Petition language could have prevented the majority of agency lethal removal decisions.

Example: "The petitioner's language would have prevented 29 wolves from being killed by the Department, the Department must apply its considered alternatives to its past realities in its SEIS to analyze impacts" (Washington Wildlife First, Comments on Draft Supplemental Environmental Impact Statement for the Wolf-Livestock Conflict Deterrence Rule Making, April 11, 2022).

Response: There is no basis in fact for this comment. Wolf-livestock conflict scenarios are dynamic, and it is not known how certain management actions (e.g., not removing wolves, removing wolves more quickly, deploying range riders, etc.) would have impacted ongoing patterns of livestock depredation and resultant wolf removals.

Comment: One comment perceived that WDFW chose to use the DSEIS as an opportunity to respond to or rebut rule making language from the Petition.

Response: Discussion of WDFW's Alternative 3 was not intended as a response or rebuttal; rather, it is an analysis of whether Alternative 3 would have the potential to result in fewer lethal removals of wolves in response to livestock depredations as compared with other alternatives using factual scenarios WDFW has experienced.

5.8. Comments on Draft SEIS section 4.6.2. Unique species (listed species, candidate species, and species of concern)

Comment: "The Department mainly uses the method of shooting wolves from helicopters for lethal removal operations. As noted in the DSEIS, 30 of the wolves killed by the agency were by this method and only four were killed by the other two methods. The Department is assuming that this highly selective method of killing wolves will be the main method used going forward. However, the Department fails to meaningfully discuss the high costs of this method or the extreme danger to the people who conduct these missions and how an increasing wolf population may have impacts on availability and use of aerial gunning.

What happens when the wolf population has increased and funds are no longer available to conduct almost 90% of the state's wolf removal by aerial gunning? Why does the DSEIS not consider how a growing wolf population may require the need for other methods if the Department plans to continue killing wolves and how those methods might impact sensitive species?" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: WDFW made no such assumption "that this highly selective method of killing wolves will be the main method used going forward." WDFW did discuss the "extreme danger to the people who conduct these missions" on page 34 of the DSEIS: "However, low-level flying in small aircraft is dangerous and presents significant risk to human safety; it is the leading cause of job-related death for wildlife professionals (Sasse 2003, Conway et al. 2004)."

Costs and availability of aerial operations are not environmental impacts (though some economic impacts of the proposed rule are explored in the Small Business Economic Impact Statement[27]). However, as stated in the DSEIS (pg. 34), "If the location of the wolves and weather are favorable, aerial shooting is one of the most effective and selective lethal tools available, and depredation problems can sometimes be resolved very quickly and effectively in the short-term through aerial shooting."

[27] WDFW. 2022. Wolf-Livestock Conflict Deterrence Proposed Rule: Small Business Economic Impact Statement. Available at https://wdfw.wa.gov/publications/02311.

Of note, WDFW spent five times as much on non-lethal measures than on lethal actions in 2018[28], three times as much in 2019[29] and 2020[30], and 16 times as much in 2021.[31] As stated in the DSEIS (pg. 8), "more than 80% of the budget for wolf-livestock conflict [is] spent on non-lethal approaches."
Comment: "The DSEIS fails to properly consider how auditory attractants used for ground shooting impact other species, especially if ground shooting becomes more prevalent as the wolf population continues to grow" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022). **Response:** As discussed in section 4.6.2. of the SEIS, WDFW only employs selective lethal removal methods. As stated in the DSEIS (pg. 35), "There is virtually no risk of injuring or killing a non-target species using this method" because the shooter would not shoot a non-target species.
Comment: "The DSEIS also fails to properly explore the impacts of trapping on non-target species. Although the DSEIS mentions that traps may occasionally capture larger, non-target species there is no further discussion of this issue. Specifically, there is no acknowledgement that an increase in trapping could impact the endangered grizzly bear population" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022). **Response:** As stated in the DSEIS (pg. 34), "The action of trapping and/or lethally removing wolves, if conducted indiscriminately, could have significant impacts on endangered species such as grizzly bears and lynx. However, such impacts are not likely because WDFW's current practice of employing selective lethal removal methods (described below) avoids non-target species, makes operations as safe and effective as possible for both wildlife and people, and reduces trauma, stress, and chances of injury and/or death to captured wildlife. No impacts on non-target species have been documented related to wolf trapping and/or lethal removal conducted by WDFW in Washington to date."

[28] WDFW. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Available at https://wdfw.wa.gov/publications/02062.

[29] WDFW. 2020. Washington Gray Wolf Conservation and Management 2019 Annual Report. Available at https://wdfw.wa.gov/publications/02136.

[30] WDFW. 2021. Washington Gray Wolf Conservation and Management 2020 Annual Report. Available at https://wdfw.wa.gov/publications/02256.

[31] WDFW. 2022. Washington Gray Wolf Conservation and Management 2021 Annual Report. Available at https://wdfw.wa.gov/publications/02317.

Comment: "The DSEIS fails to consider trap injuries in the wolf population and how an increase in the use of traps could exacerbate trap injuries. There is already evidence in the state that traps have caused injury and potential death. Pursuant to public records requests, the Department provided the Center records related to a wolf death five days after that wolf had been caught in a leghold trap and immobilized via dart. The autopsy found traumatic injury to the wolf's hip and lacerations on the front digits of the foot that was caught in the trap were also recorded. An exact cause of death is not stated in these records, but it is quite probable that a violent struggle to get out of the foothold trap could have resulted in this injury. The Center is still receiving records related to this request and there may be other incidences of trapping injury or death. If the Department increases use of foothold traps for wolf capture as the population increases that will likely increase the potential for not only harm to wolves, but harm to other non-target species. The DSEIS fails to include a robust discussion of this issue and this analysis must be added prior to publication of the final DSEIS" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: WDFW appreciates and shares commenters' concern about potential injury and/or death to wildlife incidental to capture and handling events, and WDFW takes great care to mitigate this concern. The record referenced by commenters does not provide evidence that potential injury and/or death to wildlife incidental to capture and handling events is a significant environmental impact of this rule making. First, no known evidence suggests that trapping events will increase specifically as a result of this rule making effort. The assertion that trapping will increase a result of any of the rule making alternatives is speculative. Second, there is inherent risk to wildlife in any capture and/or handling event, regardless of method. Foothold ("leghold" is a misnomer) trapping of wolves has been employed by researchers for decades and innovations to reduce risk of injury to wolves have been well-studied; capture using rubber-padded foothold traps (such as those used by WDFW) are widely used and acknowledged as humane (Frame and Meier 2007).[32] Third, the DSEIS (pg. 35-36) details provisions in place for deploying wolf traps to make operations as safe and effective as possible for both wildlife and people, and to reduce trauma, stress, and chances of injury and/or death to captured wildlife. Moreover, commenters' narrative of events is inaccurate. The record referenced by commenters as "evidence in the state that traps have caused injury and potential death" is a necropsy report that suggests a recently captured wolf may have died from "traumatic injury to the right hip and subsequent infection," that would not have been the result of a foothold trap. WDFW first-hand observations indicate that the injury was believed to have been caused by a tranquilizer dart, not a trap wound (T. Roussin, personal communication). The report notes that "several digits on one of the front limbs had deep lacerations… presumed to have happened at the time of capture…". Injuries related to foothold trapping are infrequent and field personnel deploy wolf traps as described in the DSEIS (pg. 35-36) to reduce risk of injury to wolves. WDFW has not documented any wolf mortality specifically caused by foothold trapping conducted by WDFW personnel or contractors.

[32] Frame and Meier. 2007. Field-assessed injury to wolves captured in rubber-padded traps. Journal of Wildlife Management 71:2074-2076.

Comment: "The DSEIS fails to consider impacts of lead ammunition to wildlife and ecosystems. The Department mentions that they use lead shot in all aerial lethal removal operations for wolves due to lack of a better alternative. However, the DSEIS fails to consider the impact of this lead ammunition because they say all wolf carcasses are retrieved from the field and thus assume that no lead ammunition is left on the landscape. With this assertion is the Department saying they never miss a shot when conducting aerial lethal removal? The failure to analyze impacts assumes that no lead ammunition is left after performing aerial gunning – however, the Department fails to provide any support for this assertion in the document. Without the support for this assertion the Department should include an analysis of the impacts of lead ammunition on non-target species in the DSEIS" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: The SEIS analysis does not make an assumption "that no lead ammunition is left after performing aerial gunning." WDFW uses a *de minimis* amount of lead shot as part of infrequent operations. Lead shot poses the most significant danger to wildlife and people when it is ingested. A *de minimis* amount of lead shot that may be left on the ground (not in a carcass likely to be scavenged by wildlife) does not pose a significant environmental impact.

5.9. Miscellaneous topics

Comment: The Snoqualmie Tribe advised that WDFW should work with tribal and local communities to devise effective, pro-active non-lethal strategies to mitigate wolf-livestock conflict proactively. The Tribe believes lethal removal of wolves should remain available as a last resort. The Tribe stated that Alternatives 2 and 3 as presented in the DSEIS most closely align with the Snoqualmie Tribe's recommendations for the rule proposal. They expressed that as implementation of a rule occurs, flexibility provided in Alternative 2 may be useful for managers and stakeholders initially, and that perhaps after 4-5 years, more prescriptive measures as described in Alternative 3 would be preferable. The Tribe also requested continued consultation and communication regarding known wolf territories or areas with wolf presence in Washington.

Response: WDFW thanks the Snoqualmie Tribe for their perspective. WDFW agrees that we should work with tribal and local communities to devise effective, pro-active non-lethal strategies to mitigate wolf-livestock conflict proactively. WDFW is committed to continued consultation and communication with tribes about wolf presence, recovery, and management. WDFW works regularly with tribes in areas occupied by wolves and will continue to do so as wolves expand into additional areas of the state.

Comment: Multiple commenters state that a rule must have "clear and enforceable measures," "requirements," etc. and that it is within WDFW's authority to require specific non-lethal measures prior to considering lethal removal of wolves.

Response: As stated in section 2.1.1. of the SEIS, WDFW's enabling statutes authorize broad discretion to manage wildlife; they do not generally authorize WDFW to mandate, regulate, or

enforce animal husbandry practices. As such, WDFW cannot create requirements for livestock producers. WDFW can develop expectations livestock producers are expected to follow if WDFW is going to use its authority to kill wolves in response to livestock depredations. All alternatives provide general expectations for non-lethal deterrence measures; Alternatives 2 and 3 prescribes specific proactive non-lethal measures that should be in place prior to the consideration of lethal removal of wolves; all alternatives predicate lethal removal of wolves on the use of non-lethal tools.

Comment: Some commenters believe WDFW should focus on deterrence measures instead of lethal removal and include further studies in the SEIS on how human-caused mortality can impact wolf population viability.

Response: WDFW agrees that the Department should focus on non-lethal deterrence measures and does so as current practice unrelated to this rule making. All alternatives provide expectations for non-lethal deterrence measures and consider lethal removal only as a last resort after non-lethal measures have been implemented. As stated in the DSEIS (pg. 8), "WDFW focuses on promoting the proactive use of non-lethal deterrents to minimize wolf-livestock conflict and considers lethal removal as a last resort when those tools have not mitigated conflict. WDFW's spending reflects that commitment, with more than 80% of the budget for wolf-livestock conflict spent on non-lethal approaches." Effects of lethal removal on wolf population growth and viability are discussed in section 4.2.1. (SEIS, pg. 22-24) and the section already includes publications referenced by commenters (Table 1).

Comment: Some commenters believe that WDFW does not adequately consider science that shows efficacy of non-lethal conflict deterrence measures.

Example: "There is a massive body of scientific research that shows how effective nonlethal deterrence measures are when used properly. This research demonstrates that a proactive nonlethal approach to mitigate livestock-wolf conflict and reduce losses leads to better conflict mitigation outcomes. Petitioners are concerned that this body of science is not being given due weight in the rule language. Focus on nonlethal measures must be emphasized and nonlethal tools must be required" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: WDFW agrees that non-lethal deterrence measures can be effective when used properly and added language and citations to this effect in section 2.1.3. of the Final SEIS. WDFW also agrees that the Department should focus on non-lethal deterrence measures and does so as current practice unrelated to this rule making. As stated in the DSEIS (pg. 8), "WDFW focuses on promoting the proactive use of non-lethal deterrents to minimize wolf-livestock conflict and considers lethal removal as a last resort when those tools have not mitigated conflict. WDFW's spending reflects that commitment, with more than 80% of the budget for wolf-livestock conflict spent on non-lethal approaches." All SEIS alternatives provide general expectations for non-lethal deterrence measures; Alternatives 2 and 3 prescribes specific proactive non-lethal measures that

should be in place prior to the consideration of lethal removal of wolves; all alternatives predicate lethal removal of wolves on the use of non-lethal tools.

Comment: Commenters expressed a wide range of views about range riding, its effects, and whether it should be considered in rule. Some stated that range riding has proven effective; others stated that it is ineffective in stopping depredations and expensive (such that it defeats the purpose of using public lands for grazing); others stated that effectiveness of range riding should be studied further. Some commenters state that Alternative 2 should include a standardized definition and requirements for the use of range riders.

Response: As stated in section 2.1.1. of the DSEIS, WDFW's enabling statutes authorize broad discretion to manage wildlife; they do not generally authorize WDFW to mandate, regulate, or enforce animal husbandry practices. As such, WDFW cannot create requirements for livestock producers. WDFW can develop expectations livestock producers are expected to follow if WDFW is going to use its authority to kill wolves in response to livestock depredations, and all alternatives do so.

Although WDFW cannot impose standardized requirements for the use of range riders on livestock producers, WDFW agrees that range riding can be an effective way to prevent wolf-livestock conflict for dispersed grazing operations and expectations for range riding are included in all alternatives (SEIS section 3.2., Table 3, "Expectations for range riding").

WDFW is not aware of any peer-reviewed, published research on range riding; nonetheless, WDFW considered and cited three non-peer-reviewed studies that are available (Barnes 2015, Parks 2015, Louchouarn and Treves 2021; Table 1). WDFW is currently a partner and data contributor for ongoing research evaluating the effectiveness of range riding practices.

Comment: "[Nothing in the 2017 Protocol] precludes WDFW from killing pups still dependent on their parents for survival. Wolf pups should never be the target of lethal removal operations and also must be considered when lethal removal is taking place. If the Department kills the adult wolves in a wolf pack, it is also reducing the likelihood of pup survival. In 2021, the Oregon Department of Fish and Wildlife removed at least three wolf pups 6-months or younger. This type of action should be prohibited. The 2017 Protocol does nothing to address how wolf pups can be protected which is a failure of the Protocol and cannot be codified" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: WDFW thanks commenters for their perspective. It is not true that killing adult wolves always reduces the likelihood of pup survival. As stated in the SEIS (pg. 17), "Wolf pup survival is influenced by a multitude of factors, and depending on the specific scenario, lethal removal of certain pack members could reduce, enhance, or have no effect on pup survival (see section 4.2.2. of this document for further discussion). WDFW does not have the ability to know or predict definitively if lethal removal would jeopardize the survival of wolf pups."

Furthermore, as stated in the DSEIS (pg. 17), "by the time wolf pups reach 6 months old, they closely resemble adults; when wolf pups are 10-12 months old, visually distinguishing between juvenile and adult wolves is difficult or impossible at a distance (Mech 1970)." Once pups closely resemble adults, prohibiting removal of wolf pups is not a workable regulatory requirement. Moreover, removing a wolf pup does not present a different and/or more significant environmental impact than removal of an adult.

Comment: "Under current management, the Department continues to kill wolves in an unscientific manner while ignoring the desires of the majority of Washingtonians" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).

Response: A study (Duda et al. 2014)[33] found that the majority of Washington residents support wolf recovery (64%) *and* there is also a majority who support (63%) some level of lethal wolf control to protect livestock in Washington. A minority (28%) of residents oppose lethal wolf control. In any event, public opinion does not establish or eliminate significant adverse environmental impacts potentially at issue in the SEIS.

Comment: Some commenters stated a belief that prior litigation where a few individuals and non-profits filed suit against WDFW provided important context for evaluating chronic conflict.

Response: Several different Washington State Superior Court judges considered and rejected APA and SEPA claims against WDFW. To date, none of WDFW's lethal removal decisions have been found unlawful or improper in court. On the only occasion that litigation has proceeded to the merits, the court found that WDFW acted within its statutory authority and upheld the lethal removal decision. WDFW nonetheless notes that it closely considered the lengthy opinion in the last court case (Huskinson v. WDFW, King County Superior Court Cause No. 19-2-20227-1 SEA, Findings of Fact and Conclusions of Law Denying Petition for Declaratory and Injunctive Relief, dated July 23, 2020) when WDFW began piloting a draft conflict mitigation plan in 2021.

5.10. Environmental and regulatory phenomena outside scope of the proposed rule making

Comment: Commenters expressed a wide range of views about livestock grazing on public lands, and whether or not it should be permitted. Common statements among commenters supportive of grazing stated that grazing livestock on public land reduces threat of wildfires and ranchlands provide habitat for wildlife. Common statements among commenters against grazing stated that

[33] Duda et al. 2014. Washington residents' opinions on bear and wolf management and their experiences with wildlife that cause problems. Available at https://wdfw.wa.gov/sites/default/files/publications/01594/wdfw01594.pdf.

livestock grazing is detrimental to ecosystems and/or that livestock displace and/or compete with native ungulate herds.

Response: Environmental impacts related to livestock grazing on public lands are not specifically caused by this rule making. WDFW has no authority over grazing on federal public lands (e.g., the Colville National Forest). WDFW does not have the authority to award, revoke, or amend federal grazing permits. National forest lands, and the uses of them, are the purview of the U.S. Forest Service.

The WDFW Fish and Wildlife Commission's policy[34] is that livestock grazing on WDFW-owned or controlled lands may be permitted if determined to be consistent with the desired ecological conditions for those lands, or with the WDFW's Strategic Plan.[35] If permitted, grazing is integrated with other uses to ensure the protection of all resource values, the most important being the integrity of the ecosystem.

WDFW's Lands Division recently worked internally and externally to formally update livestock grazing permit activities on a subset of WDFW-managed lands. Some portions of the document underwent a public comment period as part of State Environmental Policy Act (SEPA)- and Washington Administrative Code (WAC)-associated processes. Concerns raised during the public comment periods were thoroughly explored in the Concise Explanatory Statement for Livestock Grazing on Department Lands[36] and the WDFW Response to SEPA Comments on Mitigated Determination of Non-Significance (20-043).[37]

Comment: Commenters state that the SEIS needs to consider climate change and the possibility of a reduction in wolf immigration to Washington based on wolf management practices in Idaho and Montana.

Example comments: "WDFW must examine the impacts of killing an endangered species within the greater context of climate change and the biodiversity crisis. The climate crisis has worsened over the last decade and is related to massive wildfire across wolf habitat increased pressure on

[34] WDFW. 2021. Domestic Livestock Grazing on Department Lands. Available at https://wdfw.wa.gov/about/commission/policies/domestic-livestock-grazing-department-lands.

[35] WDFW. 2020. WDFW 25-Year Strategic Plan: A Path to an Improved Era for Fish, Wildlife, and People. Available at https://wdfw.wa.gov/publications/02149.

[36] WDFW. 2021. Concise Explanatory Statement for Livestock Grazing on Department Lands. Available at https://wdfw.wa.gov/sites/default/files/about/regulations/filings/2021/grazingcessepacommentcombined_0.pdf.

[37] WDFW. 2021. WDFW Response to SEPA Comments on Mitigated Determination of Non-Significance (20-043). Available at https://wdfw.wa.gov/sites/default/files/2021-02/response_to_sepa_grazing_comments.pdf.

ecosystems, and extreme weather patterns in the state. The [DSEIS] and 2011 EIS should be updated to reflect this and how it will impact the wolf population" (Washington Wildlife First, Comments on Draft Supplemental Environmental Impact Statement for the Wolf-Livestock Conflict Deterrence Rule Making, April 11, 2022).

"The [DSEIS] and the EIS both fail to consider the impacts of increased wolf killing in the Northern Rocky Mountains including the impacts on population from dispersing wolves from the Northern Rocky Mountain Distinct Population Segment. The SEIS touches on immigration from Idaho, Wyoming and Montana. Yet the SEIS must consider how Idaho's campaign to kill 90% of its wolf population and the expansion of Montana's wolf killing opportunities will impact immigration from the two states and beyond" (Washington Wildlife First, Comments on Draft Supplemental Environmental Impact Statement for the Wolf-Livestock Conflict Deterrence Rule Making, April 11, 2022).

Response: The purpose of this SEIS is to examine potential significant environmental impacts that might be caused specifically by the proposed rule making or the considered alternatives. Climate change and potential for change in future year wolf immigration due to other states' regulatory actions are not "environmental consequences of the alternatives" (WAC 197-11-402); rather, they are baseline conditions of the affected environment that exist regardless of whether this rule making and any related actions are implemented.

However, all alternatives are designed to account for the future possibility of a high level of wolf mortality from sources unrelated to the impacts of this rule making. Section 4.5.1. of the SEIS acknowledges that "…the potential exists that WDFW may discover a higher level of wolf mortality (e.g., from causes such as disease, poaching, or tribal harvest) than was known by WDFW at the time that a decision to lethally remove wolves was made. This could result in agency lethal removal of wolves unintentionally adding to a disproportionate impact on the wolf population due to unknown mortality. The uncertainty of this worst-case scenario exists under all alternatives" (DSEIS, pg. 43). Climate change and wolf management choices made in neighboring states are additional sources of uncertainty in whether or how Washington's wolf population might be affected; however, WDFW actively monitors Washington's wolf population and conducts annual population counts and does so unrelated to any aspect of the proposed rule making. In addition, the DSEIS also acknowledges that "because of this uncertainty, all alternatives include a provision that lethal removal of wolves would be considered only if it is not expected to harm the wolf population's ability to reach recovery objectives statewide or within individual wolf recovery regions. This measure is already in practice by WDFW using empirical and predictive data each time lethal removal of wolves is considered" (DSEIS, pg. 43).

5.11. Literature listed by commenters for consideration and/or inclusion in the SEIS

Multiple commenters listed numerous publications for consideration in the SEIS. WDFW reviewed each of the studies suggested for inclusion in the SEIS by commenters (64 in total). Although multiple commenters stated that the science in the 2011 EIS needed to be updated, they included 22 publications that were older than the 2011 EIS. Thirteen of these had already been included in the 2011 EIS or SEIS. Thirty-eight were incorporated into the final SEIS. Consideration of these publications and WDFW's responses are in the table below.

Commenters list several studies (Miller et al. 2016, Treves et al. 2016, Bergstrom 2017, Eklund et al. 2017, Moreira-Arce et al. 2018, van Eeden et al. 2018, Haswell et al. 2019, Khorozyan and Waltert 2019a, Bruns et al. 2020) that aim to demonstrate the effectiveness of non-lethal measures to reduce wolf-livestock conflict. WDFW agrees that non-lethal deterrence measures can be effective when used properly. WDFW also agrees that the Department should focus on non-lethal deterrence measures and does so as current practice unrelated to this rule making. As stated in the DSEIS (pg. 8), "WDFW focuses on promoting the proactive use of non-lethal deterrents to minimize wolf-livestock conflict and considers lethal removal as a last resort when those tools have not mitigated conflict. WDFW's spending reflects that commitment, with more than 80% of the budget for wolf-livestock conflict spent on non-lethal approaches." All SEIS alternatives provide general expectations for non-lethal deterrence measures; Alternatives 2 and 3 prescribe specific proactive non-lethal measures that should be in place prior to the consideration of lethal removal of wolves; all alternatives predicate lethal removal of wolves on the use of non-lethal tools.

Commenters list several publications (Sutherland et al. 2004, Eklund et al. 2017, Lennox et al. 2018, van Eeden et al. 2018, Khorozyan and Waltert 2019, Treves et al. 2019) that conduct literature reviews on the efficacy of non-lethal and lethal conflict-mitigation measures, and conclude that most studies are retrospective, correlative, and conducted without intentional experimental design. WDFW agrees with these publications in highlighting the lack of scientific data regarding conflict mitigation measures and the extreme difficulty of designing controlled experiments in field settings with vastly varied and dynamic attributes. Treves et al. (2019) acknowledge difficulties as well: "We realize that implementing gold- and platinum-standard research in predator control will face substantial logistical, financial, and cultural barriers" (pg. 11).

One comment stated, "Many scientists are calling for more rigorous controlled experimentation to evaluate the efficacy of carnivore-livestock conflict mitigation efforts, and we recommend WDFW collaborate with interdisciplinary academic researchers and livestock producers to conduct rigorous and unbiased assessments of wolf-livestock conflict mitigation methods to guide science-based wolf management throughout the state" (Scientist letter, Washington Needs Policy for Proactive Wolf-Livestock Non-lethal Practices Across Wolf Range, April 4, 2022).

WDFW is currently a partner and data contributor to two studies designed to address these difficulties, one evaluating the effectiveness of range riding practices and another on the effectiveness of radio-activated guard (RAG) boxes. WDFW is also in the beginning stages of collaboration on a study with the University of Washington in three new methodological domains including 1) longitudinal studies of attitudes and perspectives over time in an area experiencing wolf recolonization; 2) mapping social phenomena to complement ecological understandings of

habitat suitability and connectivity; and 3) including robust understandings of attitudes and values in science communication.

Table 1. Citations listed by commenters for consideration and/or inclusion in the SEIS.

Citation	Commenter notes	Newer than 2011 EIS?	Previously included in 2011 EIS and/or Draft SEIS?	Relevance to SEIS and/or WDFW response
Adams, L. G., R. O. Stephenson, B. W. Dale, R. T. Ahgook, and D. J. Demma. 2008. Population Dynamics and Harvest Characteristics of Wolves in the Central Brooks Range, Alaska. Wildlife Monographs 170:1–25.	N/A	No	Yes – already cited in DSEIS	Already cited in DSEIS as well as Final SEIS
Akçakaya, H. R., A. S. L. Rodrigues, D. A. Keith, E. J. Milner-Gulland, E. W. Sanderson, S. Hedges, D. P. Mallon, M. K. Grace, B. Long, E. Meijaard, and P. J. Stephenson. 2020. Assessing ecological function in the context of species recovery. Conservation Biology 34:561–571.	"Use of term thrive (in 4.1 and 4.4) focuses solely on population growth and viability. The International Union for Conservation of Nature and the international science community are increasingly calling on ecological function (Akçakaya et al. 2020), resiliency and redundancy (Wolf et al. 2015) to be considered in species recovery efforts in addition to representation and viability" (Defenders of Wildlife, RE: Comments for the draft State Environmental Impact Statement amending the Washington Administrative Codes to require use of non-	Yes	No	Relevant – added to section 4.4. of the Final SEIS. WDFW agrees that ecological function, resiliency, and redundancy should be considered in species recovery efforts in addition to representation and viability.

	lethal techniques to reduce wolf-livestock conflict, April 4, 2022).			
Aronsson, M. & Persson, J. Mismatch between goals and the scale of actions constrains adaptive carnivore management: the case of the wolverine in Sweden. *Anim. Conserv.* **20**, 261–269 (2017).	"Developing a piecemeal policy that only focuses on areas of chronic conflict may lead to reactive management, including retaliatory killing of wolves, and have detrimental consequences for conflict mitigation and carnivore conservation efforts" (Scientist letter, Washington Needs Policy for Proactive Wolf-Livestock Non-lethal Practices Across Wolf Range, April 4, 2022).	Yes	No	Not relevant to SEIS. This study states that wolverine monitoring and management in Sweden is currently focused on alpine reindeer husbandry areas where wolverine abundance and associated depredation conflicts have been highest, but ignores a potential southwards population expansion because current monitoring relies on snow-based tracking methods that are not applicable outside northern alpine areas. WDFW has already planned for wolf recovery and management statewide, and section 4.1. of the SEIS states, "Recognizing that wolves are likely to eventually colonize all suitable habitat in the state and through dispersal may be present anywhere in Washington (including areas not considered preferred wolf habitat), the affected natural environment for all four alternatives is statewide." A rule focused on chronic conflict areas does not reflect the totality of all wolf conservation and management in the state and does not limit the scope of non-lethal conflict prevention measures. Rather, it would be additional regulation intentionally focused to address the specific scenarios where most wolf-livestock conflict in the state have occurred, namely "a situation where chronic depredations and lethal removals have occurred in the same territory for multiple years" (DSEIS, pg. 10), situations that "do not neatly fit the guidance set out in the Protocol" (DSEIS, pg. 10). WDFW has guiding documents that apply to wolf conservation and management statewide and create expectations for proactive non-lethal conflict deterrence measures, namely the 2011 Wolf Conservation and Management Plan the 2017 Wolf-Livestock Interaction Protocol as described in section 2.1.3. of the SEIS. WDFW has a Wildlife Conflict program that employs Wildlife Conflict Specialists statewide, including areas that do

				not yet have wolves but likely will have them in the future, who work with landowners and domestic animal owners both proactively and reactively to prevent and mitigate human-wildlife conflict and on cost-sharing non-lethal conflict prevention strategies. In addition, wolves receive federal protection under the Endangered Species Act in the western two-thirds of Washington. As stated in the DSEIS (pg. 9), "WDFW only considers lethal removal of wolves in the area of the state where the gray wolf is not listed as endangered or threatened under the federal Endangered Species Act (as of February, 10, 2022, wolves are federally delisted in Washington east of Highway 97 from the British Columbia border south to Monse, Highway 17 from Monse south to Mesa, and Highway 395 from Mesa south to the Oregon border, and are federally listed west of these highways)." This area comprises most of the state as well as the recolonizing front of Washington's wolf population. Washington's wolf population was recently federally delisted statewide for approximately 13 months, and WDFW did not consider or conduct any lethal removal of wolves in the western two-thirds of the state.
Ausband, D. E., C. R. Stansbury, J. L. Stenglein, J. L. Struthers, and L. P. Waits. 2015. Recruitment in a social carnivore before and after harvest. Animal Conservation 18:415–423.	N/A	Yes	No	Outside the scope of this SEIS. This study aimed to estimate recruitment in a population of gray wolves before and after hunting and trapping seasons. Hunting and trapping seasons are not being proposed in this rule making.
Ausband, D. E., M. S. Mitchell, C. R. Stansbury, J. L. Stenglein, and L. P.	N/A	Yes	Yes – already cited in DSEIS	Already cited in DSEIS as well as Final SEIS

Waits. 2017a. Harvest and group effects on pup survival in a cooperative breeder. Proceedings of the Royal Society B: Biological Sciences 284.				
Ausband, D. E., M. S. Mitchell, and L. P. Waits. 2017b. Effects of breeder turnover and harvest on group composition and recruitment in a social carnivore. Journal of Animal Ecology 86:1094–1101.	"On page 27 of the DSEIS the Department states "[h]arvest had no effect on the frequency of breeder turnover, suggesting that even in unexploited wolf populations, breeder turnover may be common." However, a 2017 study by Ausband et al. clearly finds that subtle changes to a group of wolves, including even the removal of one individual, can have impacts. These impacts can include reduction in recruitment and short term population growth related to lethal removal" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).	Yes	Yes – already cited in DSEIS	Already cited in DSEIS as well as Final SEIS. The quote highlighted by commenters, "[h]arvest had no effect on the frequency of breeder turnover, suggesting that even in unexploited wolf populations, breeder turnover may be common," is information from the same publication (pg. 1098) they reference in their following sentences. As stated in the DSEIS (pg. 27), "Ausband et al. (2017b) further elucidate how breeder turnover affects breeding opportunities of subordinates and the number and sex ratios of subsequent litters of pups. Breeder turnover led to shifts in the reproductive hierarchies within groups and the resulting changes to group composition were highly variable and depended on the sex of the breeder lost." The authors of the publication cited by commenters found that turnover of breeding females actually resulted in short-term increases in group size due to polygamy (turnover of breeding males was not). The study showed, "harvest was not associated with increased breeder turnover," (pg. 1099). The effects of lethal removal on pack dynamics and social behavior of wolves, including the publication referenced by commenters, are thoroughly reviewed in section 4.2.2. of the SEIS.
Bangs, E. *et al.* Non-Lethal and Lethal Tools to Manage Wolf-Livestock Conflict in the Northwestern United States. *Proc. Vertebr. Pest Conf.* **22**, (2006).	N/A	No	Yes – already cited in both 2011 EIS and DSEIS	Already cited in both 2011 EIS and DSEIS, as well as Final SEIS

Barnes, M. Low-stress Herding Improves Herd Instinct, Facilitates Strategic Grazing Management. *Stock. J.* **4**, 34–43 (2015).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Bergstrom, B., "Carnivore conservation: shifting the paradigm from control to Coexistence," Journal of Mammalogy, 98(1):1-6, 2017	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Bjorge, R. R., and J. R. Gunson. 1983. Wolf predation of cattle on the Simonette River pastures in west-central Alberta. Pages 106–111 in L. N. Carbyn, editor. Wolves in Canada and Alaska: Their status, biology, and management. Canadian Wildlife Service, Edmonton, Alberta.	N/A	No	No	Not relevant to this SEIS. This publication describes the reduction of a population of ~40 wolves to ~13 wolves over a two-year period through strychnine poisoning. Strychnine poisoning is an indiscriminate method of lethal control that is not being proposed as part of this rule making.
Bogezi, C., L. M. van Eeden, A. J. Wirsing, and J. M. Marzluff. 2021. Ranchers' Perspectives on Participating in Non-lethal Wolf-Livestock Coexistence	N/A	Yes	No	Cited in footnote 18 of this Response. This study highlights barriers that hindered rancher participation in non-lethal wolf-livestock coexistence strategies, including disdain for regulation.

Strategies. Frontiers in Conservation Science 2:1–12.				
Borg, B. L., Brainerd, S. M., Meier, T. J. & Prugh, L. R. Impacts of breeder loss on social structure, reproduction and population growth in a social canid. *J. Anim. Ecol.* **84**, 177–187 (2015).	N/A	Yes	Yes – already cited in DSEIS	Already cited in DSEIS as well as Final SEIS
Bradley, E. H. & Pletscher, D. H. Assessing factors related to wolf depredation of cattle in fenced pastures in Montana and Idaho. *Wildl. Soc. Bull.* **33**, 1256–1265 (2005).	N/A	No	Yes – already cited in 2011 EIS	Relevant – already cited in 2011 EIS and added to section 2.1.3. of the Final SEIS
Bradley, E. H., H. S. Robinson, E. E. Bangs, K. Kunkel, M. D. Jimenez, J. A. Gude, and T. Grimm. 2015 Effects of wolf removal on livestock depredation recurrence and wolf recovery in Montana, Idaho, and Wyoming. Journal of Wildlife Management 79:1337 1346.	Comment 1: "This study, which state and federal agents cite to in support of killing wolves, found that recurring predations were typically made by the next pack to occupy the vacant territory within 2 years. WDFW must consider the long-term effects of this study and its applicability to the long-term efficacy of killing wolves in Washington" (Washington Wildlife First, Comments on Draft Supplemental Environmental Impact	Yes	Yes – already included in DSEIS	Response 1: In the Bradley et al. (2015) study, full pack removal reduced the occurrence of subsequent depredations by 79% over a span of five years. WDFW does not claim that lethal removal of wolves is a permanent solution to wolf-livestock conflict. Lethal removal is intended to stop a current, ongoing pattern of depredation after non-lethal measures have already been implemented. Effects of lethal removal on wolf population growth and viability are discussed in sections 4.2.1. and 4.2.3. of the DSEIS and Final SEIS. Response 2:

	Statement for the Wolf-Livestock Conflict Deterrence Rule Making, April 11, 2022). Comment 2: "However, there are two things that must be considered with this analysis and the paper by Bradley et al. that the Department often cites when discussing the efficacy of lethal removal to increase time between depredations. First, is the lack of any data regarding nonlethal tools that may or may not have been in place in these areas experiencing wolf depredations. This factor can dramatically alter the outcome. Second, is the fact that the assessment, at least in the Bradley et al. example, is done at the regional level. This paper identifies this as a shortcoming stating that, "most research aimed at evaluating the effectiveness of lethal wolf removal to date has focused on wolf removal and depredation patterns at a regional level" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).			WDFW agrees that collecting data on the efficacy of non-lethal measures deployed in Washington is an important step. WDFW is currently a partner and data contributor to two such studies, one evaluating the effectiveness of range riding practices and another on the effectiveness of radio-activated guard (RAG) boxes. The research discussed in Bradley et al. 2015 was conducted at a regional scale to create sample sizes large enough to absorb the variation in the factors mentioned above. Although this study design results in reduced resolution of the exact factors at play in any given situation, it is as fine of a resolution as has been possible to achieve to date in trying to elucidate this question. To adequately address these issues, there would need to be significantly larger sample sizes (more removal events analyzed), or decreased variation in the other covariates. Although natural variation is out of our control, even variables that could theoretically be controlled typically are not, for important reasons. For instance, although reducing variation among non-lethal measures and how they are applied may allow for a "cleaner" analysis of the effects of lethal removal, it stands to potentially decrease their effectiveness due to inherent differences in each situation.
Brainerd, S. & Andrén, H. The effects of breeder loss on wolves. *J. Wildl.*	N/A	No	Yes – already cited in both 2011 EIS and DSEIS	Already cited in both 2011 EIS and DSEIS, as well as Final SEIS

Manage. **72**, 89–98 (2008).				
Breck, S. W. *et al.* Domestic calf mortality and producer detection rates in the Mexican wolf recovery area: Implications for livestock management and carnivore compensation schemes. *Biol. Conserv.* **144**, 930–936 (2011).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Bruns, A., Waltert, M. & Khorozyan, I. The effectiveness of livestock protection measures against wolves (Canis lupus) and implications for their co-existence with humans. *Glob. Ecol. Conserv.* **21**, e00868 (2020).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Bryan, H. M., J. E. G. Smits, L. Koren, P. C. Paquet, K. E. Wynne-Edwards, and M. Musiani. 2015. Heavily hunted wolves have higher stress and reproductive steroids than wolves with lower hunting pressure. Functional Ecology 29:347–356.	N/A	Yes	No	Relevant - added to section 4.2.2. of the Final SEIS

Carter, N. H. & Linnell, J. D. C. Co-Adaptation Is Key to Coexisting with Large Carnivores. *Trends Ecol. Evol.* **31**, 575–578 (2016).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Ciucci, P., Mancinelli, S., Boit ani, L., Gallo, O., Grottoli, L., Anthropogenic food subsidies hinder the ecological role of wolves: Insights for conservation of apex predators in human modified landscapes, Global Ecology and Conservation (2019).	N/A	Yes	No	Outside scope of SEIS. This is not a study on non-lethal conflict deterrence as stated by commenters. This study explores the extent to which anthropogenic food subsidies affected feeding ecology of a wolf population in a human-modified landscape, which is not a significant environmental impact caused by this rule making.
Creel, S., and J. J. Rotella. 2010. Meta-analysis of relationships between human offtake, total mortality and population dynamics of gray wolves (Canis lupus). PLoS ONE 5.	N/A	No	Yes – already included in both 2011 EIS and DSEIS	Yes – already included in both 2011 EIS and DSEIS, as well as Final SEIS
Creel, S., M. Becker, D. Christianson, E. Droge, N. Hammerschlag, M. W. Hayward, U. Karanth, A. Loveridge, D. W. Macdonald, W. Matandiko, J. M'soka, D. Murray, E.	N/A	Yes	No	Outside the scope of this SEIS. Hunting is not being proposed in this rule making.

Rosenblatt, and P. Schuette. 2015. Questionable policy for large carnivore hunting. Science 350:1473–1475.				
Davidson-Nelson, S. J. & Gehring, T. M. Testing fladry as a nonlethal management tool for wolves and coyotes in Michigan. *Human-Wildlife Interact.* **4**, 87–94 (2010).	N/A	No	No	Relevant - added to section 2.1.3. of the Final SEIS
DeCesare, N., et al., "Wolf Livestock Conflict and the Effects of Wolf Management," The Journal of Wildlife Management 82(4):711 722; 2018.	"Killing wolves has little to no long term effect (i.e. beyond limited time duration that wolves are absent) and may pose adverse effects on predation of livestock. Vacant territories are quickly recolonized even if entire wolf packs are extirpated through control actions, neighboring or dispersing individuals readily fill vacancies Again, WDFW must consider the long-term environmental impacts of killing wolves, by citing this study in their SEIS" (Washington Wildlife First, Comments on Draft Supplemental Environmental Impact Statement for the Wolf-Livestock Conflict Deterrence Rule Making, April 11, 2022).	Yes	Yes – already included in DSEIS	DeCesare et al. (2018) showed that removing a greater number of wolves through targeted removal in one year significantly decreased the probability of having any depredations the subsequent year. WDFW does not claim that lethal removal of wolves is a permanent solution to wolf-livestock conflict. Lethal removal is intended to stop a current, ongoing pattern of depredation after non-lethal measures have already been implemented. Effects of lethal removal on wolf population growth and viability are discussed in sections 4.2.1. and 4.2.3. of the DSEIS and Final SEIS.

Eklund, A., López-Bao, J. V., Tourani, M., Chapron, G. & Frank, J. Limited evidence on the effectiveness of interventions to reduce livestock predation by large carnivores. *Sci. Rep.* **7**, 10.1038/s41598-017-02323-w (2017).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Fritts, S. H., Paul, W. J., Mech, L. & Scott, D. P. *Trends and management of wolf-livestock conflicts in Minnesota*. *Resource Publication - US Fish & Wildlife Service* vol. 181 (1992).	N/A	No	No	Relevant - added to section 2.1.3. of the Final SEIS
Fuller, T. K., L. D. Mech, and J. F. Cochrane. 2003. Wolf Population Dynamics. Pages 161–191 in L. Mech and L. Boitani, editors. Wolves: Behavior, Ecology, and Conservation. University of Chicago Press.	N/A	No	Yes – already included in DSEIS	Yes – already included in DSEIS as well as Final SEIS
Gese, E. M., Hart, J. P. & Terletzky, P. A. Gray Wolves. *APHIS Wildl. Damage Manag. Tech. Ser.* 29 (2021).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS

Gosling, E., Bojarska, K., Gula, R. & Kuehn, R. Recent arrivals or established tenants? History of wolf presence influences attitudes toward the carnivore. *Wildl. Soc. Bull.* **43**, 639–650 (2019).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Gude, J. A., M. S. Mitchell, R. E. Russell, C. A. Sime, E. E. Bangs, L. D. Mech, and R. R. Ream. 2012. Wolf population dynamics in the U.S. Northern Rocky Mountains are affected by recruitment and human-caused mortality. Journal of Wildlife Management 76:108–118.	N/A	Yes	Yes – already included in DSEIS	Yes – already included in DSEIS as well as Final SEIS
Haber, G. 1996. Biological, Conservation, and Ethical Implications of Exploiting and Controlling Wolves. Conservation Biology 10:1068–1081.	N/A	No	No	Not relevant to/outside the scope of this SEIS. This publication provides an overview of other sources and presents an opinion and anecdotes that "heavy indiscriminate harvest or control" and sterilization are not desirable approaches to wolf management. Neither of those actions is being proposed in this rule making.
Haswell, P. M., Shepherd, E. A., Stone, S. A., Purcell, B. & Hayward, M. W. Foraging theory	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS

provides a useful framework for livestock predation management. *J. Nat. Conserv.* **49**, 69–75 (2019).				
Hayes, R. D., and A. S. Harestad. 2000. Demography of a recovering wolf population in the Yukon. Canadian Journal of Zoology 78:36–48.	N/A	No	No	Relevant - added to section 4.2.1. of the Final SEIS
Janeiro Oteroa, A., Newsome, T., Van Eeden L., Ripple W., Dormann, C., "Grey wolf (Canis lupus) predation on livestock in relation to prey availability," Biological Conservation, 2020.	N/A	Yes	No	Outside scope of SEIS. This is not a "study" on non-lethal conflict deterrence as stated by commenters. This publication is a review of studies investigating whether wild prey density affects livestock depredation by large carnivores. Implications are not directly related to any environmental impact caused as a result of this rule making.
Khorozyan, I. & Waltert, M. A framework of most effective practices in protecting human assets from predators. *Hum. Dimens. Wildl.* **24**, 380–394 (2019).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Khorozyan, I. & Waltert, M. How long do anti-predator interventions remain effective? Patterns,	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS

thresholds and uncertainty. *R. Soc. Open Sci.* **6**, (2019).				
Lance, N. J., Breck, S. W., Sime, C., Callahan, P. & Shivik, J. A. Biological, technical, and social aspects of applying electrified fladry for livestock protection from wolves (Canis lupus). *Wildl. Res.* **37**, 708–714 (2010).	N/A	No	No	Relevant - added to section 2.1.3. of the Final SEIS
Larivière, S., H. Jolicoeur, and M. Crête. 2000. Status and conservation of the gray wolf (Canis lupus) in wildlife reserves of Quebec. Biological Conservation 94:143–151.	N/A	No	No	Relevant – added to section 4.2.1. of the Final SEIS
Lennox, R., Gallagher A., Ritchie, E., Cooke, S., (2018), "Evaluating the efficacy of predator removal in a conflict-prone world," 2018.	N/A	Yes	No	Addressed in section 5.11. above.
Louchouarn, N. X. & Treves, A. *Low-Stress Livestock Handling Protects Cattle in a Five-Predator Habitat*. https://doi.org/10.21	"Recently completed yet still unpublished research from University of Wisconsin was the first study of its kind and looked at the efficacy of Low-Stress Livestock Handling (L-SLH) as a	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS. Comment noted, and noted that this study is not published or peer-reviewed.

203/rs.3.rs-1061804/v1.	deterrent of carnivore-livestock conflict. This study found L-SLH to be effective at deterring carnivores and should be referenced when developing a standardized definition and set of requirements for range riding in Washington" (Petitioners, RE: SEPA DSEIS 22-011: Wolf-Livestock Conflict Deterrence Rule Making; Public Comments, April 11, 2022).			WDFW is currently a partner and data contributor for ongoing research evaluating the effectiveness of range riding practices.
Marco Musiani, M., Muhly, T., Gates, C., Callaghan, C., Smith, M., Tosoni, E., "Seasonality and reoccurrence of depredation and wolf control in western North America, Wildlife Society Bulletin, 2005.	"In study area, even if entire wolf packs are extirpated through control actions, neighboring or dispersing individuals may readily fill home range vacancies. Lethal wolf control is not designed to decrease wolf predation at a regional scale or in the long term. The greatest promise for reducing wolf predation by improving animal husbandry, especially in high risk seasons. WDFW must clearly define non-lethals as applied to animal husbandry, prior to it considering killing wolves. WDFW cannot enforce husbandry, but it can decline to kill wolves for inadequate husbandry practices and WDFW must consider this" (Washington Wildlife First, Comments on Draft Supplemental Environmental	No	Yes – already included in 2011 EIS	Although already cited and discussed in 2011 EIS, also added to section 4.3. of the Final SEIS. WDFW agrees that "lethal wolf control is not designed to decrease wolf predation at a regional scale or in the long term." WDFW does not claim that lethal removal of wolves is a permanent solution to wolf-livestock conflict. Lethal removal is intended to stop a current, ongoing pattern of depredation after non-lethal measures have already been implemented. The perspective stated by commenters, "WDFW must clearly define non-lethals as applied to animal husbandry, prior to it considering killing wolves. WDFW cannot enforce husbandry, but it can decline to kill wolves for inadequate husbandry practices and WDFW must consider this," is not relevant to the findings of Musiani et al. 2005.

	Impact Statement for the Wolf-Livestock Conflict Deterrence Rule Making, April 11, 2022).			
McManus, J.S., Dickman, A.J., Gaynor, D., Smuts, B.H., "Dead or alive? Comparing costs and benefits of lethal and non-lethal human wildlife conflict mitigation on livestock farms," 2014.	"Lethal removal of carnivores can prove more costly than non-lethal deterrence measures" (Scientist letter, Washington Needs Policy for Proactive Wolf-Livestock Non-lethal Practices Across Wolf Range, April 4, 2022).	Yes	No	Not added to Final SEIS. This is a study about South African livestock farms, and although some implications might be transferable to the scope of this study, WDFW had a Small Business Economic Impact Statement developed specifically to understand economic implications of this rule making. In Washington, non-lethal measures are far more costly than lethal removal (because WDFW emphasizes proactive use of non-lethal measures and limits use of lethal removal). Although costs are not an environmental impact, if cost is of concern to commenters, it is of note that WDFW spent five times as much on non-lethal measures than on lethal actions in 2018, three times as much in 2019 and 2020, and 16 times as much in 2021. As stated in the SEIS (pg. 8), "more than 80% of the budget for wolf-livestock conflict [is] spent on non-lethal approaches."
Miller, J. R. B. *et al.* Effectiveness of contemporary techniques for reducing livestock depredations by large carnivores. *Wildl. Soc. Bull.* **40**, 806–815 (2016).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Moreira-Arce, D., Ugarte, C. S., Zorondo-Rodríguez, F. & Simonetti, J. A. Management Tools to Reduce Carnivore-Livestock Conflicts: Current Gap and Future Challenges.	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS

Rangel. Ecol. Manag. **71**, 389–394 (2018).				
Much, R. M., Breck, S. W., Lance, N. J. & Callahan, P. An ounce of prevention: Quantifying the effects of non-lethal tools on wolf behavior. *Appl. Anim. Behav. Sci.* **203**, 73–80 (2018).	Commenters cited this study as support for the following statement: "A comprehensive policy that creates consistency across wolf geographic range and allows for adaptive management to address human-wolf interaction will better serve Washington's wolves and rural communities" (Scientist letter, Washington Needs Policy for Proactive Wolf-Livestock Non-lethal Practices Across Wolf Range, April 4, 2022).	Yes	No	This study measures how prior experience (i.e., conditioning) influenced the motivation and persistence of captive wolves seeking a food reward. This study is not relevant to the statement made by commenters and was not added to the Final SEIS.
Mueller, B. Why public policies fail: Policymaking under complexity. *EconomiA* **21**, 311–323 (2020).	"Developing a piecemeal policy that only focuses on areas of chronic conflict may lead to reactive management, including retaliatory killing of wolves, and have detrimental consequences for conflict mitigation and carnivore conservation efforts" (Scientist letter, Washington Needs Policy for Proactive Wolf-Livestock Non-lethal Practices Across Wolf Range, April 4, 2022).	Yes	No	Not relevant to this SEIS. After reviewing this publication, it is unclear how it supports statements made by commenters or how it applies to this rule making.
Murray, D. L., G. Bastille-Rousseau, J. R. Adams, and L. P. Waits. 2015. The Challenges of Red Wolf Conservation and the Fate of an Endangered Species	N/A	Yes	No	Not relevant to this SEIS. The red wolf (*Canis rufus*), a different species from gray wolves in an entirely different population from Washington's gray wolves, is critically endangered with fewer than 20 known wild individuals and no other known populations or natural effective

Recovery Program. Conservation Letters 8:338–344.				emigration/immigration.[38] Red wolves face population viability challenges not faced by Washington's gray wolves. Section 4.2.1. of the SEIS provides detail on the large and expansive wolf metapopulation of which Washington's wolves are a part.
Oregon Department of Fish and Wildlife, Non-Lethal Measures to Minimize Wolf-Livestock Conflict, May 2019.	N/A	Yes	No	Not added to Final SEIS. Some commenters list this citation under "Studies on Non-lethal Conflict Deterrence." This is not a "study" on non-lethal conflict deterrence as stated by commenters. It is a list of non-lethal conflict mitigation measures for consideration created by ODFW. As stated in the document, "it is not intended to be a list of mandatory prescriptions applicable to all producers or situations. Rather it is a guide for appropriate non-lethal measures which are likely to be most effective in different circumstances." WDFW has a similar list available here: https://wdfw.wa.gov/sites/default/files/2019-02/livestock_wolf_mitigation_checklist_.pdf
Parks, M. Participant Perceptions of Range Rider Programs Used To Mitgate Wolf-Livestock Conflicts in the Western United States. *Thesis* (Utah State University, 2015).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Person, D. K., and A. L. Russell. 2008. Correlates of mortality in an exploited wolf population. Journal of Wildlife Management 72:1540–1549.	N/A	No	No	Outside the scope of this SEIS. This publication investigates the influence of habitat use on wolf vulnerability to public hunting and trapping, which is not being proposed in this rule making.

[38] U.S. Fish and Wildlife Service. 2022. Red Wolf Recovery Program. Available at https://www.fws.gov/project/red-wolf-recovery-program.

Rigg, R. *et al.* Mitigating carnivore-livestock conflict in Europe: Lessons from Slovakia. *Oryx* **45**, 272–280 (2011).	N/A	No	No	Relevant - added to section 2.1.3. of the Final SEIS
Shivak, J. A., Treves, A. & Callahan, P. Nonlethal Techniques for Managing Predation: Primary and Secondary Repellents. *Conserv. Biol.* **17**, 1531–1537 (2003).	N/A	No	No	Relevant - added to section 2.1.3. of the Final SEIS
Sparkman, A. M., L. P. Waits, and D. L. Murray. 2011. Social and demographic effects of Anthropogenic mortality: A test of the compensatory mortality hypothesis in the red wolf. PLoS ONE 6.	N/A	No	No	Not relevant to this SEIS. The red wolf (*Canis rufus*), a different species from gray wolves in an entirely different population from Washington's gray wolves, is critically endangered with fewer than 20 known wild individuals and no other known populations or natural effective emigration/immigration.[38] Red wolves face population viability challenges not faced by Washington's gray wolves. Section 4.2.1. of the SEIS provides detail on the large and expansive wolf metapopulation of which Washington's wolves are a part.
Stone, S. A. *et al.* Adaptive use of nonlethal strategies for minimizing Wolf-sheep conflict in Idaho. *J. Mammal.* **98**, 33–44 (2017).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Sutherland, W., Pullin, A., Dolman, A., Knight, T., "The Need for	N/A	No	No	Addressed in section 5.11. above.

evidence-based conservation," 2004.				
Treves and Naughton Treves 2005. Evaluating lethal control in the management of human wildlife conflict. Conservation Biology Series Cambridge, 9, pp 86.	N/A	No	No	Relevant - added to section 2.1.4. of the Final SEIS
Treves, A., Krofel, M. & McManus, J. S. Predator control should not be a shot in the dark. *Front. Ecol. Environ.* **14**, 380–288 (2016).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Treves, A., Krofel, M., Ohrens, O. & van Eeden, L. M. Predator Control Needs a Standard of Unbiased Randomized Experiments With Cross-Over Design. *Front. Ecol. Evol.* **7**, 1–14 (2019).	N/A	Yes	No	Addressed in section 5.11. above.
Treves, A., Martin K.A., Wydeven, A.P., Wiedenhoeft, J.E. 2011. Forecasting Environmental Hazards and the Application of Risk Maps to Predator Attacks on Livestock.	N/A	No	No	Not added to SEIS. A similar, more recent study was conducted in Washington (Hanley et al. 2018) and is already cited in both the Draft and Final SEIS.

Bioscience 61(6): 451-458.				
van Eeden, L. M. *et al.* Carnivore conservation needs evidence-based livestock protection. *PLOS Biol.* **16**, (2018).	N/A	Yes	No	Addressed in section 5.11. above.
van Eeden, L. M. *et al.* Managing conflict between large carnivores and livestock. *Conserv. Biol.* **32**, 26–34 (2018).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
van Liere, D. *et al.* Farm characteristics in Slovene wolf habitat related to attacks on sheep. *Appl. Anim. Behav. Sci.* **144**, 46–56 (2013).	N/A	Yes	No	Relevant - added to section 2.1.3. of the Final SEIS
Wolf, S., B. Hartl, C. Carroll, M. C. Neel, and D. N. Greenwald. 2015. Beyond PVA: Why recovery under the Endangered Species Act is more than population viability. BioScience 65:200–207.	"Use of term thrive (in 4.1 and 4.4) focuses solely on population growth and viability. The International Union for Conservation of Nature and the international science community are increasingly calling on ecological function (Akçakaya et al. 2020), resiliency and redundancy (Wolf et al. 2015) to be considered in species recovery efforts in addition to representation and viability" (Defenders of Wildlife, RE:	Yes	No	Relevant – added to section 4.4. of the Final SEIS. WDFW agrees that ecological function, resiliency, and redundancy should be considered in species recovery efforts in addition to representation and viability.

	Comments for the draft State Environmental Impact Statement amending the Washington Administrative Codes to require use of non-lethal techniques to reduce wolf-livestock conflict, April 4, 2022).			
Wydeven, A., Treves, A., Brost, B., Wiedenhoeft, J. (2004). Characteristics of Wolf Packs in Wisconsin: Identification of Traits Influencing Depredation. In People and Predators: From Conflict To Coexistence (29-49). Island Press.	N/A	No	No	Relevant - added to section 4.3. of the Final SEIS