Peer Review Comments and Responses

on the

Draft Mexican Wolf Recovery Plan, First Revision

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Southwest Region

U.S. Fish and Wildlife Service

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Peer Review Comments on the Draft Mexican Wolf Recovery Plan, First Revision

The U.S. Fish and Wildlife Service released the draft Mexican Wolf Recovery Plan, First Revision (draft Recovery Plan) for public comment and peer review on June 30, 2017 (82 FR 29918). The comment period lasted for 60 days and closed on August 29, 2017. At the close of the review period on the draft Recovery Plan, we received comments from 5 peer reviewers, which are posted on our website (http://www.fws.gov/southwest/es/mexicanwolf). Peer review comments and our responses are provided below.

#	Name	Peer Review Comment	USFWS Response
1	Beier	The Biological Report defends the historic range of *baileyi* because it corresponds to the distribution of Madrean pine-oak woodlands and geographic distribution of small bodied wolves. But then the Service defends a MWEPA that extends 200 miles beyond the historic range in light of "the recent success shown by rapid growth of the wild population of Mexican wolves" (Heffelfinger et al. 2017). If potential for population growth can be used to define the MWEPA, then a wider buffer could be used to include north rim of Grand Canyon, San Juan Mountains, Sangre de Christos, and other areas of good habitat that lie within the southwestern Distinct Population Segment. It is reasonable to prioritize areas closest to historic range for recovery by using I-40 as a soft boundary, but the current documents do not justify a hard boundary at I-40. What if the current MWEPA is too small for the population to reach 320? In my opinion, a reasonable compromise would be to state that if (for example) the population does not reach 200 by 2025 and 300 by 2035, the MWEPA will automatically be expanded northward. With a trigger like this, partners who want to hold to the current boundaries would be incentivized to make it work, possibly including genetic introgression (See point #1 in the next section) if evidence suggests it would be a more reliable way to reach the population criteria than expanding the MWEPA. It took entirely too long to expand the Blue Range Experimental Area; a reasonable trigger could ensure a similar prolonged mess will not occur again.	*Canis lupus* as a species is certainly able to survive in a great variety of climates and environments. Thus, the Mexican wolf would adapt to the majority of landscapes in the southwest United States. However, the historical distribution of this subspecies is strongly associated with pine-oak and pine forests and arid and semiarid regions of northern Mexico and southwestern U.S. (Heffelfinger et al. 2017). We are focusing our recovery efforts in the area that is accepted as historical range for the Mexican wolf. Interstate 40 provides an easily recognizable and reasonable demarcation of the northern extent of the area in which we are currently focusing our reintroduction and recovery efforts. This area comports with the scientific literature that addresses historical range (discussed in the Biological Report), previous Service focus on this area (Service 1996), and the ecological niche of Mexican wolves (Martinez-Meyer et al. 2017). Martínez-Meyer et al. (2017) used an Ecological Niche Model that was calibrated with all wolf presence records available in the historical range as depicted by Parsons (1996) in Arizona, New Mexico, and Texas, as well as records from Mexico. This model showed all possible areas climatically similar to the presence records, and it recognized that northern areas are quantitatively different. The model also shows the area south of Interstate 40 as the area overall with the highest-quality habitat due to the high availability of ungulates, particularly elk and therefore, with the highest estimation of Mexican wolf carrying capacity under any scenario. The Sierra Madre Occidental, both north and south, is the area with the potential to hold the largest number of wolves in Mexico. The estimated carrying capacity for the U.S. Recovery Area is about 1000 wolves, whereas, the estimated carrying capacity is approximately 300 for the northern Sierra Madre Occidental and 350 for the southern Sierra Madre Occidental. Our recovery

2	Beier	Explain why 320 wolves are needed in MWEPA but 170 suffice for the Sierra Madre Occidental.	PVA modeling (Miller 2017) shows that a population in Mexico with an average annual population abundance of 200 (revised from 170 in the draft) and a population in the U.S. with an average annual population abundance of 320 have at least a 90% probability of persisting for 100 years, demonstrating both the resiliency of each population and redundancy from having two populations. Because of historical genetic management, the U.S. population is currently in a less desirable genetic state. This means that more intensive genetic management of the wild population is required to retain approximately 90% of the remaining gene diversity of the captive population. Specifically, introduction of new genes from the SSP population is necessary in next few years, and a larger long-term population size is required to reduce the rate of loss of that newly introduced gene diversity. In contrast, the Mexico population is in the very early stages of establishment, with much greater management flexibility that can be used to create a genetically viable population. Consequently, a higher level of gene diversity retention is possible with a smaller population size because a starting gene diversity that is close to the current value of the SSP population can be created through a proper early release strategy. In addition, carrying capacity for the U.S. recovery area is about 1000 wolves, whereas, the carrying capacity is 300 for the northern Sierra Madre Occidental and 350 for the southern Sierra Madre Occidental.
3	Beier	I would delete the “alternative” downlisting criteria (lines 240-247). The proposed minimum of 150 animals in each population is only slightly more than exists in MWEPA now, and I don’t think the MWEPA population is “almost there”. I don’t see how the added criterion of “increasing trend” makes up for the vastly lower target for population sizes.	We changed "a positive growth trajectory" in this downlisting criterion to "an annual positive population growth rate". Also, in the Explanation of Downlisting Criteria section, we added further explanation that the PVA model predicts that a population abundance of 150 Mexican wolves confers a level of genetic and demographic stability (i.e., a low extinction risk). Therefore, at 150 animals (in each of the two populations), the Mexican wolf would no longer meet the definition of an endangered species (i.e., in danger of extinction throughout all or a significant portion of its range), but would qualify for consideration as a threatened species (i.e., any species which is likely to become an endangered species within the foreseeable future throughout all or a signification portion of its range).

4	B e i e r	The Disclaimer (page 3) explains that the new Recovery Planning and Implementation Process is intended to be less specific than past processes used to write Recovery Plans, so that the RP can be written faster, can remain relevant for a longer period of time, and allow greater flexibility. Having been annoyed at detailed recovery plans that bury important actions in a mind-numbingly long list of actions, I support these goals. However, I find Section VI (Actions Needed) far too short on details. It does not suffice as "a description of such site-specific management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species" (ESA 4(f)(1)). Perhaps all of these details are being pushed into the Recovery Implementation Strategy. However, my subconsultant agreement specifies that I should comment on the adequacy of proposed actions based solely on my review of the Draft Biological Report and the Draft Revised Recovery Plan (excluding the Recovery Implementation Strategy). Thus this is my only opportunity to comment on recovery actions. Although it is fine to relegate some recovery actions to the Recovery Implementation Strategy, the RP should include the most important actions and describe each of them in enough detail to convince me that the actions will meet the stated criteria.	We have added more actions and details to the Recovery Action Table. Additionally, more detailed activities (stepped-down from the actions) are included in the Implementation schedule table.

5	B e i e r	1. One action should be an experimental introgression of genes of northern wolves into a subset of the captive population. Consider 3 facts: (1) the 7 founders of the captive population had only a fraction (I'd guess less than half) of baileyi's historic gene diversity, (2) only 83% of the diversity of the 7 founders has been retained, and (3) the MWEPA population retains 76% of the gene diversity of the captive population (with some founders highly under-represented). Together, these 3 facts suggest that the population may suffer high genetic load (reduced mean fitness due to fixation or dominance of detrimental mutations) and that the Plan's proposed genetic management (use planned releases to increase the fraction of captive genes from 76% to 90%, with extremely limited ability to improve balance) may be insufficient. The Plan's genetic management addresses only the 3rd of these 3 facts, and if the proposed genetic management is successful the MWEPA would have only 75% [i.e., 90% of 83%] of the already depauperate founder gene pool. I think a high priority action for the RP should be to experimentally cross some northern wolves with captive baileyi wolves. Only a small fraction of the baileyi population (the most over-represented genotypes) need to be involved in the experiment (thus maintaining options for using genotypes in captive and wild populations). The northern x baileyi individuals (and F2 backcrosses to baileyi) should be compared to well-matched control individuals with respect to growth, survival, disease susceptibility, behavior, reproduction, and offspring survival. The results of the experiment would help managers decide (a) whether to	The potential for positive benefit through genetic augmentation from cross-breeding Mexican wolves *C.l baileyi* with northern gray wolves versus the negative potential of "genetic swamping" of the Mexican wolf subspecies is a subject which we intend to further explore as part of our recovery actions. As we state in the Biological Report, careful evaluation of the potential effects of introgression of gray wolves is needed to determine whether allowing gray wolves to breed with Mexican wolves could be appropriate during a later stage of recovery or after recovery (Hedrick and Fredrickson 2010). Until such evaluation occurs, and pending its results, we would manage against such breeding events occurring south of Interstate 40 in the United States. We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity in the wild populations.

6	Beier	2. Management actions regarding northern migrants into MWEPA. The Biological Report suggests that FWS intends to remove all northern individuals that might migrate into MWEPA, and (perhaps) all northern individuals that migrate into north rim of Grand Canyon, San Juan Mountains, Sangre de Christos, and other areas of good habitat that lie within the southwestern Distinct Population Segment. Are these areas intended to remain wolf-free for the indefinite future? In the context of recovering baileyi, it is reasonable to prioritize historic baileyi range, but it is not reasonable to leave large portions of former wolf range as blank spots on the map of recovery of Canis lupus. Moreover, in light of the fact that genetic exchange occurred historically and eventually will occur again, such an action (removal of all northern migrants) seems inappropriate. Yes, it'd be nice for hybridization to wait until the baileyi population is large (to minimize swamping) but the benefits of outcrossing probably outweigh the risks that introgression would disrupt the natural history or behavior of the population. I think 1 or 2 northern wolves joining a population of >100 or >300 baileyi wolves would mimic historic genetic exchange, and should be encouraged. At a minimum, any proposed action to limit migrants should be clearly stated and justified. The exclusion of the north rim of Grand Canyon, San Juan Mountains, and Sangre de Christos might be acceptable if the FWS intended these areas to be occupied by northern wolves, but there is no evidence that this is the case.	The wild Mexican wolf population in the U.S. is not a Distinct Population Segment; rather it is listed under 10(j) of the ESA as a nonessential, experimental population. The MWEPA is considered the nonessential experimental population area. With regard to the question about areas north of Interstate 40 remaining wolf-free for the indefinite future; we are currently focusing our recovery efforts south of Interstate 40 for various reasons explained in our response to Beier #1 and #5. Furthermore, the 5 and 10-year status reviews, discussed in Section V. of the draft recovery plan, will assess progress toward recovery and help us determine whether our current strategy is effective or needs to be revised. Changes in the strategy could include changing techniques used to address gene diversity.
7	Beier	3. Management action to remove any baileyi individuals that move to the North Rim of the Grand Canyon, the San Juan Mountains, the Sangre de Christo Mountains, and other areas of good habitat that lie within the southwestern Distinct Population Segment. The 10(j) rule allows but (I think) it does not require such removals, and Mexican wolves outside the MWEPA would have conservation value. The RP should clearly state how these animals will be treated, and justify the proposed treatment.	The wild Mexican wolf population in the U.S. is not a Distinct Population Segment; rather it is listed under 10(j) of the ESA as a nonessential, experimental population. The MWEPA is considered the nonessential experimental population area. In accordance with the preamble to the Revision to the Regulations for the Nonessential Experimental Population of the Mexican Wolf (80 FR 2512), we revised and reissued the Mexican Wolf Recovery Program's section 10(a)(1)(A) research and recovery permit so that it applies to the management of Mexican wolves both within and outside of the MWEPA. Under this permit, we will authorize removal of Mexican wolves that can be identified as coming from the experimental population that disperse and establish territories in areas outside of the MWEPA. We will make a determination, based in part on their genetic value relative to the Mexican wolf population, to maintain these wolves in captivity, translocate them to areas of suitable habitat within the MWEPA, or transfer them to Mexico.

8	B e i e r	4. Management actions regarding diversionary feeding. Diversionary feeding has been key to population growth since 2010, but Section VI is silent about this action (presumably it is rolled into row 1 of Table 1). Given the importance of this management action, it deserves more explanation. Does the RP envision that diversionary feeding will likely continue up to and even after downlisting or delisting? Does diversionary feeding have any potential negative consequences, such as increased likelihood of detrimental interactions with humans? Does the RP include any steps to minimize any potential downsides?	In response comments, we explored new PVA scenarios that eliminate diversionary feeding by model year 20 for both populations. The results from these new analyses, which indicate that populations can remain viable in the absence of diversionary feeding with reduced wolf mortality, were used to modify the recovery criteria in the plan. While diversionary feeding is not necessary to achieve viable wolf populations, it may be used as a tool to reduce wolf-livestock interactions. Additionally, diversionary feeding will be addressed in the Implementation Schedule Table. We have not documented any negative consequences of diversionary feeding.
9	B e i e r	5. Actions (in addition to or instead of diversionary feeding) to avoid management removals. For example, will there be an action to transfer allotments to wolf-friendly livestock operators, or to retire grazing allotments?	Grazing allotments are managed by the Forest Service; however, we will work with livestock producers on a voluntary basis to reduce and address wolf-livestock interactions/conflicts. Changes in livestock management are not required for recovery of Mexican wolves; however, recommendations to reduce wolf-livestock interactions and avoid management removals (e.g. the use of range riders, fencing, fladry, hazing, translocations) are now included in the Implementation Schedule Table.
10	B e i e r	6. Actions (in addition to or instead of diversionary feeding) to avoid illegal killing. For example, will there be actions to beef up law enforcement against illegal killing? If the Service fears such actions could backfire if implemented too soon, the RP should specify thresholds (e.g., more than a certain number of illegal killings over a 3-year period) that would trigger more aggressive enforcement. Such triggers could incentivize some opponents of recovery to behave better.	Illegal killing has been the biggest source of Mexican wolf mortality since we began reintroducing Mexican wolves back into the wild in the United States in 1998. Approximately 55 percent of total documented mortality between 1998 and 2013 is attributed to illegal killing. In Mexico, illegal killing of Mexican wolves released to the wild has been a continuous source of mortality over the course of the reintroduction project. We have incorporated Mexican wolf mortality from all sources, including illegal killing, in our Population Viability Analysis and population growth rate estimates for reintroduced wild populations of Mexican wolves in both the U.S. and Mexico. All cases of suspected illegal take of Mexican wolves in the U.S. are investigated by the Service's Office of Law Enforcement Special Agents. The Service recently hired a Conservation Law Enforcement Officer, which is included as an activity in the Implementation Schedule Table. This position will help us address law enforcement issues and conduct outreach on wolf conservation. While law enforcement and regulatory protections to prohibit and penalize illegal killings are important mechanisms, we recognize that illegal killing will likely continue to occur and may possibly increase as the wolf population increases in size. Since 2009, the Mexican wolf population in the United States has been growing at an average annual rate of over 10 percent, which has enabled the population to grow despite illegal mortalities.

11	Beier	7. Actions to address the proposed border wall. Some potential realizations of the Trump Wall could preclude natural connectivity between MWEPA and Sierra Madre Occidental. This problem should be acknowledged. There should be some actions related to this threat to connectivity.	The PVA model incorporated a low level of dispersal between the U.S. and Mexico populations (~one wolf every 12-16 years) and results indicate that populations still have at least a 90% probability of persistence over 100 years. In response to comments, we created an additional scenario that examines the impact of eliminating dispersal between the U.S. and Mexico populations. The results indicate that prohibiting transborder dispersal has a negligible impact on population abundance, and the very small impact on gene diversity retention would be insufficient to impact achievement of recovery criteria. That said, we recognize the benefits of connectivity and added activities to the Implementation Schedule Table to work with CBP to explore options to maintain connectivity between populations in the U.S. and Mexico. In addition, we will collaborate with Mexico and the states of Arizona and New Mexico to continue monitoring and management of wolves as they cross the international border. Furthermore, the 5 and 10-year status reviews, discussed in Section V. of the draft recovery plan, will assess progress toward recovery and help us determine whether our current strategy is effective or needs to be revised.
12	Beier	Line 489: 280 mi is not the same as 320 km. One of these numbers is wrong. I expect you meant to write 200 mi.	Fixed
13	Beier	Fig. 2. The caption should define “recruitment”	Changed to "pups alive as of December 31."
14	Hedrick	**1. Are the downlisting and delisting criteria objective and measurable?** a. For all these criteria, the following criterion should be added. c) Supplemental and diversionary feeding should be absent for four consecutive years	While diversionary feeding is not necessary (see response to Beier #8 above) to achieve viable wolf populations, it may be used as a tool to reduce wolf-livestock interactions. Reducing interactions helps us keep wolf removal rates low. Therefore, we are not requiring the absence of diversionary feeding as part of the recovery criteria.
15	Hedrick	b. It seems very odd that Mexican wolves could be downlisted given the criteria in Mexico are met and the criteria are not met in the US.	In response to comments, we removed the option for downlisting if only the Mexico population was performing as expected.
16	Hedrick	c. It would be much better if “average” was taken out in a number of places so it would read “MWEPA population abundance…” instead of “average MWEPA population abundance…” For example, there could be 400, 400, 400, and 81 individuals over four years with an average greater than 320 but indicating a population that is in real trouble.	In response to comments, we modified the delisting criterion (for the U.S. and Mexico) to reflect the importance of maintaining the population at or above the population target threshold during the latter 3 years of the 8-year timeframe of interest.

17	Hedrick	d. How is the term of 4 years determined? I assume that this is because it is about one wolf generation. Please state.	Yes, four years is equivalent to one wolf generation. We clarified this in the recovery plan.
18	Hedrick	e. How is the number of 22 arrived at? Is this from 2017 on? It seems like 22 in the first few years would be quite different than 22 over many years and it would also depend on whether they reproduce or not (and how much). As a result, it would be better to have a genetic goal (expected or observed genomic heterozygosity greater than some value) than this seemingly arbitrary number.	The number is derived from needing to achieve approximately 90% of the gene diversity of the captive population. Based on the current estimates of first year mortality, we need about 70 releases in the U.S. and 100 releases or translocations in Mexico to get 22 in the U.S. and 37 in Mexico, but the number of releases/translocations could be reduced if we are able to increase survival of released/translocated wolves. Releases that will contribute toward this recovery criterion in the U.S. begin in January 2016, and in Mexico, they begin in January 2017. We agree that releases need to be incorporated early in the recovery process and conducted according to a schedule that predicts success in achieving 90% representation of the gene diversity of the captive population. The schedule of releases will be addressed in the Implementation Schedule Table and the number of releases is reflected in our 5 and 10-year status reviews (see section V of the draft recovery plan). Regarding reproduction, the model treats released individuals that survive 1-2 years and reach breeding age the same as other wolves in the population. Thus, not all of the 22 individuals are expected to reproduce to achieve 90% of the gene diversity of the captive population.
19	Hedrick	f. It is not clear how important these releases are or the exact number of releases is. There might be a point where the benefit from introductions reducing inbreeding depression and increasing genetic variation is offset by the loss in adaptation in the wild population.	The importance of the releases is demonstrated graphically in the PVA report (Miller 2017). Based on the current estimates of first year mortality of wolves released from captivity, we need about 70 releases in the U.S. and 100 releases or translocations in Mexico to get 22 in the U.S. and 37 in Mexico, but that could change depending on whether we can improve survival of wolves released from captivity. The PVA does not explicitly consider the trade-offs between genetic augmentation of the wild population through releases and the risk of genetic adaptation to captive conditions. We recognize that loss in adaptation could be a potential issue for long-term recovery, but a) we have no information on the degree to which this is a problem for Mexican wolves; and b) we assume the genetic benefits to the wild population will outweigh the adaptive costs. We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity in the wild populations.

20	Hedrick	g. Please explain why the Mexican population meets the criteria when the average is 170 while the MWEPA meets the criteria when the average is 320.	See response to comment Beier #2 above
21	Hedrick	h. How important is the 37 number in light of the discussion above about the number 22?	See our responses to comment Hedrick #18 and 19.
22	Hedrick	i. If the average MWEPA abundance was only 150 (and that in the Mexican population was 150), it would be downlisted. This is much too small to have the USFWS criteria of "resilience, redundancy, and representation" because the Mexican population will not help the MWEPA on any of these values.	See response to comment Beier #3
23	Hedrick	j. This plan does not result in the "resiliency, redundancy, and representation" of USFWS that would be necessary for recovery for the following reasons. (a) Because the two populations are functionally not connected, it is unlikely that the MWEPA population would have an adequate level of resiliency to withstand or bounce back from environmental or demographic stochastic events without continued diversionary feeding and continued low amount of removals. If either of these management actions were changed, then the population would probably be not resilient. This is particularly true because of the very high rate of human-caused mortality in the MWEPA population.	Miller (2017) adequately explores environmental and demographic stochastic events in the presence of minor levels of diversionary feeding (15% of the population) and higher mortality than demonstrated from 2009-2015 (low removals). A mortality rate of 25% (6% higher than 2009-2015) is adequate to allow for population growth towards recovery goals with minor levels of diversionary feeding. In addition, the effective mortality rate is approximately 5% higher when the population in the model is predicted to be above 380 (or 275 in the northern Sierra Madre Occidental) wolves due to wolves being removed from the population. Nevertheless, we explored additional modeling scenarios with diversionary feeding being discontinued after year 20-25; in those exploratory scenarios, the mortality rate would have to be reduced to ~21% to grow towards recovery and could be as much as 5% higher after the population is above 380, due to additional removal. If we reduce diversionary feeding, we recognize the need to reduce the mortality rate to compensate for lower pup production in the absence of feeding.

24	H e d r i c k	(b) Because there are only two unconnected populations, the level of redundancy advocated is much less than for either the northern Rockies gray wolves or the Great Lakes wolves. The MWEPA population does not have any redundancy because the Mexican population will not increase the ability of the MWEPA population to rebound from catastrophic events. In addition, the very low genetic variation in these unconnected populations very likely decreases the ability of the populations to rebound from catastrophic events.	As we explain on page 31 of the draft recovery plan, redundancy (in this case, 2 populations) provides for security against extinction from catastrophic events that could impact a single population by ensuring that one or more additional resilient, representative populations persist. So, just because populations are isolated does not mean they are not redundant. With regard to reintroduced species, Allendorf and Luikart (2007) recommend that at least two demographically and environmentally independent populations should be established and maintained. The PVA model incorporated catastrophic events, gene diversity, and a low level of dispersal between populations (~one wolf every 12-16 years) and results indicate that populations still have at least a 90% probability of persistence over 100 years. As explained in our response to Beier #11, a new scenario, in which we examined the impact of eliminating connectivity, also indicates that populations still have at least a 90% probabilty of persistence over 100 years. That said, we recognize the benefits of connectivity and added activities to the Implementation Schedule Table to work with Customs and Border Protection to explore ways to maintain connectivity between populations in the U.S. and Mexico. Furthermore, the 5 and 10-year status reviews, discussed in Section V. of the draft recovery plan, will assess progress toward recovery and help us determine whether our current strategy is effective or needs to be revised. Changes in the strategy could include establishing new recovery areas in the United States.
25	H e d r i c k	(c) Because the Mexican wolf already has less variation than any other gray wolf population as measured both by actual genomic data and expected by pedigree analysis, it is not clear that the Mexican wolf population has the genetic variation (called “representation” here) to adapt to environmental changes. Perhaps if additional populations were started both on the north rim of the Grand Canyon and in northern NM-southern CO and then there was introgression from northern gray wolves into these three interconnected populations, it would result in enough genetic variation to adapt to environmental changes.	See response to Beier #5. We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity in the wild populations. Furthermore, as discussed above, the 5 and 10-year status reviews, discussed in Section V. of the recovery plan, will assess progress toward recovery and help us determine whether our current strategy is effective or needs to be revised. Changes in the strategy could include establishing new or expanding existing recovery areas or changing techniques used to address gene diversity.

26	H e d r i c k	**2. Will the site-specific management actions achieve the plan's goal for the conservation and survival of the Mexican wolf?** a. The advocacy of only two unconnected populations, one in AZ – NM and one in Mexico, is not the best science and is not likely to support recovery. Both the northern Rockies and Great Lakes wolf recovery programs advocated three interconnected populations. Earlier Mexican wolf recovery teams also advocated three interconnected populations, the present AZ-NM one and two additional ones on the north rim of the Grand Canyon and in northern NM – southern CO. Exchange between these populations to form a metapopulation could result in both demographic rescue and genetic rescue so that the overall viability of the introduced animals would be increased by the presence of the other populations. The populations in Mexico and the AZ-NM are unlikely to be functionally connected because of the plans of the present administration to build a high, insurmountable-to-wolves wall along the US – Mexico border. In other words, instead of a metapopulation, the two proposed populations, one in the present MWEPA and one in Chihuahua, will not interact and they would not have any demographic and evolutionary connections. As a result, the presence of the Mexican population likely will not increase the viability of the US population or the overall viability of the introduced animals and conservation and survival of the Mexican wolf is unlikely.	For any species, there may be more than one strategy that provides a valid path to recovery. This is the case for the Mexican wolf. In our development of the recovery strategy for the revised recovery plan we considered different combinations and alternative scenarios for the location, number of populations, number of releases and number of wolves (population abundance) that could achieve the recovery objective. Our recovery strategy is focused on alleviation of the threats to the Mexican wolf from human-caused mortality, lack of gene diversity, and small population size. Given the current habitat quality in the borderlands area (which is predominately patchy and low quality, as modeled by scientists), we expect and modeled a low level of dispersal (~one wolf every 12-16 years) between the U.S. and Mexico populations. A border wall could further constrain or completely curtail natural dispersal, but would not appreciably impact the predicted performance of the populations. In other words, we do not expect the level of dispersal predicted between the U.S. and Mexico to provide for adequate gene flow between populations to alleviate genetic threats or ensure representation of the captive population's gene diversity in both populations. Therefore, we consider genetic management, such as releases from captivity (including cross-fostering pups) and translocations, to serve as an effective tool during the recovery process to achieve appropriate representation (Miller 2017). These releases and translocations will be necessary for at least portions of the recovery process. That said, we recognize the benefits of connectivity and have added an activity in the Implementation Schedule Table to work with Customs and Border Protection to explore ways to maintain connectivity between Mexican wolf populations in the U.S. and Mexico. Other activities have also been added to address connectivity, such as implementing measures to
27	H e d r i c k	b. The surprisingly very high rate of human-caused mortality in the MWEPA, 93 of the documented Mexican wolf mortalities (70% of total mortalities) as given in the Biological Report, along with the high removal rate, appear to explain much of the early slow population growth. Although it is good to have documentation, it is not clear that the causes of this very high rate of human-caused mortality have been addressed. Is the USFWS going to do something new to address this very high rate of human-caused mortality?	See response to Beier #11
28	H e d r i c k	c. It is unlikely that the Mexican population(s) will contribute to recovery of Mexican wolves because of the lack of wild prey, lack of protection, presence of livestock, presence of humans, and presence of roads in the Mexican recovery area. Further, because the Mexican population will not have an effective connection to the US population, it will not contribute to overall recovery and could actually act as a diversion from efforts to recover the Mexican wolf in the US.	See response to comment #34 below (comment repeated)

29	H e d r i c k	d. Mexican wolves have a very low base level of genetic diversity in the captive population compared to other wolf populations because of a low number founders as documented by both pedigree analysis and genomic data. It would be good to cite or acknowledge that the amount of genetic variation from genomic analysis for Mexican wolves is lower than that for other wolves (vonHoldt et al. 2011, Genome Research 21:1294-1305). From genomic analysis, vonHoldt et al. (2011) found the observed genomic heterozygosity in Mexican wolves was only 0.12, about 55% that of northern gray wolves which had a heterozygosity of 0.22. This is about the amount of genetic variation expected if a pair of wolves were taken at random from northern gray wolves, this pair reproduced and had two progeny, and those progeny had offspring to produce a population. In other words, the level of genetic variation in Mexican wolves already is that expected from an extreme two-generation bottleneck of two individuals each generation from northern gray wolves.	Comment noted. We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity in the wild populations.
30	H e d r i c k	e. The loss of 17% of the genetic variation predicted is very large but genomic data demonstrate that Mexican wolves already have 45% less variation than northern gray wolves. The concern over the very low genetic diversity (and high inbreeding) in Mexican wolves should result in the logical conclusion that introgression with northern gray wolves could result in an increase in genetic variation both for adaptation and reducing inbreeding depression. This interbreeding is what historically occurred and should be an important goal for the reintroduced population.	See response to Beier #5. We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity in the wild populations. Furthermore, the 5 and 10-year status reviews, discussed in Section V. of the draft recovery plan, will assess progress toward recovery and help us determine whether our current strategy is effective or needs to be revised. Changes in the strategy could include changing techniques used to address gene diversity.
31	H e d r i c k	**3. Is the overall recovery strategy and specifically the recovery criteria supported by scientific information in the revised recovery plan and/or the Biological Report?** a. Because of the great increase in diversionary feeding since 2009, it is not possible to measure appropriately inbreeding depression for litter size, as would be experienced by a population that is not being fed. Further, other factors that influence fitness, such as viability, mating success, and probability of reproduction, might also be impacted negatively by inbreeding. In other words, it is highly likely in a population with only two founder genome equivalents remaining (as estimated for the current Mexican wolf population) that there would be inbreeding depression. Ignoring the potential consequences of inbreeding depression would further imperil the population.	Inbreeding depression is incorporated into the probability of producing pups (in the PVA model). Other effects of inbreeding in the wild population have not been documented but will continue to be monitored. We will continue to collect data and update analyses as appropriate.

32	H e d r i c k	b. The proposal here to have only one population in the US, which is not connected to the Mexican population, will make the low genetic variation deteriorate even further. Instead of having a lower number of populations and not having them connected to other populations as in other wolf populations, these concerns should result in more populations and having them interconnected for Mexican wolves.	Based on Miller (2017), a population in Mexico with an average annual population abundance of 200 and a population in the United States with an average annual population abundance of 320, together with the other elements of the recovery strategy are large enough to achieve the resiliency, redundancy and representation needed for recovery and delisting. Given the current habitat quality in the borderlands area which is predominately patchy and low quality (Martínez-Meyer et al. 2017), we expect and modeled a low level of dispersal (approximately one wolf every 12-16 years) between the United States and Mexico populations. It is important to note that Mexican wolves released in Mexico have crossed the border on three occasions (one wolf twice when it entered the United States and then returned to Mexico) and wolves from the United States population have traveled as far south as Interstate 10. Thus, a low level of dispersal is a valid assumption under current conditions. We recognize that the proposed border wall, if built, could further constrain or completely curtail natural dispersal, depending on its design. However, these constraints would not appreciably impact the predicted performance of the populations. The PVA model incorporated catastrophic events, gene diversity, and a low level of dispersal between populations (~one wolf every 12-16 years) and results indicate that populations have a greater than 90% chance of persistence over 100 years under certain conditions. In addition, Miller (2017) conducted model simulations in which dispersal/connectivity was removed completely to verify that both populations achieve at least a 90% probability of persistence for 100 years and maintain approximately 90% of the gene diversity available in captivity. In other words, we do not expect the level of dispersal predicted between the U.S. and Mexico to provide for adequate gene flow between populations to alleviate

33	H e d r i c k	c. The range suggested in 1998 ignores the recommendation of two subsequent recovery teams who advocated areas north of I-40 for reintroduced populations. Further, the current general recognition of climate change in the scientific community would suggest that the range should be moved further north to encompass the appropriate suitable habitat for Mexican wolf now and in the future.	For any species, there may be more than one strategy that provides a valid path to recovery. This is the case for the Mexican wolf. In our development of the recovery strategy for the revised recovery plan we considered different combinations and alternative scenarios for the location, number of populations, number of releases and number of wolves (population abundance) that could achieve the recovery objective. Our recovery strategy is focused on alleviation of the threats to the Mexican wolf from human-caused mortality, lack of gene diversity, and small population size. We are focusing our recovery efforts in the area that is accepted as historical range for the Mexican wolf. I-40 provides an easily recognizable and reasonable demarcation of the northern extent of the area in which we are currently focusing our reintroduction and recovery efforts. This area comports with the scientific literature that addresses historical range (discussed in the Biological Report) and the ecological niche model (Martinez Meyer et al. 2017). The 5 and 10-year status reviews, discussed in Section V. of the recovery plan, will assess progress toward recovery and help us determine whether our current strategy is effective or needs to be revised. Changes in the strategy could include a determination that a specific reintroduction location is not feasible and other reintroduction areas in the United States or Mexico should be considered, etc. Mexican wolves are considered habitat generalists and will likely occur in areas about 5,000 feet. We are unaware of specific information/research that suggest that wolves will be negatively impacted by climate change because they are dependent on ungulate densities. Indeed, some impacts of climate change may be predicted to impact ungulates in a negative fashion (i.e., longer and more intense periods of drought), while other impacts could be predicted to impact ungulates in a positive fashion (i.e., increased

34	H e d r i c k	d. It is unlikely that the Mexican population(s) will contribute to recovery of Mexican wolves because of the lack of wild prey, lack of protection, presence of livestock, presence of humans, and presence of roads. Further, because the Mexican population will not have an effective connection to the US population, it will not contribute to overall recovery and could actually act as a diversion from efforts to recover the Mexican wolf in the US. The Mexican UMAs where prey density was estimated in the Biological Report are the equivalent of game farms, generally with high densities of white-tailed deer for hunting and where predators are killed. In other words, wolves would not be allowed to live in these areas and they are not appropriate areas to estimate prey density in the areas where wolves would be allowed to live. The natural prey biomass in areas where wolves would be allowed to live is likely to be much less and might be at a level that is unsustainable for wolves.	UMA data were not used for either elk or mule deer modeling, but were used for white-tailed deer modeling in combination with aerial and camera trap surveys. Thus, white-tailed deer ungulate biomass was not explained solely by UMA data. Indeed, the variability in methods for estimating white-tailed deer likely led to the low percent of variance explained by the white-tailed deer models (see Table 8 in Martinez-Meyer et al. 2017). Further, Martinez-Meyer et al. 2017 appropriately note: "Our point estimates of prey density and UBI come with significant uncertainty, mainly for the Mexican portion of the distribution of the wolf. In Mexico the only wild ungulate that is a primary prey for the Mexican wolf is the Coues white-tailed deer and our analysis revealed the density modeling for this species is the weakest…….Nonetheless, it is important to note that our relative ungulate density results for this species do capture the general geographic patterns of density known for this species in the United States (J. Heffelfinger [AZGFD] and S. Liley [NMDGF]). Despite this general agreement with known variations in elk, mule deer, and white-tailed density, the UBI values for any given pixel may not accurately represent the actual biomass at that location.....Currently, there is no better information available on prey density, so it is clear that an urgent next step is to carry out a coordinated effort to gather updated, systematic field data that fulfills the needs for robust rangewide ungulate density estimations. In the meantime, we present biological carrying capacity estimations for the Mexican wolf in the different areas where suitable habitat exists, according to our geographical analyses." The habitat model demonstrates there are areas of suitable habitat for Mexican wolves in Mexico, and we have a committed partner in recovery. We expect Mexico to contribute to recovery via redundancy, as well as ecological representation. If, during our 5
35	H e d r i c k	e. It is likely that the MWEPA and the Mexico population are in quite different habitats and as a consequence the genetic variation necessary for adaptation to environmental changes in the two populations could be quite different. How is this being taken into account? It appears that there will be an effort to make the populations genetically similar even though many aspects of their environments are probably very different.	Our goal is to ensure the gene diversity represented in captivity is represented in the wild populations. The two areas provide geographic representation, which may result in different adaptations over time.

36	Hedrick	f. The proposed genetic management appears to have some rather scientifically questionable aspects to it. For example, one would assume that the wild population is adapting to its environment and genetically changing as a result. Introducing captive animals that are not adapted, or adapting, to the wild environment and potentially adapting to the captive environment, might actually be detrimental to some degree for the wild population. In other words, there might be some limit to the benefit of introducing genetic variation from the captive population to the wild population and it might be beneficial to examine the potential for introducing genetic variation from wild-adapted northern gray wolves as would occur naturally. Of course, the potential problems of inbreeding depression should be evaluated as well because they might be somewhat ameliorated by further releases. However, because of diversionary feeding changing the environment around 2009, it might be very difficult to determine the level of inbreeding depression on litter size and other traits since 2009.	Our goal is to ensure the gene diversity represented in captivity is represented in the wild populations. We expect this gene diversity will allow for adaption over time, as animals breed in the wild. We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity in wild populations. Furthermore, the 5 and 10-year status reviews, discussed in Section V. of the draft recovery plan, will assess progress toward recovery and help us determine whether our current strategy is effective or needs to be revised. Changes in strategy could include changing techniques used to address gene diversity. Finally, cross-fostering efforts will help elucidate the impacts of genetic adaptation to the wild versus experience in the wild.
37	Hedrick	line 181. Should be “descended from 7 founder wolves”. There were actually many more than 7 wolves.	We made this change
38	Hedrick	l. 184. The advocacy of only two unconnected populations, one in AZ – NM and one in Mexico, is not the best science and is not likely to support recovery. Both the northern Rockies and Great Lakes wolf recovery programs advocated three interconnected populations. Earlier Mexican wolf recovery teams also advocated three interconnected populations, the present AZ-NM one and two additional ones on the north rim of the Grand Canyon and in northern NM – southern CO. Exchange between these populations to form a metapopulation could result in both demographic rescue and genetic rescue so that the overall viability of the introduced animals would be increased by the presence of the other populations. The populations in Mexico and the AZ-NM are unlikely to be functionally connected because of the present administration plans to build a high, insurmountable-to-wolves wall along the US – Mexico border. In other words, instead of a metapopulation, the two proposed populations, one in the present MWEPA and one in Chihuahua, will not interact and they would not have any demographic and evolutionary connections. As a result, the presence of the Mexican population likely will not increase the viability of the US population or the overall viability of the introduced animals.	See response to comment #27 above (Hedrick repeat)

39	Hedrick	l. 187. The surprisingly very high rate of human-caused mortality, 93 of the documented Mexican wolf mortalities (70% of total mortalities) as given in the Biological Report, along with the high removal rate, appear to explain much of the early slow population growth. Although it is good to have this documentation, it is not clear that the causes of this very high rate of human-caused mortality have been addressed. Is USFWS going to do something new to address this very high rate of human-caused mortality?	See response to Beier #11 (repeated comment)
40	Hedrick	l. 295. This again is an incorrect statement, how about "a captive breeding population descended from seven Mexican wolf founders."	We made this change
41	Hedrick	l. 319. This summary ignores the three plans written by three different recovery teams formed by USFWS around 1997, 2004, and 2011. These plans all included objectives i) and ii) above and would have included all three objectives if USFWS would have allowed the teams to continue their work.	We changed "written" to "finalized". We also included more information on previous recovery planning efforts.
42	Hedrick	l. 350. It is not clear that these previous plans were not finalized because of "logistical issues" as suggested, but primarily because USFWS disagreed with these plans developed by wolf and conservation scientists.	For any species, there may be more than one strategy that provides a valid path to recovery. This is the case for the Mexican wolf. In our development of the recovery strategy for the revised recovery plan we considered different combinations and alternative scenarios for the location, number of populations, number of releases and number of wolves (population abundance) that could achieve the recovery objective. The recovery strategy focuses on alleviation of the threats to the Mexican wolf from human-caused mortality, lack of gene diversity, and extinction risk due to small population size. See our summary of previous recovery planning efforts in the final Mexican Wolf Recovery Plan.
43	Hedrick	l. 388. Previously I made extensive comments about the PVA. Here it is important to note that in the addendum to the PVA report the population numbers over time were given in Figure 1 and 2 (because this was sent out just before our reviews were due, I did not realize the significance of these figures). For MWEPA, under all scenarios, very surprisingly the population number begins to decline after about 50 years. This is completely unacceptable and should be a red flag to indicate that even under the "favorable" conditions modelled here, the population is not sustainable.	We have evaluated additional scenarios that define the mortality conditions necessary to maintain long-term population abundance consistent with recovery. Under these conditions, the gradual decline in abundance observed in earlier scenarios can be eliminated. We have incoporated insights from these new analyses into revised recovery criteria.

44	Hedrick	l. 390. Previously, I also made extensive comments about the habitat suitability report. In summary, it is unlikely that the Mexican population(s) will contribute to recovery of Mexican wolves because of the lack of wild prey, lack of protection, presence of livestock, presence of humans, and presence of roads. Further, because the Mexican population will not have an effective connection to the US population, it will not contribute to overall recovery and could actually act as a diversion from efforts to recover the Mexican wolf in the US.	Responses to comments on the Habitat Suitability Report are on the websites. See also response to Hedrick #33 above.
45	Hedrick	l. 396. "We will update the Biological Report as needed to maintain a compendium of the best scientific information upon which to base our recovery efforts…" This statement appears incorrect because there were no changes made in the Biological Report based on my extensive, scientifically based review of the Biological Report before it was made public. As a result, it appears likely that the Biological Report (and the Recovery Plan) will not be changed as the result of the input of scientific information from the reviewers.	The cover note on the Draft Biological Report for the Mexican wolf (June 22, 2017) states "This version of the Draft Biological Report (June 22, 2017) and population viability analysis (June 13, 2017) include some revisions that are responsive to those reviews, but additional revisions will continue to be made until the document and its appendices are finalized." We will provide the final, updated Biological report concurrent with the Final Mexican Wolf Recovery Plan, First Revision.
46	Hedrick	l. 407. It would be more correct to say "three effective founder wolves" There were more than 3 wolves captured but some did not reproduce and others were related to the founders.	We made this change
47	Hedrick	l. 413. This statement is incorrect. It should read "Ghost Ranch lineage, founded by two unrelated wolves, and the Aragon line, founded by two unrelated wolves, …"	We made this change
48	Hedrick	l.423. It would be good to cite or acknowledge that the amount of genetic variation from genomic analysis for Mexican wolves is lower than that for other wolves (vonHoldt et al. 2011, Genome Research 21:1294-1305). For genomic analysis, vonHoldt et al. (2011) found the observed genomic heterozygosity in Mexican wolves was only 0.12, about 55% that of northern gray wolves which had a heterozygosity of 0.22. This is about the amount of genetic variation expected if a pair of wolves were taken at random from northern gray wolves, this pair reproduced and had two progeny, and those progeny had offspring. In other words, the level of genetic variation in Mexican wolves already is that expected from a two-generation bottleneck of two individuals from northern gray wolves!	See reponse to comment #30 above (Hedrick repeat)

49	Hedrick	l. 428. This loss of 17% of the genetic variation is very large but the genomic data cited above demonstrate that Mexican wolves already have 45% less variation than northern gray wolves. This concern over the very low genetic diversity (and high inbreeding) in Mexican wolves should result in the logical conclusion that introgression with northern gray wolves could result in an increase in genetic variation both for adaptation and reducing inbreeding depression. This interbreeding is what historically occurred and should be an important goal for the reintroduced population.	See response to Beier #5 and Hedrick #31 above (Hedrick repeat)
50	Hedrick	l. 437. Some management can be done in the wild such as removing pure inbred McBride pairs that are not reproductive or reintroducing wolves with given lineage representation into areas where that representation is low or lacking. Also on l. 486, it states that one wild pair in Mexico has reproduced in three different years. It appears likely that for good management this wild pair should be removed so that a large proportion of the ancestry in the population does not come just from this single pair.	We acknowledge that removing these wolves may be a possible managment option; we will consider a variety of management actions to increase gene diversity in cooperation with the genetic management group. Second sentence - comment noted. The proposed release schedule will allow for adequate gene diversity in the wild population in Mexico.
51	Hedrick	l. 447. This area does not include large areas of suitable habitat north of I-40 that are very similar to where the present reintroduced population is exhibiting “robust growth.” Arbitrarily eliminating these northern areas from reintroduction greatly reduces the probability of success of Mexican wolf recovery. These areas were recommended as suitable habitat by the two recovery teams that worked on a recovery plan around 2004 and 2011.	See response to Beier #1
52	Hedrick	l. 453. This increase in population size appears attributable to changes in management in 2009 which increased diversionary feeding and decreased removals. Will these two management changes be continued? How much longer will artificial feeding continue?	See response to Hedrick comment #54 below
53	Hedrick	l. 455. One surviving cross-foster pup out of six? This low success does not bode well for the cross-fostering efforts, which are presumably much more labor-intensive than translocations.	We are still gathering data on the survival on cross-fostered pups.

54	Hedrick	l. 458. The population increase from 2009 to the present appears to be mainly driven by the increased diversionary feeding and fewer removals. Are these management changes going to be continued into the future? If not, it is likely that the population growth will again stall as it was before 2009? The goal should be to reduce this micromanagement of the population and stop, or greatly reduce, both diversionary feeding and removals.	As stated in the PVA report (Miller 2017), "Management authorities in the United States and Mexico estimate that about 70% of pairs are currently receiving diversionary feeding in each country. As the populations grow, the extent of feeding will decline due to logistical complexities and other sociological factors. The rate at which feeding declines will be a function of the rate of population growth to the management target; populations that are growing at a faster rate will experience a more rapid decline in the rate at which they are fed. This dynamic diversionary feeding process was incorporated into all our population simulations. We assumed that feeding will begin to decline five years into the simulation, with the subsequent rate of decline from 70% feeding determined by the extent of growth toward that population's management target. Authorities assume that the long-term feeding rate will not drop to zero but will likely be maintained at approximately 15% to allow for management of occasional livestock depredations." In response to comments, we explored new PVA scenarios that feature elimination of diversionary feeding by model year 20 (calendar year 2035) for both populations. The results from these new analyses indicate that populations can remain viable in the absence of diversionary feeding and with reduced wolf mortality. While diversionary feeding is not necessary to achieve viable wolf populations, it may be used as a tool to reduce wolf-livestock interactions into the future. Diversionary feeding is also addressed in the Implementation Schedule Table. With regard to removals, please see page 29 of the draft recovery plan and page 40 (lines 1288 to 1314) of the draft biological report.
55	Hedrick	l. 463. What is the average mean kinship? What is the relatedness?	ADDED: Mean kinship for the U.S. population is 0.2452 (Siminski and Spevak 2017). Mean kinship is the measure of relatedness.
56	Hedrick	l. 467. The captive population only has slightly higher genetic variation than the wild population. The closely related captive and wild populations also share many of the same detrimental variants that result in inbreeding depression.	Comment noted.

57	Hedrick	l. 470. Because of the great increase in diversionary feeding since 2009, it is not possible to measure appropriately inbreeding depression for litter size as would be experienced by a population that is not being fed. Further, other factors that influence fitness, such as viability, mating success, and probability of reproduction, might also be impacted by inbreeding. In other words, it is highly likely in a population with only two founder genome equivalents remaining as in the current Mexican wolf population that there would be inbreeding depression and ignoring inbreeding depression might further imperil the population.	See response to Hedrick #32 above (commented repeated above)
58	Hedrick	l. 486. It looks like too much ancestry from this pair, which could result in inbreeding depression and loss of genetic variation.	See response to comment #50 Hedrick above
59	Hedrick	l. 490. 280 miles = 451 km! Or is it 320 km = 199 miles. Please correct.	Corrected
60	Hedrick	l. 494. One of these was the female "Chiricahua" wolf in 2017 but what was the other one that returned to Mexico? Any details on these wolves, such as sex, age, potential reason for movement, etc. might be relevant to include.	The second wolf was M1425, which traveled into the United States from Mexico in January 2017 and returned to Mexico within only a few days.
61	Hedrick	l. 570. The proposal here is to have only two populations, instead of three like both the northern gray wolves and the great lakes wolves, and to not have them connected. In other words, the level of redundancy advocated is much less than for either the northern gray wolves or the great lakes wolves. The MWEPA population does not have any "redundancy" because the Mexican population will not increase its ability to rebound from catastrophic events.	See response to comment #24 above (repeat Hedrick)
62	Hedrick	l. 575. Does representation actually mean ability to adapt? This does not seem obvious from the ordinary use of the word "representation." It is not clear that the Mexican wolf population has the genetic variation to adapt to environmental changes because it has much less variation already than any other wolf population.	See the section on representation on page 30 of the draft recovery Plan. We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity so that over time, the Mexican wolf has the ability to respond and adapt to various and changing environmental conditions

63	Hedrick	l. 599. The range suggested in 1998 ignores the recommendation of two subsequent recovery teams who advocated areas north of I-40 for reintroduced populations. Further, the current general recognition of climate change in the scientific community would suggest that the range should be moved further north to encompass the appropriate suitable habitat for Mexican wolf now and in the future	See response above to comment # 33 (comment repeated above)
64	Hedrick	l. 615. It is unlikely that the Mexican population(s) will contribute to recovery of Mexican wolves because of the lack of wild prey, lack of protection, presence of livestock, presence of humans, and presence of roads. Further, because the Mexican population will not have an effective connection to the US population, it will not contribute to overall recovery and could actually act as a diversion from efforts to recover the Mexican wolf in the US. The Mexican UMAs where prey density was estimated in the Biological Report are the equivalent of game farms, generally with high densities of white-tailed deer for hunting and where predators are killed. In other words, wolves would not be allowed to live in these areas and they are not appropriate areas to estimate prey density in the areas where wolves would be allowed to live. The natural prey biomass in areas where wolves would be allowed to live is likely to be much less and might be at a level that is unsustainable for wolves.	See response above to comment # 34 (comment repeated above)
65	Hedrick	l. 637. This map arbitrarily does not examine any of the suitable habitat north of I-40.	Martinez Meyer et al. (2017) do not arbitrarily fail to examine suitable habitat north of I-40. Please see the methods section of the Martinez Meyer et al. (2017) report "Mexican wolf habitat suitability analysis in historical range in the Southwestern US and Mexico"
66	Hedrick	l. 670. Why is this entirely based on pedigree analysis when USFWS supported a study to carry out genomic analysis of Mexican wolves (R. Fitak. 2014. Conservation genomics of the endangered Mexican wolf and de novo SNP marker development in pumas using next-generation sequencing. PhD thesis. University of Arizona, Tucson, Arizona, USA.)?	We are currently in the process of evaluating the use of SNPs and we'll continue to evaluate the most effective ways to monitor and manage gene diversity in cooperation with the genetic management group.
67	Hedrick	l. 678. What does “genetically advantageous” mean in this context? Maybe this needs to be defined or reworded.	We reworded to: Cross-fostering is a relatively new technique in which we place captive-born pups into wild dens to be raised with the wild litter. This technique is used to improve the gene diversity of the wild population.

68	Hedrick	l. 685. It is unlikely that either the states of Arizona or New Mexico would support any releases into their states. What will USFWS do when they refuse?	The states are partners in recovery of the Mexican wolf and recovering the Mexican wolf ultimately allows states to have full management authority of the species. Furthermore, the 5 and 10-year status reviews, discussed in Section V. of the recovery plan, will assess progress toward recovery - including whether releases have been conducted - and help us determine whether our current strategy is effective or needs to be revised.
69	Hedrick	l. 692. Why not use the number of released wolves that produce progeny? This is also related to previous definitions of packs. Presumably there is a pedigree of the wild population that is being constructed using molecular data to determine parentage as in other wolf populations.	The current version of the PVA model does not explicitly track pup production among released animals. Therefore, we can't derive from PVA model output an exact number of released animals that subsequently reproduce. However, based on our knowledge of 50% average reproductive success among adult female wolves annually, we estimate that a large proportion (i.e., 85-90%) of released animals that survive and reach adulthood will produce pups at least once in their lifetime.
70	Hedrick	l. 704. It is likely that the MWEPA and the Mexico population are in quite different habitats and as a consequence the genetic variation necessary for adaptation to environmental changes in the two populations could be quite different. How is this being taken into account? It appears that there will be an effort to make the populations genetically similar even though many aspects of their environments are probably very different.	See response to comment #35 above (comment repeated)
71	Hedrick	l. 720. This genetic management appears to have some rather scientifically questionable aspects to it. For example, one would assume that the wild population is adapting to its environment and genetically changing as a result. Introducing captive animals that are not adapted, or adapting, to the wild environment and potentially adapting to the captive environment, might actually be detrimental to some degree for the wild population. In other words, there might be some limit to the benefit of introducing genetic variation from the captive population to the wild population and it might be beneficial to examine the potential for introducing genetic variation from wild-adapted northern gray wolves as would occur naturally. Of course, the potential problems of inbreeding depression should be evaluated as well because they might be somewhat ameliorated by further releases. However, because of diversionary feeding changing the environment around 2009, it might be very difficult to determine the level of inbreeding depression on litter size and other traits since 2009.	See response to comment #36 (Hedrick repeat)

72	Hedrick	l. 736 and following. It is good to see the recognition of the problem of human killing and high rates of removals. How is USFWS going to reduce the human killing? They seem to have been very ineffective in the last 19 years in stopping human killing. When is the artificial feeding of animals going to be stopped? The reintroduction is nearing 20 years, much too long for artificial feeding to continue.	Human-caused mortality is not currently limiting the population in the U.S.; however, we will address human-caused mortality in recovery actions and activities. For feeding, see responses to comments # 8 and 14 above.
73	Hedrick	l. 777. Because both Arizona and New Mexico have opposed reintroduction of Mexican wolves, it seems unlikely that they would manage Mexican wolves for the betterment of the species.	See response to Hedrick #68
74	Hedrick	l. 796. For all these criteria (lines 810, 822, 831, 848, and 860), the following criterion should be added. c) Supplemental and diversionary feeding should be absent for four consecutive years	See response to comment #14 above (comment repeated)
75	Hedrick	l. 797. This seems very odd that Mexican wolves could be downlisted given the criteria in Mexico are met and they are not met in the US.	See response to comment #15 above (comment repeated)
76	Hedrick	l. 800. It would be much better if “average” was taken out so it would read “MWEPA population abundance…” For example, there could be 400, 400, 400, and 81 individuals over four years with an average greater than 320 but indicating a population that is in real trouble.	See response to Hedrick comment #16 above (comment repeated)
77	Hedrick	l. 800. 320. Does this refer to adults older than one year? Please be specific.	This refers to any Mexican wolves documented as surviving as of December 31 in any given year. We added this to the recovery criteria.
78	Hedrick	l. 801. How is the term of 4 years determined? Is this because it is about one wolf generation? Please state.	See response to Hedrick #17 (comment repeated)

79	Hedrick	l. 804. How is this number of 22 arrived at? Is this from 2017 on? It seems like 22 in the first few years would be quite different than 22 over many years and it would also depend on whether they reproduce or not (and how much). As a result, it would be better to have a genetic goal (expected or observed genomic heterozygosity greater than some value) than this seemingly arbitrary number. It is not clear how important these releases or this exact number is. As stated above, there might be a point where the benefit from introductions reducing inbreeding depression and increasing genetic variation is countered by the loss in adaptation in the wild population.	See response to comment #18 (Hedrick repeat)
80	Hedrick	l. 812. Delete “average”.	This downlisting criterion option was deleted.
81	Hedrick	l. 813. Please explain why the Mexican population meets the criteria when the average is 170 while the MWEPA meets the criteria when the average is 320.	See response to comment #20 above (comment repeated)
82	Hedrick	l. 817. Again how important is the 37 number because of the discussion above about 22?	See response to comment #21 above (comment repeated)
83	Hedrick	l. 827. Delete “average.”	We left average for the downlisting criteria, but added an annual positive growth rate.
84	Hedrick	l. 827. This appears to mean that if the average MWEPA abundance was only 150 (and that in the Mexican population was 150) that it would be downlisted. This is much too small to have the USFWS criteria of “resilience, redundancy, and representation” because the Mexican population will not help the MWEPA on any of these values	See response to Hedrick #22 (comment repeated)

85	Hedrick	l. 828. What is defined as a “positive growth trajectory”?	We changed this to "annual positive growth rate."
86	Hedrick	l. 835. Again please explain why the Mexican population meets the criteria when the average is 170 while the MWEPA meets the criteria when the average is 320. Also on l. 878-882.	See response to comment #20 above (comment repeated)
87	Hedrick	l. 868. This plan does not result in the “resiliency, redundancy, and representation” of USFWS that would be necessary for recovery for the following reasons. (d) Because the two populations are functionally not connected, it is unlikely that the MWEPA population would have an adequate level of resiliency to withstand or bounce back from environmental or demographic stochastic events without continued diversionary feeding and continued low amount of removals. If either of these management actions were changed, then the population would probably be not resilient. This is particularly true because of the very high rate of human-caused mortality in the MWEPA population. (e) Because there are only two unconnected populations, the level of redundancy advocated is much less than for either the northern Rockies gray wolves or the Great Lakes wolves. The MWEPA population does not have any redundancy because the Mexican population will not increase the ability of the MWEPA population to rebound from catastrophic events. In addition, the very low genetic variation in these unconnected populations very likely decreases the ability of the populations to rebound from catastrophic events. (f) Because the Mexican wolf already has less variation than any other wolf population measured by actual genomic data and by expected by pedigree analysis, it is not clear that the Mexican wolf population has the genetic variation (called “representation” here) to adapt to environmental changes. Perhaps if populations were started both on the north rim of the Grand Canyon and northern NM-southern CO, then introgression from northern gray wolves into	See response above to 23, 24, and 25 (comments are repeated above)
88	Hedrick	l. 878. Take out “average”.	See response above (Hedrick 16).

89	Hedrick	l. 879. How 'about adult mortality below 25%", take out "average"? This seems to be a reasonable bar to reach.	We removed "average" and modified the sentence to refer the reader to the PVA report. We acknowledge and describe in the Rationale for Recovery Criteria that mortality rates must be at levels where the population grows toward or is maintained at the desired population abundance. This value can change over time in response to different management regimes.
90	Hedrick	l. 881 and l. 882. Take out "average."	See response above (Hedrick 16)
91	Hedrick	l. 890. The wolf population should be allowed to increase above 380 and to be in other areas such as the north rim and northern NM-southern CO.	PVA modeling (Miller 2017) shows that a population in the U.S. with an average annual population abundance of 320 has at least a 90% probability of persisting for 100 years. We recognize that unrestricted Mexican wolf population growth may erode social tolerance in local communities or cause other management concerns, such as unacceptable impacts to wild ungulates (USFWS 2014). Therefore, we used the Vortex model to explore viability of populations that were not allowed to increase over 380 Mexican wolves in the United States to simulate management response to problem wolves and unacceptable impacts to native ungulate herds (Miller 2017). While 380 Mexican wolves functioned as a population cap in the model, it was not intended as a limit on the number of Mexican wolves in the wild. However, if population growth is causing management concerns, we will consider any and all management options, including allowing mortality rates to increase through permitted take or other mechanisms, provided at least 320 Mexican wolves are likely to be maintained. We have clarified this issue in the recovery plan.
92	Hedrick	l. 892. There appears to be great general support for recovering wolves in AZ and NM.	Agreed and comment noted
93	Hedrick	l. 893. Here is a statement that indicates the impact suggested by game and fish personnel where they are primarily trying to protect ungulate hunting and revenues. Are these considered "socioeconomic concerns"?	Yes

94	Hedrick	l. 896. A population of 200 wolves in Mexico would not be viable.	PVA modeling (Miller 2017) indicates that a population in Mexico (in the northern Sierra Madre Occidental) with an average annual population abundance of 200 has at least a 90% probability of persisting for 100 years, which we consider to be a viable population.
95	Hedrick	l. 935. Is it realistic to have pup survival less than 13%? If supplemental and/or diversionary feeding were discontinued (as presumably it will be), what would pup survival be?	The 13% refers to pup mortality, not pup survival. Specifically, pup mortality less than 13% refers to radio-collared pups older than 4 months. If diversionary feeding is discontinued, survival of pups older than 4 months should remain the same because diversionary feeding is rarely continued for packs with pups beyond 4 months of age.
96	Hedrick	l. 952. Why would removals be increased to change the mean mortality rate?	We may increase removals to address social tolerance concerns as long as the populations are maintaining an adequate rate of population growth toward recovery.
97	Hedrick	l. 954-957. Does this mean hunting? If so, why not say it directly?	Management options will depend on the listing status of the Mexican wolf and authorized take at that time. Hunting may be considered post delisting, but would not be considered before delisting.
98	Hedrick	l. 959. Is 25-35 years realistic (6 to 9 generations) for the population to go from 113 to 320? Does this assume continued diversionary feeding for the whole period and a low level of removals for the whole period?	According to the PVA model (Miller 2017), it is realistic for the population to increase from 113 to 320 in about 18 years, under certain scenarios. With regard to diversionary feeding and removals, please see our response to Hedrick #54.
99	Hedrick	l. 963. Downlisting in 16-20 years, under what criteria?	Based on the revised downlisting criteria, downlisting could be achieved in 16-20 years in both options.
100	Hedrick	l. 974. It is unlikely that the genetic threats will ever be ameliorated in a population with only two founder genome equivalents remaining unless there is gene flow from outside from northern gray wolves.	We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity in the wild populations.

101	Hedrick	l. 975. The statement that “ensuring gene diversity in the near term will help ensure inbreeding depression is avoided” is not correct. Remember this population has about two founder genome equivalents remaining and that the captive population has the same ancestry. In other words, even if releases keep the genetic variation from declining very fast, the releases contain many, if not all, of the same detrimentals and lethals that cause inbreeding depression in the wild population. Remember, inbreeding depression is generally defined as lower fitness in progeny from related parents than in progeny from unrelated parents.	We changed this sentence to: "Ensuring gene diversity in the near term will reduce the incidence of inbreeding depression,...." Inbreeding depression is incorporated into the probability of producing pups (in the PVA model). Other effects of inbreeding have not been documented in the wild population but will continue to be monitored. We will continue to collect data and update analyses as appropriate. Furthermore, we plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity in the wild populations.
102	Hedrick	l. 977. As discussed above, the genetic variation in Mexican wolves is much lower than in other wolves so the adaptive response “to various and changing environmental conditions” would also be expected to be much less.	See response to Hedrick 62 above.
103	Hedrick	l. 1083. Who is “we” here? Is this USFWS? Or is this the recovery group that has met recently? Or some independent evaluation?	We added a clarification in the executive summary that "we" is the Service.
104	Hedrick	l. 1087. The target for 2022 in the MWEPA is 120? This is not very optimistic.	We corrected this number to 145 based on the PVA model which predicts that in 2022 (or model year 7), the U.S. will have 145 wolves.
105	Hedrick	l. 1125. How about crossing with northern gray wolves? This would be a much more effective approach to increase genetic variation and would replicate the natural situation that occurred before wolves were extirpated.	We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity.
106	Hedrick	l. 1162. The amounts in this budget are generally incredibly high and the total is unbelievably high (about $9,000,000/year). It is important to divide the amounts provided by different sources, such as USFWS, AZGFD, NMDGF, etc. For example, AZGFD has claimed that they do not spend money on wolf recovery.	Costs have been recalculated with a time to recovery estimate of 25 years, instead of 35. Costs reflect the cost of recovery actions needed to recover the Mexican wolf. In addition, we have noted on the table the costs that would be incurred by the government and NGOs to achieve recovery. In particular, the overall cost includes that of the captive breeding facilities, which are provided *pro bono.*

107	Hedrick	Are the amounts for Forest Service and Wildlife Services "new money" or money that is already in their budgets that they are suggesting is relevant to Mexican wolf activities?	Costs reflect the cost of recovery actions needed to recover the Mexican wolf and not necessarily what is already in budgets of the responsible parties.
108	Hedrick	There is surprisingly little money for research, considering the large overall amount in this budget. In particular, it is surprising that only $30,000/year is going to Genetic Analyses. In this era, only genomic analyses can determine what is actually happening, particularly given the complicated scenarios proposed here for population numbers and releases.	Costs, including costs for research and genetic analyses, have been recalculated and are included in the updated Recovery Action Table.
109	Stetz	1. Are the downlisting and delisting criteria objective and measurable? Most of the downlisting criteria are objective and measurable, at least if some of my comments below are addressed; however, some of the criteria themselves raise questions. United States (a): Setting a target for average abundance (320 wolves over four consecutive years) is straightforward enough. My first concern is how abundance is determined? Elsewhere in the Plan, minimum abundances are reported. Will this continue to be the metric used, or will statistical models be used, and if so, what are they and how will they be used (e.g., point estimate versus lower confidence interval)? It is difficult to assess the criteria without such details. Also, there is nothing about positive population growth rates or mortality thresholds mentioned here even though they are mentioned elsewhere (e.g., in the alternative criteria on Line 238).	In the U.S., minimum population abundance is currently determined by counts conducted via ground and aerial surveys. According to our Standard Operating Procedure "Year End Population Counts of Mexican Wolves," when the U.S. population reaches a point at which statistical sampling techniques are more appropriate, this SOP will be updated to reflect that change. Regarding growth rates and mortality thresholds, our rationale for recovery criteria was included on pages 27 and 28 of the draft recovery plan; however, we have updated this language in the final recovery plan.
110	Stetz	United States (b): surviving to breeding age is no guarantee that a wolf will actually incorporate its genes to a population, as acknowledged on Line ~691. So although this criterion is measurable, I am not sure it's the best measurement to make even with estimates of post-release survival and reproduction. If genetic diversity is the key metric here, why not define a target based directly on it and not an indirect measure that may or may not reflect population status? From an outsider's perspective, it makes more sense to define a population target (e.g., observed heterozygosity), then adjust the releases accordingly instead of relying on assumptions about how well released animals integrate their genes into the population.	Our genetic recovery criterion provides a target that articulates the number of Mexican wolves that need to be released and incorporated into the wild populations to achieve the desired gene diversity in the wild populations. We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase and monitor gene diversity in the wild populations.
111	Stetz	Mexico (a): Same comments as United States (a).	See response to Stetz #109 above

112	Stetz	Mexico (b): Same comments as United States (b), which are supported by having a different target (ie, 37 instead of 22 released wolves surviving to breeding age). Again, if the target is genetic diversity, why not measure it directly?	See response to Stetz #110 above
113	Stetz	Alternative criteria (a) ~ Line 238: without documenting functional demographic and genetic connectivity between these two populations, this criterion is not very satisfying. A somewhat extreme example of why would be having 200 wolves in the NSMO population and 100 wolves in MWEPA. Despite being improbable, under this definition, it would still lead to considering a downlisting action. An important distinction here over the population-specific abundance criteria is having a "positive growth trajectory". But as with the abundance criteria, how growth will be estimated and interpreted is not specified. Knowing the expected modeling framework is not necessary, but at least addressing if this is a simple index based on minimum counts versus a rigorous statistical analysis seems reasonable. My concerns about functional connectivity are acknowledged on Line ~716 (ie, "…we do not expect the level of dispersal predicted between any of the sites (particularly between MWEPA and NSMO) to provide for adequate gene flow between populations to alleviate genetic threats…"). If even genetic connectivity is not expected, demographic connectivity certainly cannot be. As such, I fail to see how the status of the Mexican population can be given such significance, particularly as it would likely weaken resiliency and redundancy overall. And regrettably, connectivity is likely to only worsen as anthropogenic barriers increase, with or without a stupid border wall.	Under the alternative downlisting criteria a), each population would need to meet the abundance and genetic criteria, so each population would need to have an average population abundance greater than or equal to 150 wolves with an annual positive growth rate. Therefore, under the example provided in the comment, the Mexican wolf would not be considered for downlisting. We do not expect the two populations to achieve demographic or genetic connectivity, rather each is predicted to independently achieve the genetic and demographic parameters described in the delisting and downlisting criteria. Because each of the populations is genetically and demographically independent, they are truly redundant populations. In response to other portions of your comment, please see our responses to Hedrick #24 and 26, Beier #3 and 11, and Stetz 109.
114	Stetz	Delisting criteria Line 249: (1) United States (a): The longer time frame here (i.e., eight versus four years) makes it less likely that having an average population abundance >320 wolves could occur despite potentially serious declines in abundance in later years. Nonetheless, abundance (or average abundance) by itself is not a very strong indicator of population performance without other metrics such as number and distribution of packs.	In response to comments, we modified the recovery criterion to reflect the importance of maintaining the population at or above the population target threshold during the latter 3 years of the 8-year timeframe of interest. Number and distribution of packs, survival, production, and reproduction all factor into the population performance and the observation of the trend in the population. Thus, we consider population abundance as the culmination of all other population metrics and the strongest indicator of the performance of the population. Because wolves are territorial, a stable or increasing population is indicative of a stable number and distribution of packs, unless packs greatly increase in the average number of animals within each pack, which would only last until the following dispersal season.

115	Stetz	United States (b): Same comments as the population-specific criteria.	See response above (Stetz 114)
116	Stetz	Mexico (a): Same comments as United States (a).	See response above (Stetz 114)
117	Stetz	(2) Line 278: The criteria listed here are vague and, therefore, it is difficult to consider them objective or measurable. Other recovery plans that I am familiar with provide explicit mortality limits, usually expressed as age-class/sex-specific percentages of abundance estimates. Defining limits as 'good enough to maintain a viable population' is not sufficient detail. Further, stating that Mexico (or the U.S. for that matter) has a proven track record of protecting wolves may be relatively true in the recent past, but clearly it is not a given. Finally, having such regulations in place does not address other important anthropogenic mortality risks such as vehicle collisions, and does not appear to be adaptive in terms of responding to natural mortality sources including disease.	See lines 934-936 in the Draft Recovery Plan for specific age class mortality information that allow a population to reach recovery. There is no evidence of differential survival between male and female wolves. However, at the time of delisting, populations will be stable or increasing and thus, while the survival rates detailed in line 934-936 (in the Draft Recovery Plan) address the level of mortality needed to grow to population recovery targets, they do not take into account additional mortality (i.e., removing wolves above upper modeled management targets). Presumably, the level of mortality will be based on the amount of mortality in this stable period. We have revised the second delisting criterion regarding regulations, such that it no longer has the language "proven track record". We have included actvities in the Implementation Schedule Table to address risks such as vehicle collisions and disease. Neither of these are considered significant threats to Mexican wolves, and as such, are not addressed in the recovery criteria.
118	Stetz	2. Will the site-specific management actions achieve the plan's goal for the conservation and survival of the Mexican wolf? Without access to the Recovery Implementation Strategy it is difficult to assess the site-specific management actions that will be taken to achieve down/delisting criteria. The only criteria that have specific actions tied to them are the number of released animals surviving to breeding age, which as I suggest above, may not be the most appropriate criteria. I agree that it is not necessary or prudent to identify future release sites; however, this example is overly specific, and there are other actions that could be better defined. These include empirical genetic diversity measures, disease monitoring and response plans, how population parameters are derived and interpreted, and how supplemental/diversionary feeding is determined and adapted.	Comment noted and we added more detailed recovery actions and activities to the Recovery Action Table and Implementation Schedule Table, respectively, including monitoring disease, genetic, and population parameters.

119	Stetz	3. Is the overall recovery strategy and specifically the recovery criteria supported by scientific information in the revised recovery plan and/or the Biological Report? Abundance: Among my biggest concerns about the criteria themselves is the lack of any intrapopulation spatial components or number of packs in the population(s). These could be indexed by occupied territories, distribution of packs on the landscape (i.e., proportion of area occupied), and/or trends in each. Such criteria would likely go a long way to providing additional measures of intra-and interpopulation resiliency, redundancy, and representation. They would also be relatively easy to define and objectively measure, and would (I assume) be consistent with monitoring efforts needed to identify future release sites (per Line 1140), among other benefits. Relying strictly on abundance without other considerations, particularly for a social species, is missing an important part of their ecology. Further, given the ongoing legal battles with wolves in the Great Lakes (see Judge Millett's recent ruling), I would expect such criteria to be an easy target, although I recognize that may be beyond the scope of this review. Based on the PVA, however, the abundance targets should provide reasonable resiliency in the near- to mid-terms if they can be met.	Please see response to Stetz #114 above.

120	Stetz	Genetics: As I touch on in other places, defining genetic criteria based only on proportion of the captive populations' diversity is missing the point. Clearly there are hard limits to what can be achieved given such a small founding population and the inability to control breeding in the wild. Nonetheless, the issue is with the actual genetic status of the wild population(s), as this has been shown to influence reproduction and is likely to become a bigger concern over time unless additional genetic material is brought into the population (i.e., from other subspecies). I suggest that the current criteria would be more appropriate as a "how" (to achieve a target) than a "what" (the target actually is). Similarly, is there a point at which releases of members from other subspecies would be considered? And if so, what would such triggers look like? Although controversial, such a thing has been done before to considerable success. Although I do not discount the potential significance of genetic diversity in the wild populations and its interactions with demographic processes, there may be too much emphasis placed on it relative to other threats, particularly for such small populations. One obvious example is disease, which receives essentially no attention throughout the Plan (although I realize it was incorporated into the PVAs, which I'll address later). Relying on data from Yellowstone or other wild populations is a reasonable start, but is not necessarily sufficient for these populations. For one, there are larger human population centers, including Albuquerque and Tucson, than in the GYE, which could	We plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity in the wild populations. With regard to "how," we explain in our Rationale for Recovery Criteria on page 31, that Miller (2017) identifies several release scenarios that are able to achieve 90% gene diversity of the captive population in the wild within approximately 20 years. Changes in the strategy could include changing techniques used to address gene diversity. Disease is not currently identified as a significant threat to the Mexican Wolf (see USFWS 2015). If monitoring reveals that disease is a signficant threat, we will respond accordingly. We currently monitor for disease in Mexican wolves and added disease monitoring to the Implementation Schedule Table.
121	Stetz	Somehow I missed this while reviewing the Draft Biological Report, but why is there a 5% reduction in adult mortality during a CDV outbreak (Line 333 in the revised report). Should this read a reduction in survival (as with pups)?	Yes. In the PVA, Dr. Miller will change the text to survival.

122	Stetz	Another concern is the possibility of downlisting or delisting the entire sub-species when a population outside the United States demonstrates even relatively weak evidence of recovery. Although it may be implausible to think the MWEPA population will not continue to be the stronger performing population, using averages or totals across MWEPA and NSMO could place unrealistic long-term pressure on population(s) in Mexico, and weakens the concept of redundancy, as noted on Line 1059. Clearly the U.S. has no authority over how wolves are managed in Mexico, regardless of MOUs or a recent history of dedicated recovery efforts. As such, the alternative criteria for downlisting do not seem strong enough, particularly the average abundance criterion, GIVEN the limited (at best) connectivity between MWEPA and NSMO populations. Requiring positive population growth strengthens this criterion; however, how this is determined is not specified. Any model-based approach to estimate growth rates would be expected to be too imprecise to not overlap zero (and likely negative) growth. To really assess how objective and measurable the criteria are, the methods and rules (e.g., growth rate estimate will use model-averaged point estimate versus upper or lower 95% confidence interval) should be specified.	In response to comments, we changed the first downlisting option to include only the United States population. Therefore, the species would not be considered for downlisting if only the Mexico population meets its population and genetic downlisting criteria. See also our response to Beier #3.
123	Stetz	Specific comments: Line 215: MWEPA not defined in text yet (recognizing it is defined on Line 1171).	Added definition
124	Stetz	Line 499/Fig.2: Again, is this a minimum count, or abundance estimate? Line 459 says minimum count, but the figure says minimum population estimate.	We changed the figure to "minimum count.
125	Stetz	Line 879: This appears to be the first mention of average adult mortality (<25%) thresholds on top of average abundance of >320. I would think this should be listed explicitly with the abundance criteria at each instance assuming that it is applicable to each.	Commented noted. We do not provide the mortality rate explicity every time we mention the abundance critierion for simplicity of communication. However, we acknowledge and describe in the Rationale for Recovery Criteria that mortality rates must be at levels where the population grows toward or is maintained at the desired population abundance. This value can change over time in response to different management regimes.
126	Stetz	Line 977: “ensure” is a strong expectation here, as even relatively large, well-connected populations may not be able to respond and adapt to changing environmental conditions. Optimizing genetic diversity, to the extent possible, will AID in a species’ ability to adapt, but does not ensure it	Changed to: Ensuring gene diversity in the near term will reduce the incidence of inbreeding depression, while over a longer timeframe it will aid the Mexican wolf’s ability to respond and adapt to various and changing environmental conditions.

127	Stetz	Line 985: Again, a target of 90% of the captive population's genetic diversity says little about the actual status of the wild population. I would prefer to see specific target values for the wild population such as expected and observed heterozygosity, allelic richness, and average inbreeding coefficients instead. This will not appear as "rosy" as the current 90% target, but are more relevant.	Our genetic recovery criterion provides a target that articulates the number of animals that need to be released and incorporated into the wild populations to achieve the desired gene diversity in the wild populations. Furthermore, we plan to convene a genetic management group (this is included as an activity in Implementation Schedule Table) to assist us with genetic management and recovery of the Mexican wolf, including addressing the most effective approaches to increase gene diversity in the wild populations.
128	Stetz	Line 1082 (5- and 10-year status reviews): how were the interim criteria determined? Also, are the abundance targets strictly the status of the population(s) at year 5/10 instead of multi-year averages as with the recovery/downlisting criteria? If so, I would suggest establishing criteria that account for trends in the population(s), either showing positive population growth or at least average abundance over the period of the review. Also, would it make more sense to align the review periods with other criteria (i.e., 4- and 8-year intervals used to calculate average abundance)? I assume this interval is at the discretion of the Team and not a legal mandate under the ESA (pre-delisting, that is). Finally (and again), is this criteria a minimum count or estimate? Either way, the target for the 5-year review seems quite low given the population's status as of 2016 and, therefore, may not be strong enough to really assess program successes/failures and inform adaptive management.	We have corrected the numbers in the 5 and 10-year status reviews. The numbers we used in the public draft were incorrect. We based them on calendar years from the signing of the final recovery plan. However, they should have been based on model years. The model used data through December 2015, so model year 7 equates to calendar year 5, and model year 12 equates to calendar year 10. The model predicted that in five years there would be approximately 145 wolves in the U.S. and 100 wolves in Mexico with 9 released and 25 released/translocated wolves suriving to breeding age within the U.S. and Mexico populations, respectively. The model predicted that in 10 years there would be approximately 210 wolves in the U.S. and 167 wolves in Mexico with 16 released and 37 released/translocated wolves suriving to breeding age within the U.S. and Mexico populations, respectively. Note that we revised the interim abundance targets to reflect changes in the model that occurred between the draft and final versions of the recovery plan. The 4 and 8-year durations listed in the criteria are based on generation length and the 5 and 10-year status reviews are aligned with ESA 5-year review requirements. The interim abundance target would be a minimum count until the population reaches a point at which statistical sampling techniques are more appropriate (at which point our Standard Operating Procedure "Year End Population Counts of Mexican Wolves" will be updated to reflect that change.

129	R o e m e r	The criteria for downlising or delisting the subspecies refer to two reintroduced populations of Mexican wolves, one larger population located in Arizona and New Mexico of the U.S. – the Mexican Wolf Experimental Population Area (MWEPA) and another smaller population located in the northern portion of the Sierra Madre Occidental in northern Mexico (SMOCC-N). In general, the concept of maintaining populations large enough to reduce the probability of extinction over 100 years is an accepted strategy and a population > 250 individuals that is stable over 2 generations (8 years) appears to have a low risk of extinction that is supported by the current Population Viability Analysis (Miller 2017: Figs. 3 and 4), a prior PVA (Carroll et al. 2014: Fig. 1), and by expert opinion (Wayne and Hedrick 2011). However, populations below this value naturally have a higher risk of extirpation and this risk is dependent on population vital rates (e.g., mortality rate and reproduction), levels of connectivity between the existing populations, and other factors such as demographic stochasticity, inbreeding depression, environmental variation, catastrophes, human-caused impacts to the wolf populations and their habitat, and what level of risk we decide is acceptable. Currently, the target population size in the Recovery Plan for the MWEPA is 320 Mexican wolves whereas the target for the SMOCC-N is 170 wolves. Thus, the latter target may be low, but neither target may preclude long-term persistence and persistence will depend on various factors which may or may not be under management control (Harding et al. 2016).	Comment noted

130	R o e m e r	One factor that was specifically modeled in the current PVA by Miller (2017) was introduction of wolves from the captive population or translocation of wolves from the MWEPA to the SMOCC-N and although both scenarios tended to reduce the extinction risk for the SMOCC-N, one key aspect here is that natural movement between these two populations is most likely minimal owing to the relatively large distance separating them. Natural dispersal was also modeled by Miller (2017) and conclusions there and in the Draft Biological Report (USFWS 2017a: L1456-1469) suggest that without some level of connectivity the risk of extinction for the SMOCC-N will necessarily increase. Carroll et al. (2014) also suggested that the risk of extinction for a population below 200 individuals will be more strongly affected by dispersal. In summary, if management actions, such as translocation of wolves from the MWEPA to the SMOCC-N are to be curtailed or stopped after downlisting or delisting, then the extinction risk to a population of wolves averaging 170 individuals within the SMOCC-N may increase and be unacceptable. The Service has also recognized this (USFWS 2017a: L1373-1379):	Releases and translocations necessary to meet the recovery criteria are anticipated, per the PVA model (Miller 2017), to be completed in model year 18 (see [EISx2]20_20). As we state in the recovery plan, we do not expect regular releases from the captive population to be necessary after Mexican wolves have been recovered because gene diversity from captivity will have been incorporated into the wild populations and wild populations will be sufficiently abundant such that releases from captivity for population augmentation will not be necessary. That said, if monitoring reveals that wolves are threatened by low levels of connectivity, then management actions (e.g., translocations) will be taken to ameliorate this threat. Furthermore, we have added activities to the Implementation Schedule Table to maintain connectivity between populations in the U.S. and Mexico.
131	R o e m e r	"In the northern Sierra Madre Occidental, a population of less than 200 wolves is unable to reach the 90% benchmark except at the lowest tested mortality rate (approximately 19%), which is well below the population's current average adult mortality rate and expected to be unlikely to be achieved during the early years of the reintroduction. Larger population sizes at or above 200-250 are needed for persistence of this population at a mortality rate of approximately 25%, while populations of 200-250 are not able to achieve persistence at mortality rates of 28% and 31%." This summary reflects the analysis in Miller (2017) and suggests that the recovery target for the SMOCC-N may be too low. What may be important here is to develop a sound monitoring program that will be used to identify when a population may be in trouble, what causal factors are involved, and to articulate potential management interventions that could be enacted to then avert any potential decline (e.g., see Bakker et al. 2009). That said, a new target of 200-250 individuals in the SMOCC-N may be necessary.	This language is from the draft Biological Report, and while it accurately characterizes Miller's (2017) Scenario Set 1 (No Additional Transfers to and among Wild Populations), we incorrectly referred to this scenario in our report because we intend on reaching recovery with releases and translocations (i.e., Scenario Set 2 and specifically, [EISx2]20_20). In response to comments and further exploration of new PVA scenarios that examined elimination of diversionary feeding by model year 20, we increased the abundance target of the Mexico population to 200 wolves (see the updated recovery criteria in the final recovery plan). Results of the elimination of diversionary feeding under the previous upper management level of 200 wolves with 24.9% mortality indicated that the population exhibited a steep decline over 100 years. This decline was due to an accumulation of inbreeding and lower pup production. Therefore, we examined scenarios that stablize the population over 100 years. Increasing the average population abundance target to 200 and upper management level to 300 wolves in combination with a lower mortality rate resulted in a stable population over 100 years. Mexico has a Mexican wolf monitoring program; more details of this program have been included in the Implementation Schedule Table.

132	Roemer	Finally, 2 established populations is the minimum that might be considered for recovery and although there are very influential socioeconomic issues to consider, additional reintroduction sites, such as near the Grand Canyon in Arizona or an additional site in northern New Mexico and southern Colorado (Wayne and Hedrick 2011) might be considered, at least within a modeling context, to explore how such a configuration might reduce the risk of extinction for the entire subspecies.	Please see responses to Beier #1 and Hedrick #24
133	Roeme r	Are these demographic targets objective and measurable? It is not clear why a target of 170 individuals was selected for the SMOCC-N, as this seems to be somewhat low based on various analyses and opinion, but abundance estimates are measurable.	Please see response to Beier #3 and Roemer #131 above
134	Roemer	The entire subspecies of the Mexican wolf is founded from 7 individuals, and it is recognized that the wild population has a higher level of inbreeding than the captive population which itself, is larger in number than either reintroduced population. Although inbreeding depression may have occurred in some pairings as the recovery effort unfolded (Fredrickson et al. 2007), more recent reproduction in the wild suggests that inbreeding depression has declined (Harding et al. 2016, USFWS 2017a, b). That said, the current genetic targets for downlisting or delisting include specific language about the number of individuals released from the captive population that will survive and be available to breed. For example, for the MWEPA it is written that: "Gene diversity available from the captive population has been incorporated into the MWEPA through scheduled releases of a sufficient number of wolves to result in 22 released Mexican wolves surviving to breeding age in the MWEPA.", and similarly for the SMOCC-N it is written that: "Gene diversity available from the captive population has been incorporated into the northern Sierra Madre Occidental through scheduled releases of a sufficient number of wolves that results in 37 released Mexican wolves surviving to breeding age in the northern Sierra Madre Occidental." One issue here is that the social structure of wolves, which typically involves an extended family pack structure with a dominant pair that breeds, may actually hinder the incorporation of new genes from individuals released into the reintroduced populations from the captive population. Although counting or estimating the number of released individuals that survive to breeding	Please see our response to Hedrick #18

135	R o e m e r	Since 2009, a series of management actions including law enforcement, non-lethal methods of livestock protection, cross-fostering of pups, diversionary feeding, and the cessation or reduction in lethal and permanent removal of individuals have resulted in what appears to be a growing population of Mexican wolves in the MWEPA (Fig. 1; Miller 2017). In addition, a second population of Mexican wolves was reintroduced into the Sierra Madre Occidental of Mexico. These actions are all very positive toward conserving this subspecies, but the recovery criteria merely state what the goals are, and mostly in a general sense, rather than articulate how those goals will be achieved. Under Heading III: Recovery Strategy of the recovery plan, there were statements regarding strategy under 5 additional subheadings: Geographic Distribution (L591), Population Abundance (L642), Genetic Management (L665), Monitoring and Adaptive Management (L731) and Collaborative Recovery Implementation (L763). Here's the statement for Population Abundance: "Our strategy to establish two populations over a large geographical area of the Mexican wolf's range addresses the conservation principles of redundancy and (ecological and geographical) representation, as discussed in the Rationale for Recovery Criteria." **This is not a strategy but rather an objective, and although it is a worthy one, it does not explain how this goal will be accomplished. There is no strategy or plan as to how any of these goals are going to be accomplished in the future beyond a general sense. Regarding population abundance, how will the populations be monitored? How many releases are planned per year for each site? How**	We added a goal and objectives, as well as more detailed recovery actions to the recovery plan. The recovery actions provide recommendations to address threats and achieve the recovery criteria. Addtionally, we added more detailed recovery activities, needed to implement the recovery actions, to the Implementation Schedule Table.

136	Roemer	There has been a wealth of information collected on both the reintroduced and captive populations and clearly there has been an enormous effort, from a variety of standpoints, to preserve this subspecies. This effort should be lauded; however, the analysis of these data, its presentation, and its incorporation into additional modeling exercises have some serious issues that are reminiscent of problems that plagued other recovery programs, namely that for the Florida panther (Beier et al. 2003). The ESA specifically states that a determination regarding a threatened or endangered species will be made "... solely on the basis of the best scientific and commercial data available..." and that a recovery plan will include "a description of such site-specific management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species." In regards to these statements, I think the current recovery plan falls short, the data analysis is inadequate and site-specific management actions to recover both populations or critical population-based or threat-based criteria that once breached, will elicit specific management actions to reverse a negative impact on population persistence, have not been outlined.	The Recovery Plan was prepared in accordance with the requirements of Recovery Planning and Implementation (RPI) which is a revised recovery planning process adopted by the Service in 2016. It contains the required recovery plan elements specified by the Endangered Species Act (ESA) (section 4(f)(1)). We developed the Implementation Strategy Table with partner agencies including the U.S. Forest Service, Bureau of Land Management, and National Park Service; the Arizona Game and Fish Department and New Mexico Department of Game and Fish; Tribes; County representatives; and the Mexican government and field staff. While the Recovery Implementation Strategy provides additional detailed, near-term activities that are needed to implement the actions identified in the recovery plan, there are no site-specific management actions in the Recovery Implementation Strategy that are not in the recovery plan. Therefore, the public was given the opportunity to comment on the entire recovery plan, including the site-specific management actions, and comment on the Recovery Implementation Strategy is not required. We added objectives and more detailed actions to the recovery plan. We will review the Implementation Strategy Table on an annual basis to ensure that recovery activities are implemented to achieve recovery objectives that lead to the recovery goal. The Recovery Implementation Strategy, which includes the Implementation Schedule Table, has been posted to our website.
137	Roeme r	There is a wealth of data that has been collected on this subspecies that has not been analyzed using appropriate methods. The following is a list of some analyses that may want to be considered.	Comment noted, see responses to your specific questions below.

138	Roemer	1. Estimates of the size of the reintroduced population in the MWEPA has apparently been collected via aerial survey but these data have been presented as point estimates without associated estimates of precision, yet the probability of detecting individuals in an aerial survey is clearly < 1. Like any abundance estimation procedure, aerial surveys have various assumptions and data-collection issues and appropriate sightability models should be used with these data to estimate abundance and the precision around the estimate (e.g., see Lubow and Ransom 2016). Further, it is not clear if the estimates of population growth rate were simply calculated as Nt+1/Nt, and thus based on the point estimates, which have no measures of precision. Alternative methods of analysis, including recently developed integrated population models may want to be explored to estimate abundance and population growth rate, improve estimates of precision for all demographic rates, as well as be used to compare observed growth rates, based on estimates of abundance, to realized growth rates based on estimates of vital rates (Schaub and Abadi 2011).	In the U.S., minimum population abundance is currently determined by counts conducted via ground and aerial surveys. The annual count is conducted from November through the helicopter operation in January/February. According to our Standard Operating Procedure "Year End Population Counts of Mexican Wolves," when the U.S. population reaches a point at which statistical sampling techniques are more appropriate, this SOP will be updated to reflect that change. We will explore integrated population models as a statistical sampling technique that may be more appropriate.
139	Roemer	2. Regarding the vital rates and in particular the probability of survival, it is not clear how survival estimates were derived. Many wolves were radio-collared and in Appendix D of Miller (2017) there are estimates of survival with associated confidence intervals but how these estimates were obtained is not explained. There also appears to be some assumptions as to the fate of different individuals. These data should most likely be analyzed with an appropriate approach, such as a known-fate model, and presented with an associated variance estimate, and estimate of which would vary depending on sample size (White and Garrot 1990). Known-fate models can be used to compare survival probabilities over time and between different classes (e.g., age or wild-born vs. captive-born).	Appendix D indicates the method used to estimate survival rates was based on the methods described in Heisey and Fuller (1985). Text was edited in Appendix D to more clearly describe this.
140	Roemer	3. From Appendix D of Miller (2017) it is clear that a wealth of GPS data on movements and locations of wolves has been compiled; between 2009 – 2014 there were over 75,000 radio-days on wolves across three age classes. Yet there is no use of these data in a resource selection framework (Manly et al. 2002). Given the development of the species distribution models (SDMs) to determine suitable habitat for reintroduction (Martinez-Meyer et al. 2017), it would seem prudent to analyze these locational data to actually assess resource use and to compare that derived from the GPS data to that developed from the SDMs.	A limited locational data set from the United States was utilized in use/availability analyses (see Land cover and vegetation types section in methods section of Martinez-Meyer et al. 2017). In other portions of the analyses (ecological niche, human and road density, and ungulate density), we did not utilize locational data from the U.S. because the relationships were designed to examine historic patterns (ecological niche) or well established in the literature (human, road, and ungulate density). The general goal was to examine the habitat patterns across Mexico and the United States rather than establish new patterns through a resource selection framework.

141	Roemer	4. Although two PVAs have been conducted on this subspecies, both used the Vortex platform and the most recent analysis by Miller (2017) does not appear to incorporate model or parameter uncertainty in the analysis nor does it explore potential functional relationships with, for example, estimates of prey abundance. The Scientific Review Team (SRT; Beier et al. 2003) that reviewed the Florida panther recovery program specifically mentioned that: "Although VORTEX and other canned procedures can reveal sensitivity to some parameter estimates, they are opaque on many other issues, especially those related to functional relationships." and "The SRT recommends that any future PVA models should be built from scratch and explicitly consider parameter uncertainty, variation (demographic, environmental) in parameters, and uncertainty in key functional relationships such as density dependence and the effects of inbreeding." and further, "In general, there is a serious need to take into account the various sources of uncertainty in these projections, among them uncertainty in the input values and assumptions. Management alternatives could then be evaluated considering all these sources of uncertainty." This critique of the Florida panther recovery program has many parallels with the current Mexican wolf recovery plan and should most likely be a source to consider when reexamining the data available for the Mexican wolf. Other sources to scrutinize include the demographic and population viability analysis by Bakker et al. (2009) and the subsequent recovery plan devised for the island fox (USFWS 2015). So, are the recovery criteria supported by scientific	There is no explicit uncertainty analysis in the current PVA as is also the case in the Carroll et al. (2014) publication that describes the previous Mexican Wolf PVA used to inform recovery. A full uncertainty analysis would not alter the conclusions used to derive robust recovery criteria, but can inform future research needs to improve management toward recovery. The sensitivity analysis of Carroll et al. (2014) was used to identify critical demographic parameters that influence growth of the population toward recovery, in particular adult mortality. This became a central element of the PVA that helped identify critical mortality thresholds for management of wolf populations toward recovery. Sensitivity analyses of other parameters including disease frequency and severity and density dependance in mortality were also crucial in refining PVA model structure and implementation.
142	Lnlafo	l 182. Was in 2005 not 2011	Mexico's first official, sanctioned release to the wild was in 2011.
143	Lafon	l 284. It´s possible to add a Third option??. 3.- A wolves population is found in central NSMO that could increase the resiliency, representation and redundancy of the ongoing population	Evidence suggests that finding a previously unknown wolf population in central NSMO, or anywhere, is unlikely; however, such a discovery could enhance recovery efforts if newly discovered wolves are determined to be additional founders to the population, and we may change our recovery activities in response to such an event. We would not change our recovery criteria unless our 5 or 10-year status reviews indicate that our current strategy is not effective and needs to be revised. We note here that the commenter is likely referring to wolves that were part of a non-sanctioned release event from the Los Encinos Ranch in 2005. These wolves were part of the captive breeding population and descendents from the same 7 founders as the extant population. See related responses to comments (Lafon 148)

144	Lafon	l 291. Family packs or packs?	Packs
145	Lafon	l 301. How about the free ranging wolves in Chihuahua?	Lines 297 to 298 in the draft recovery plan state: Today, Mexican wolves again inhabit portions of the southwestern United States in Arizona and New Mexico, and the northern Sierra Madre Occidental of Chihuahua in Mexico. See response to related comments (Lafon 148)
146	Lafon	l 323. SEMARNAT 2000, is not in LITERATURE CITED	Secretaría de Medio Ambiente, Recursos Naturales y Pesca (SEMARNAP). 2000. Proyecto de Recuperación del Lobo Mexicano. Mexico, D.F. 103 pp.
147	Lafon	l 386. wild born: because it doesn´t said anything about searching for new wild populations that still inhabit some areas of Chihuahua	Evidence suggests that finding a previously unknown wolf population in this area is unlikely. We note here that the commenter is likely referring to wolves that were part of a non-santioned release event from the Los Encinos Ranch in 2005. See related responses to comments (Lafon 148)
148	Lafon	l 479. 2005 like a "first pilot release" in 2011 continue with the program	Mexico's first official, sanctioned release to the wild was in 2011. The Los Encinos Ranch previously supported two enclosures which housed Mexican wolves as part of the SSP. We are aware that in 2005, the Los Encinos Ranch released five of their captive Mexican wolves on to the ranch. As reported to the SSP, at least two of these wolves are known to have died (personal communications reported 4 died and 1 was recaptured). We are also aware of their intent to release additional wolves, and that later that year Los Encinos reported a storm destroyed the enclosures and the remaining wolves either died or escaped. We have received no official documentation of any releases or confirmation of escaped wolves, and no evidence confirming any of these animals survived in the wild. In 2008, SEMARNAT decided to exclude Los Encinos from the SSP, when there was no evidence of wolves or the enclosures persisting. Prior to these events, all Mexican wolves housed by Los Encinos were descendants of only two animals (M99 and F116) and subsequent incestuous breedings (i.e. M99 bred some of its offspring and at least one brother/sister breeding was reported to the SSP). Before any of the possibly surviving animals released or escaped from this facility (or their offspring) could contribute toward recovery, their presence and genetic purity needs to be confirmed.
149	Lafon	l 482. from the first release an estimation of 20 to 30 wolves is possible inhabit the Sierra del Nido, Las Tunas and Sierra de San Andres, unfortunately non-technical following of these animal has been conducted	The first authorized release was in 2011; there is no confirmed evidence that Mexican wolves released in unauthorized manner/escaped in Mexico prior to this date have survived. See related responses to comments (Lafon 148)
150	Lafon	l 490. 402 kilometers, not 320	In the Final Recovery Plan, we changed this to 260 miles (418 kilometers).

151	Lafon	l 514. and predator control programs using 1080 in half of the 19th century	This line references threats contributing to the endangered status of the Mexican wolf in 2015, as opposed to historical threats, such as predator control programs in the 19th century.
152	Lafon	l 531. The habitat could be fine for wolves but the "habitat use" for cattle purposes is the real threat for the species. I don´t know is an extra line explaining this concept could be adequate or results could be negative for the Recovery Plan	This line references threats that contributed to the endangered status of the Mexican wolf in 1978. However, cattle grazing is not a threat to the Mexican wolf. We added management actions and activities to reduce conflicts between Mexican wolves and livestock resulting from depredations to the Recovery Action Table and Implementation Schedule Table.
153	Lafon	l 531. However, there is no records of sport hunting in Mexico, and predator control issues are not mentioned	This line references threats that contributed to the endangered status of the Mexican wolf in 1978. Sport hunting of Mexican wolves is no longer a threat and is not legal in either country.
154	Lafon	l 543. Service 2010. is not in literature	Changed to USFWS 2010, which is in the literature cited
155	Lafon	l 549. citation (USFWS 2017a) ??	Yes, changed to USFWS 2017a
156	Lafon	l 607. in 2005 was the first "official" reintroduction in Mexico	Mexico's first official, sanctioned release to the wild was in 2011. See related responses to comment (Lafon 142 and 148)
157	Lafon	l 639. looks like is not a right way to show this figure (double title ??) maybe must be in the text	Fixed, added quotation marks to indicate that the second title figure was taken from Martinez Meyer et al 2017.
158	Lafon	l 722. Do you think the border wall will affect the dispersal of wolves between MWEPA and Northern Sierra Madre Occidental? Because historic records have shown the natural dispersal from both areas	It is possible that a border wall could affect the dispersal of wolves between the U.S. and Mexico; however, see our response to Beier comment #11. Currently, segments of the border either have no fence; vehicle fence, which is permeable to wolves; or pedestrian fence, which is not permeable to wolves.
159	Lafon	l 893. Then, an extra effort of a communication and environmental education program in the releasing sites region must be conducted	Agreed; we have added education and outreach activities to increase social tolerance of Mexican wolves to the Implementation Schedule Table
160	Lafon	l 946. Smith et.al. 2010 or 2011??	Smith et al. 2010

161	Lafon	l 1135. one suggestion is to develop an educational process in Mexico at least in the states that the wolves has been released in order to let the people know what´s going on with the species, what is the purpose of this reintroduction program and benefits.	Agreed; we have added education and outreach activities to increase social tolerance of Mexican wolves to the Implementation Schedule Table
162	Lafon	l 1178. Add SEMARNAT Secretaria del Medio Ambiente y Recursos Naturales and CNG Confederación Nacional Ganadera	We added Confederación Nacional de Organizaciones Ganaderas (CNOG) and SEMARNAT
163	Lafon	Table pag 38, num 13 second column. Add SEMARNAT	Added
164	Lafon	Table pag 38, num 15 second column. Add SEMARNAT and CNG	We added both
165	Lafon	Page 4o at end. I don´t know if the recovery plan could consider search for other wolves in the wilderness of Chihuahua and Durango states. At least in those sites were tracks, individuals and/or howls has been reported recently. This wolves population is located in Sierra del Nido and other mountains of this corridor. An extra strategy could be support a last effort to find new genetical material from these animals that could increase the vialability of the program	See response to Lafon #148
166	Lafon	Literature cited: Goodman D. 1987. is not in the document	Goodman 1987 is on line 648 and in the literature cited
167	Lafon	Heffelfinger….2017. is not in the document	Removed
168	Lafon	Pimm….. 1988. Is not in the document	Pimm et al. 1988 is on line 648 and in the literature cited
169	Lafon	Soule…… 1986. is not in the document	Soule et al. 1986 is on line 427 and in the literature cited

170	Lafon	USFWS 1996. is not in the document	Deleted
171	Lafon	1. Are the downlisting and delisting criteria objective and measurable? Yes, both criteria are objective and measurable. Those criteria depends directly on the released wolves reproduction and adaptation then, monitoring cost must be consider in the plan.	Comment noted and yes, monitoring costs are included in the Recovery Action Table and Implementation Schedule Table
172	Lafon	The genetic criteria could improve if part of the program support is focus in the study of the wild wolves in Mexico that could increase the gene diversity.	Comment noted. Please see related responses to comment (Lafon 148)
173	Lafon	Also, the in the delisting criteria for Mexico new releasing areas must be consider (Namiquipa, Buenaventura counties as well as the El Nido, las Tunas, San Andres sierras)	The focus on Mexican wolf recovery in Mexico is currently in the northern Sierra Madre Occidental. Wolf releases may occur in any appropriate habitat within this region involving the mentioned counties and Sierras.
174	Lafon	Another suggestion is include a third strategy in order to establish a well-developed communication and environmental education program for public and land owners in the specific, and develop a stronger depredation compensation funds for Mexico trough different possible donors or programs like for ecological services payments.	Agreed; to increase social tolerance of Mexican wolves, we have added activities to the Implementation Schedule Table, including education and outreach; compensating livestock producers for losses due to wolves; and implementing a payments for ecosystem services program
175	Lafon	2. Will the site-specific management actions achieve the plan's goal for the conservation and survival of the Mexican wolf? The selected areas are the best according with the historical distribution of Mexican wolf. NWEPA as well as the Sierra Madre Occidental were the last sites of wild wolf's distribution and this could help to maintain the Redundancy and Representation.	Comment noted
176	Lafon	Population abundance would be in relation with prey abundance, unfortunately is not enough wild prey for wolves in some sites and land owners could be in conflict for cattle predation that could be the key factor for population growth.	We added management actions and activities to the Recovery Action Table and Implementation Schedule Table to reduce conflicts between Mexican wolves and livestock resulting from depredations, to maintain or improve the status of native prey populations, and to improve range conditions.
177	Lafon	The genetic part I think is the better supported, it´s clear defined and translocations as well as recapture of wild born individuals, could be the best way to check the genetic variability. As I have been suggesting. An extra effort is needed in sierra del Nido, central Chihuahua, just to know if this population have a special genetic value for the program.	Comment noted; see response above.

178	L n a f o	For monitoring and adaptive management the recovery plan consider excellent ideas and it's a key to measure how goals are accomplish and the wolves´ population is reestablishing in the areas.	Comment noted
179	L a f o n	Collaborative efforts are well developed between countries and technicians, land owners should be included in order to guarantee a better understanding of the Plan objective and it´s benefits in mid and long terms if population increase, more area is going to be covered, thus new conflicts with land owners could go against the recovery plan.	Agreed; we have added education and outreach activities to increase social tolerance of Mexican wolves to the Implementation Schedule Table.
180	L a f o n	3. Is the overall recovery strategy and specifically the recovery criteria supported by scientific information in the revised recovery plan and/or the Biological Report? Yes, the overall recovery strategy as well as the recovery criteria are well supported by scientific information, including the previous material reviewed (genetics, biological report). However, information and extra communication effort with people with knowledge on Mexican Wolf like Roy McBride and Jose (Pepe) Treviño, could increase the opinion about the Plan	Comment noted