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Copies via email: martha_williams@fws.gov, RDLueders@fws.gov, brady_mcgee@fws.gov.

Re: Request to resume the releases of family packs of endangered Mexican gray wolves from captivity to the wild in order to increase the U.S. wild population's depleted genetic diversity.

Dear Director Williams, Regional Director Lueders and Recovery Coordinator McGee,

The undersigned 18 non-profit organizations representing millions of members and supporters request an urgent change in management of the experimental, non-essential population of the endangered Mexican gray wolf. The purpose of our requested change is to ensure the effective introgression of as many as possible of the unique genes that remain in the captive population of Mexican wolves, into the wild population. In service of this goal, we respectfully ask the U.S. Fish and Wildlife Service to resume the releases of well-bonded male/female pairs, with pups, from captivity to the wild.[1]

Background: Dangerously Depleted Mexican Wolf Genetic Diversity

The Mexican gray wolf (*Canis lupus baileyi*) is the southernmost and smallest subspecies of the gray wolf in North America, first described scientifically in 1929[2] and repeatedly reaffirmed as a unique subspecies in the ensuing nine decades.[3] The Mexican wolf was the only

[1] By well-bonded, we mean adult animals placed together for a minimum of six months – much longer than the 63-day gestation period between wolf matings and parturition – a span that seems to have made a difference in keeping Mexican wolf pairs together. We refer to such groupings, whose releases served to start reintroduction and which were released successfully through 2006, as *family packs*.
[2] Nelson, E.W. and E.A. Goldman. 1929. A new wolf from Mexico. Journal of Mammalogy 10(2):165-166.
[3] Hall, E.R. and K.R. Nelson. 1959. The Mammals of North America. The Ronald Press, New York. Bogan, M.A. and P. Mehlhop. 1983. Systematic relationships of gray wolves (*Canis lupus*) in southwestern North America. Occasional Papers Museum of Southwestern Biology 1:1-20. Garcia-Moreno, J., M.D. Matocq, M.S. Roy, E. Geffen, and R.K. Wayne. 1996. Relationships and genetic purity of the endangered Mexican wolf based on analysis of microsatellite loci. Conservation Biology 10:376-389. National Academies of Sciences, Engineering, and Medicine. 2019. Evaluating the Taxonomic Status of the Mexican Gray Wolf and the Red Wolf. The National Academies Press, Washington, D.C..

southwestern gray wolf subspecies to survive the twentieth-century extermination of wolves that was perpetrated by the Fish and Wildlife Service (from 1940 until 1972) and its predecessor the U.S. Bureau of Biological Survey (trapping, poisoning and den-excavating wolves from 1915 to 1940).[4] The captures of six wolves in Mexico and one in southern Arizona who were not killed – those caught in the 1950's and 1960's kept alive as curiosities while those caught from 1977 to 1980 were intended for captive breeding – saved the Mexican wolf from extinction but made the descendants of those last seven animals dependent on far-sighted genetic management.[5]

Unfortunately, as a consequence of the years-long delay in starting reintroduction in 1998 as well as post-reintroduction management driven by the interests of the livestock industry, *the genetic diversity that was present in those seven founding animals has now been reduced in the U.S. reintroduced population to the equivalent of just 2.09 wolves*.[6]

The decline of genetic diversity since reintroduction began resulted in part from government removals of wolves and (as we explain below) by the paucity of effective releases of wolves from captivity to the wild after the last release of a family pack in 2006. (Illegal shootings of wolves have also caused genetic declines and, frustratingly, the Service has ignored our oft-repeated recommendations on how to reduce the wolves' vulnerability to poachers.[7])

Today's reintroduced population contains significantly less genetic diversity than found in the captive population of Mexican wolves, which retain the genetic equivalent of 2.85 out of the seven founding wolves.[8] Though still exceedingly low, that is 36% more diversity than the 2.09 founder genome equivalents present in the wild population. It is imperative to share the additional genetic diversity found in the captive population with the wild population. As we explain in the sections below, releasing well-bonded family packs from captivity into the wild is the most effective means of doing so.

I. Seventy-six Percent of Captive-born Pups Released Without Parents Into Wild Wolves' Dens Disappeared Or Were Found Dead

The Fish and Wildlife Service's currently-used technique to try to increase genetic diversity in the wild U.S. population, which at last count comprises 257 animals in southwestern New Mexico and eastern Arizona, is to release newborn pups without their parents into the dens of wild wolves who already have pups of their own. Yet as demonstrated in the following chart, *out of a total of 99 captive-born pups released without their parents through last year, just 24*

[4] Robinson, M.J. 2005. Predatory bureaucracy: the extermination of wolves and the transformation of the West. University Press of Colorado, Boulder.
[5] Hedrick, P.W., P.S. Miller, E. Geffen, E. and R.K. Wayne. 1997. Genetic evaluation of the three captive Mexican wolf lineages. Zoo Biology 16:47-69.
[6] Mexican Wolf Interagency Field Team. 2023. Mexican Wolf Experimental Population Area 2024 Initial Release and Translocation Proposal, p. 9.
[7] For example, the Center for Biological Diversity and other organizations sent the Service and/or the Department of the Interior letters with recommendations on protecting Mexican wolves from illegal killings on Jan. 27, 1997; Jan. 30, 1999; April 3, 2007; Jan. 3, 2008; June 26, 2010; Sept. 19, 2013; Dec. 17, 2013; Sept. 23, 2014; Aug. 29, 2017; Oct. 16, 2019; June 15, 2020; Jan. 27, 2022; May 16, 2022; and Dec. 8, 2022. The Center has also advocated protective measures in informal phone calls and emails with Service personnel.
[8] Scott, K., J. Kiseda, S. Greely, and E. Spevak. 2023. Population analysis and breeding and transfer plan for Mexican wolf (*Canis lupus baileyi*) AZA SAFE Program. AZA Population Management Center: Chicago, p. 5.

could be located in the end-of-year count of their first year (or if missed during the annual census, in ensuing years). Most of the remaining 75 had simply disappeared:[9]

Year	Captive-born pups released in spring	Released captive-born pups found alive in their first winter or thereafter
2016	6	2
2017	4	1
2018	8	4
2019	12	2
2020	20	9
2021	22	1
2022	11	4
2023	16	1
Total	99	24

The 76% disappearance/mortality rate reflects that a significantly-lower proportion of captive-born pups released without parents into the wild survive than do wild-born pups raised by their own parents. As the Service explained, about half of the pups raised by their parents live to their first birthday:

> [F]rom birth to one year of age, approximately 50% of pups survive, and average survival for yearlings is 0.673. Thus, we would predict that 0.34 (0.5 * 0.673) of fostered pups would survive to breeding age (two years old) should fostered pups perform similarly to other wild-born pups and be accepted upon placement in the den. This survival rate would likely be considered a minimum estimate because packs that receive fostered pups are also provided a supplemental food cache to increase pup survival. Thus, we would expect a minimum of 33 pups (0.34 * 99) to survive to breeding age from the captive fostering (n = 99) efforts conducted through 2023.[10]

Unmentioned by the Service is that a projected 0.5 one-year survival rate for captive-born released (i.e. fostered) pups should also be considered a minimal prediction for another reason: The captive-born pups are less inbred than wild-born pups, and therefore should survive at a higher rate than wild-born pups given the overall inverse correlation of inbreeding to pup survival.[11] Unfortunately, even that minimal predicted survival rate was not achieved. *Instead of their predicted minimal 50% survival at age one, just 24% of the captive-born pups released without their parents are known to have been alive at year's end, which was five months earlier than each surviving wolf's first birthday.*

[9] Mexican Wolf Interagency Field Team. 2021. Initial release and translocation proposal for 2022, pp. 5-6. Fish and Wildlife Service, Mexican wolf recovery program, progress report #25, Reporting period: January 1-December 31, 2022, p. 25.
[10] Mexican Wolf Interagency Field Team (2023), p. 4.
[11] Fredrickson, R. J., P. Siminski, M. Woolf and P. W. Hedrick. 2007. Genetic rescue and inbreeding depression in Mexican wolves. Proc. R. Soc. B, 274:2365–2371.

Most of the released captive-born pups who survived their first year fared better in their second year. From 2016 through 2022, the Service inserted 83 captive-born pups into the dens of wild wolves.[12] As shown in the chart on the previous page, 23 of those are known to have been alive in their first winter. Eighteen among those 23 also survived to age two[13] – breeding age – or 78%, a happy contrast to the Service's estimated 67% survival rate for yearlings in the population.

Despite the captive-born yearlings faring better even than the Service's figures for the population at large, perhaps due to the supplemental feeding, their higher rate of survival in their second year did not make up for their extraordinarily-high disappearance/mortality rate as pups in their first year. As noted, 18 out of those 83 pups were known to be alive on their second birthdays – just 22%, in contrast to the predicted minimum 34% two-year survival rate.

II. Family Packs Released to the Wild Survived and Successfully Raised Pups When Given a Chance

The last release of a well-bonded (i.e. paired six months or longer) male/female adult pair with their offspring occurred in 2006. The Fish and Wildlife Service has reported "that 66% . . . of the initial released breeding animals with dependent pups in areas of adequate native prey have been successful."[14] In contrast, as shown above, when the Service releases captive-born pups the actual success-rate as of yet is just 24%. Moreover, the Service defined success for released, paired adult wolves as a "released wolf that survives and produces pups in the population in the future," which is a more stringent standard than success for released neonatal wolves, who only have to reach breeding age (two years old) to be considered successful whether or not they actually breed.

The 66% survival rate of breeding adults released with dependent pups in areas of adequate native prey could be even higher if the Service would modestly change how future releases occur. Preliminary evidence suggests that adult male and female wolves who are paired together in captivity for at least six months before release into the wild, and have pups, are more likely to stay together. Plus, the Service should ensure that family groups are released into vacant territories to reduce the risk of territorial disputes, such as occurred with the Lupine Pack.[15] There is abundant vacant habitat available for new wolf families in multiple areas of the

[12] An additional 16 pups were inserted into wild wolves' dens in 2023, and 27 in 2024, but in this calculation we are only looking at the proportion of released pups surviving to age two, and the 2023 and 2024 pup cohorts are not that old yet.
[13] Mexican Wolf Interagency Field Team (2021), pp. 5-6. Fish and Wildlife Service, Mexican wolf recovery program, progress report #25, p. 25.
[14] Mexican Wolf Interagency Field Team. 2020. Mexican Wolf Reintroduction Project Initial Release and Translocation Proposal for 2021, p. 6.
[15] The unhappy fate of the Lupine Pack, one of just nine adult pairs released with their pups in areas of adequate native prey, released in 2001 but all two adults, four yearlings and three pups dead, disappeared or in captivity thereafter, also affects the true calculation of success reported by the Service. The Lupine Pack was released directly into the home range of another, already-established pack, which attacked the newcomers. The Lupine adult male, M480, was found dead with fresh as well as partially-healed (i.e. a little older) canine bite marks on his head and throughout his body, but he died of a snake bite, the venom of which caused his neck to swell, asphyxiating him from his radio collar. It seems likely that he was fighting or fleeing the other pack when he ran into one or more rattlesnakes: "The wolf was recently released, another alpha male was in the same area, and rattlesnakes were

Gila National Forest, including the Jerky Mountains in the Gila Wilderness, the Gila River canyon in the Gila Wilderness, and the Black Range in the Aldo Leopold Wilderness and further south.[16] *Excluding the Lupine Pack, a total of eight adult pairs with pups were released in areas of adequate native prey, and six of those pairs met the stringent criterion for success – 75%.*

III. Halting the Releases of Well-bonded Family Packs Worsened Inbreeding

Releases of captive-born, well-bonded, male-female Mexican gray wolf pairs with pups began in 1998 and continued sporadically through 2006. Over the ensuing 18 years, the Fish and Wildlife Service proffered multiple rationales for the cessation of family pack releases, most recently that releasing adult wolves creates nuisance behavior.[17] However, the Service has never shown through data or analysis that adult wolves released as part of well-bonded pairs with their offspring are disproportionately engaged in nuisance behavior.

Below, we show through data and analysis that discontinuing the releases of family packs made the wild wolves more inbred. In 2007, scientists correlated inbreeding in Mexican wolves with smaller litters and/or low pup-survival rates, but observed that there was still potential to reduce inbreeding and establish vigorous wild populations through effective releases of cross-lineage wolves from captivity to the wild.[18]

Unfortunately, the Service did not increase releases of captive-born wolves to the wild. Instead, from 2007 through 2015, just five captive-born wolves were released. But none released after 2006 were given sufficient time to bond with a mate before their releases. Ultimately, only one of those five animals left a descendant in the wild population.[19] Despite the success experienced with its previous releases of family packs, since 2016 the Service has solely relied upon releases of captive-born pups to increase genetic diversity.

The Service uses four metrics to quantify genetic diversity: mean (i.e. average) kinship and mean inbreeding, which are negative traits, and percent gene diversity retained (i.e. retained from the founding seven animals) and founder genome equivalents, which are positive traits. As

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present in the immediate vicinity of the wolf carcass according to the submitting agent." Fish and Wildlife Service, Veterinary Medical Examination Record (Aug. 20, 2001). Phone call between undersigned M.J. Robinson of Center for Biological Diversity and the Service's Mexican wolf recovery coordinator, B.T. Kelly, on or about July 10, 2001.

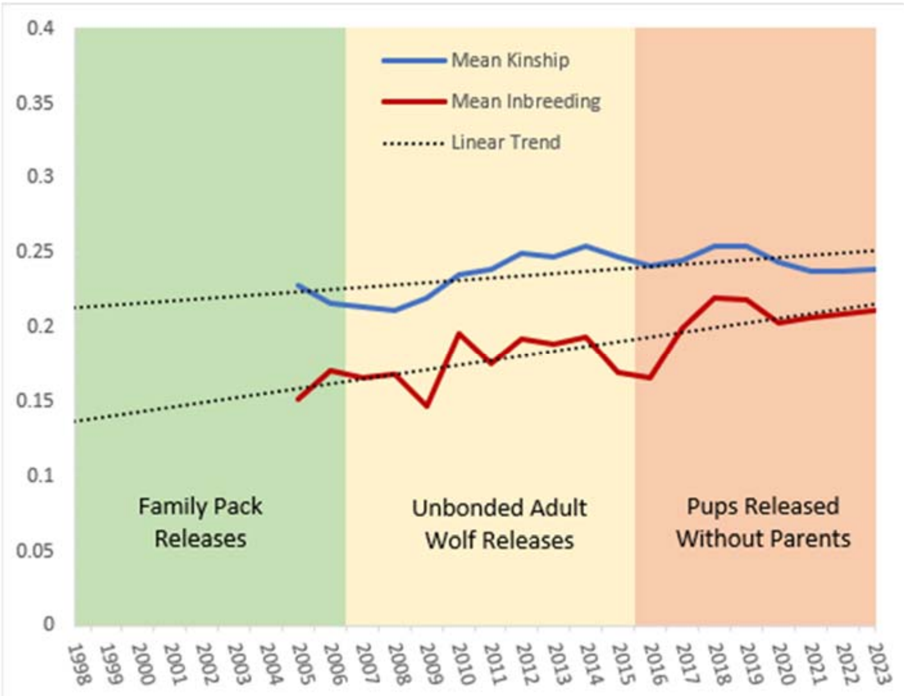
[16] The Mexican wolf interagency field team ranked the Lilley Park potential release site in the Jerky Mountains as the second-best among 32 potential release sites in Arizona and New Mexico, the Miller Springs potential release site close to the Gila River canyon as tenth-best, and the Meason Flat potential release site near the Aldo Leopold Wilderness as fourteenth-best. Mexican Wolf Blue Range Reintroduction Project, Evaluation of Initial Release and Translocation Site Availability and Suitability, Oct. 4, 2009; p. 3.

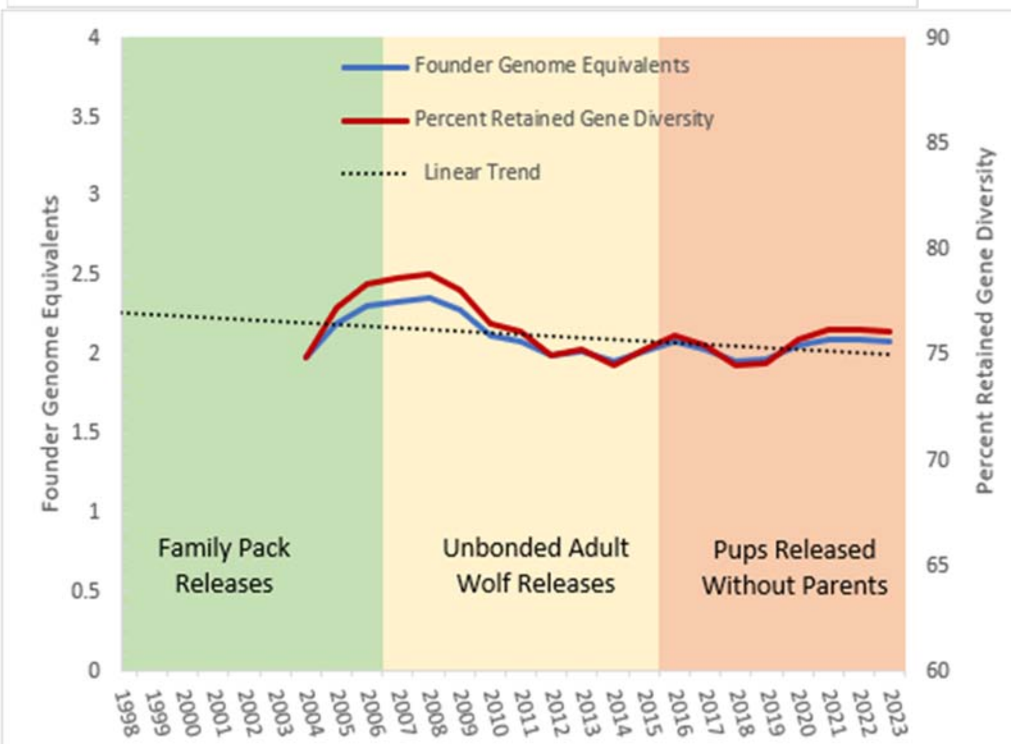
[17] Mexican Wolf Interagency Field Team (2020), p. 7; Mexican Wolf Interagency Field Team (2023), p. 3.

[18] Fredrickson et al (2007).

[19] Mexican Wolf Blue Range Reintroduction Project Interagency Field Team. Annual Report, Reporting Period: January 1 – December 31, 2008, pp. 8-9; U.S. Fish and Wildlife Service, Mexican Wolf Recovery Program: Progress Report #12, Reporting Period: January 1 – December 31, 2009, pp. 28 & 30; U.S. Fish and Wildlife Service, Mexican Wolf Recovery Program: Progress Report #16, Reporting Period: January 1 – December 31, 2013, pp. 24-25; U.S. Fish and Wildlife Service, Mexican Wolf Recovery Program: Progress Report #17, Reporting Period: January 1 – December 31, 2014, pp. 24-25, 46, 61 & 63; U.S. Fish and Wildlife Service, Mexican Wolf Recovery Program: Progress Report #18, Reporting Period: January 1 – December 31, 2015, p. 20.

depicted through the straight linear trends in the graphs below, over the course of almost the past two decades, kinship and inbreeding have increased in the population, with inbreeding on a slightly-steeper upward inclination, while percent gene diversity retained and founder genome equivalents have declined.[20]





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[20] Email and attachment from M. Dwire of Fish and Wildlife Service to the undersigned M.J. Robinson of Center for Biological Diversity, June 5, 2020. Mexican Wolf Interagency Field Team (2023), p. 9.

The curved and jagged lines in the graphs show that ending the releases of family packs after the last such release in 2006 coincided two to three years later (i.e. 2008 – 2009) in increases in the two adverse metrics and decreases in the two beneficial metrics.

IV. Releases of Pups Without Their Parents Did Not Adequately Replace the Releases of Family Packs

As shown in the graphs on the previous page, beginning two years after the releases of pups without their parents began in 2016, mean kinship stabilized at a slightly-lower level than before pup releases began, but still significantly higher than its value in 2008 two years after the last family pack release. (In 2008, kinship was at 0.2119 whereas in 2023 it was 0.2391.)

The first graph also shows that pup releases did not prevent a significant increase in mean inbreeding from before 2016. Moreover, inbreeding numbers in 2023 are vastly higher than they were at their lowest recorded level in 2009 – 0.1464 in 2009 and 0.2114 in 2023.

A similarly dour outcome manifests in perusing the positive genetic metrics shown in the second graph. Percent gene diversity retained peaked in 2008, and then regained some of its losses beginning in 2019 three years after pup releases began. By 2023 gene diversity had stabilized, though at a significantly lower level than in 2008: In 2008, the number was 78.81 and in 2023 it was 76.09.

On an almost-identical track, founder genome equivalents peaked in 2008 and by 2018 had arrested a decline, beginning a slight increase and stabilization that still left the metric in 2023 well below its post-family-pack-release high. In 2008, that metric was at 2.36 and in 2023 it was 2.09.

The Service acknowledges that "it is easier to affect the gene diversity of the wild population when it is small, and it will become more difficult as the population increases."[21] That is because proportionally more released wolves must successfully breed in the wild when the wild population is larger, to have the same influence as fewer wolves when the population is smaller. To keep the decline in genetic diversity from worsening at a *faster* rate, more wolves will have to be successfully released than in past years.

It is not clear whether the captive-breeding program has the capacity to increase breeding pups for release at a rate sufficient to achieve the genetic improvement that the Service's pup releases have been unable to achieve with a smaller wild population. Even if so, the exorbitant disappearance/mortality rate among pups released without their parents should give the Service pause in maintaining this as a primary release method, given that releases of family packs have proven to result in much-higher survival rates. If family pack releases were to be resumed quickly, that would result in more genetic diversity in the wild population.

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[21] Mexican Wolf Interagency Field Team (2020), p. 3.

V. Preliminary Evidence Points to Inbreeding as the Cause of Worrisome Physiological Infirmities

As noted, in 2007 geneticists correlated inbreeding in Mexican gray wolves with smaller litters and/or low pup-survival rates,[22] an example of *inbreeding depression* whereby low gene diversity causes deleterious physiological anomalies. Five years later, in 2012, other researchers documented that over the previous decade, fourteen Mexican gray wolves contracted a rare form of cancer in their noses – diagnosed as nasal carcinoma – and believed to include a genetic component in its causation.[23]

More recently, a yearling male wolf, m2627, of the Castle Rock Pack who was born in the wild in the U.S., died on December 10, 2022 after being struck by a vehicle. The necropsy report and accompanying photographs and x-rays (reproduced below) disclosed that the middle digits on all four of his paws were fused,[24] the first documented case of syndactyly among Mexican wolves. Syndactyly was a manifestation of inbreeding depression in the isolated Isle Royale, Michigan wolves before the population dwindled to two animals, and prior to the subsequent wolf augmentation / reintroduction.[25] It is not surprising that m2627 was the animal discovered suffering from this trait, since his paternal great-great-grandparents were the same pair as his maternal grandparents (M1341 and F1042). It is unknown how many other wolves with this congenital malformation are surviving and reproducing in the wild population. (It is our understanding that the Service has begun to more thoroughly review the physical condition of wolves when handling them.)

Figure 12. Abnormalities in the middle fingers of all four extremities of individual M2627.

[22] Fredrickson et al (2007).
[23] Sanchez, C.R., Drees, R. , J. Dunnum, I.Y. Muñoz, P.M. Gaffney, M.M. Garner, and M.J. Kinsel. 2012. Nasal carcinoma in Mexican gray wolves (*Canis lupus baileyi*): prevalence determination using computed tomography. Proceedings AAZV Conference 176-177.
[24] Lara Díaz, N.E., C.A. López González, M.C. Carmen García Chávez, R. Juárez López, J.L. Reyes Díaz, J.A. Álvaro Montejo, M.G. Camargo Aguilera. 2023. Mexican wolf recovery Program: monitoring and conservation. Universidad Autónoma De Querétaro/Soluciones Ambientales Itzeni A. C. México.
[25] Robinson, J.A., J. Räikkönen, L.M. Vucetich, J.A. Vucetich, R.O. Peterson, K.E. Lohmueller, and R.K. Wayne. 2019. Genomic signatures of extensive inbreeding in Isle Royale wolves, a population on the threshold of extinction. Science Advances 5(5).

While a single instance of syndactyly does not necessarily indicate the presence of other genetic mutations, the Service should consider it an alarm bell.

Conclusion: The Fish and Wildlife Service Should Resume Releases of Mexican Wolf Family Packs

Up till the present moment, the Service has not only ignored its own data and wealth of field experience in failing to resume family pack releases, it has done so through repudiating what is perhaps the most widely-known attribute of gray wolves, understood by countless school children: Wolves form close emotional ties with their packmates, beginning of course with their mothers. The Service once understood that and didn't even bother to explain its commonsense initial decision to release "approximately 14 family groups . . . over a period of 5 years,"[26] underlying its general practice from 1998 through 2006 not to release non-bonded wolves.

For all the afore-explained reasons, and with a plea that the Fish and Wildlife Service act before it is too late, we request resumption of releases of captive-born, well-bonded, male/female pairs with pups to the wild.

Thank you for your consideration.

Sincerely endorsed by,

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[26] 63 Fed. Reg. 1754 (Jan. 12, 1998).

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