

MEXICAN WOLF RECOVERY PROGRAM



A Mexican wolf from the Seco Creek pack. Photo credit: Mexican Wolf Interagency Field Team

Progress Report #24

Prepared by: U.S. Fish and Wildlife Service

Cooperators: Arizona Game and Fish Department, New Mexico Department of Game and Fish, USDA-APHIS Wildlife Services, U.S. Forest Service, and White Mountain Apache Tribe

Mexican Wolf Recovery Program

PROGRESS REPORT #24

REPORTING PERIOD: JANUARY 1 – DECEMBER 31, 2021

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FOREWORD

The U.S. Fish and Wildlife Service (Service) is the lead agency responsible for recovery of the Mexican wolf (*Canis lupus baileyi*), pursuant to the Endangered Species Act of 1973, as amended (Act). The Mexican Wolf Recovery Program has two interrelated components: 1) Recovery – includes aspects of the program administered by the Service with assistance from partner agencies that pertain to the overall goal of Mexican wolf recovery and delisting from the list of threatened and endangered species, and 2) Monitoring and Management – includes aspects of the program implemented by the Service and cooperating States, Tribes, other Federal agencies, and counties that pertain to the monitoring and management of the reintroduced Mexican wolf population in the Mexican Wolf Experimental Population Area (MWEPA). This report provides details on both aspects of the Mexican Wolf Recovery Program. The reporting period for this progress report is January 1 – December 31, 2021.

BACKGROUND

The Mexican wolf is listed as endangered under the Act in the southwestern United States and Mexico (80 FR 2488-2512, January 16, 2015). It is the smallest, rarest, southernmost occurring, and most genetically distinct subspecies of the North American gray wolf (*Canis lupus*).

Mexican wolves were extirpated in the wild in the southwestern United States by 1970, following several decades of private and governmental efforts to reduce predator populations due to conflict with livestock. Recovery efforts for the Mexican wolf began in 1976 with its listing as an endangered species. In the late 1970s and early 1980s, the initiation of a binational captive breeding program originating from seven wolves precluded the Mexican wolf from extinction.

As recommended in the Mexican Wolf Recovery Plan, First Revision (Service 2017) (Recovery Plan), recovery efforts for the Mexican wolf focus on the reestablishment of two Mexican wolf populations in the wild, one in the United States and one in Mexico, and on maintenance of the captive breeding population. Mexican wolves were first released to the wild in the United States in 1998. In Mexico, Mexican federal agencies initiated a reintroduction effort in 2011 pursuant to Mexico's federal laws and regulations.

Today, the wild population in the United States is managed and monitored by an Interagency Field Team (IFT) comprised of staff from the Service, Arizona Game and Fish Department (AZGFD), New Mexico Department of Game and Fish (NMDGF), White Mountain Apache Tribe (WMAT), U.S. Forest Service, and U.S. Department of Agriculture-Wildlife Services (USDA-WS).

PART A: RECOVERY ADMINISTRATION

1. MEXICAN WOLF CAPTIVE BREEDING PROGRAM

a. Mexican Wolf Species Survival Plan

The Mexican Wolf Species Survival Plan (SSP) is a binational captive breeding program between the United States and Mexico for the Mexican wolf. The SSP mission is to reestablish the Mexican wolf in the wild through captive breeding, public education, and research. While Mexican wolves are maintained in numerous captive facilities in both countries, they are managed as a single population. SSP member institutions routinely transfer Mexican wolves among participating facilities for breeding to promote genetic exchange and maintain the health and genetic diversity of the captive population. Wolves in these facilities are managed in accordance with a Service-approved standard protocol. Without the SSP, recovery of the Mexican wolf would not have been possible.

This year, the SSP's binational meeting to plan and coordinate wolf breeding, transfers, and related activities among facilities was held virtually. The meeting included updates on the reintroduced populations in the US and Mexico, discussion on gamete banking needs, evaluation and selection of release candidates for both the United States and Mexico, and reports on research including advances in gamete banking, contraception and assisted reproductive technologies, and progress toward a lifetime reproductive plan for wolves to maximize an individual's potential to contribute to the population.

As of July 2021, the SSP population includes 387 Mexican wolves managed in approximately 61 facilities in the United States and Mexico. The SSP goal is to house a minimum of 240 wolves, with a target population size of 300, to ensure the security of the subspecies in captivity and produce animals for reintroduction.



Four Mexican wolf pups were born at the El Paso Zoo in 2021. Photo credit: Sarah Borrego/El Paso Zoo

The SSP population has served as the sole source population to reestablish the subspecies in the wild. In the MWEPA, Mexican wolves released to the wild from the SSP population also serve a critically important role in improving the gene diversity of the wild population. Wolves that are considered genetically well-represented in the SSP population may be designated for release. Suitable release candidates are determined based on criteria such as genetic makeup, reproductive performance, behavior, and physical suitability. We perform analyses to ensure the released wolves are beneficial to the genetic diversity of the wild population while minimizing adverse effects to the genetic integrity of the captive population if wolves released to the wild do not survive. Since 2016, the Service and its partners have focused on cross-fostering as the primary release method. While much consideration is given to breeding captive wolves that will produce pups that genetically benefit the wild population, the selection of pups to use in cross-fostering efforts is ultimately determined by timing and synchrony of wild and captive litters. See below (page 25; releases and translocations) for more discussion on cross- fostering.

b. Mexican Wolf Pre-Release Facilities

Mexican wolves are acclimated prior to release to the wild in captive facilities designed to house wolves in a manner that fosters wild behaviors. The Service oversees the management at the Ladder Ranch and Sevilleta Wolf Management Facilities, located in New Mexico. At these facilities, wolves

are managed with minimal exposure to humans to minimize habituation to humans and maximize pair bonding, breeding, pup rearing, and healthy pack structure development. These facilities have been successful in breeding wolves for release (including pups for cross-fostering) and are integral to Mexican wolf recovery efforts. To further minimize habituation to humans, public visitation to the Ladder Ranch and Sevilleta facilities is not permitted.

Release candidates are fed carnivore logs and a zoo-based exotic canine diet formulated for wild canids. In addition, we supplement their diet with carcasses of road-killed ungulate species, such as deer and elk, and scraps (meat, organs, hides, and bones) from local game processors from wild game/prey species only. Release candidates are given annual examinations to vaccinate for canine diseases (e.g., parvo, adeno2, parainfluenza, distemper, and rabies viruses, etc.), are dewormed, have laboratory evaluations performed, and have their overall health condition evaluated. Animals are treated for other veterinary purposes on an as-needed basis.

Sevilleta Wolf Management Facility

The Sevilleta Wolf Management Facility (Sevilleta) is located on the Sevilleta National Wildlife Refuge near Socorro, New Mexico and is managed by the Service. There are a total of eight enclosures, ranging in size from 0.25 acre to approximately 1.25 acres, and a quarantine pen. National Wildlife Refuge staff assist Mexican Wolf Recovery Program staff in the maintenance and administration of the wolf pens.



A Mexican wolf is carried to a crate after being captured at the Sevilleta Wolf Management Facility. Photo credit: U.S. Fish and Wildlife Service

Through the course of the year, thirty-eight individual wolves were housed at Sevilleta. Four wolves were transferred to Sevilleta from the MWEPA. Seven wolves were released via cross-fostering into the MWEPA. Eight wolves were transferred to a remote release enclosure on the Ladder Ranch, to facilitate their translocation to the wild. As part of the breeding and transfer recommendations, four wolves were transferred to Sevilleta from SSP facilities, and sixteen wolves were transferred from Sevilleta to SSP facilities in the United States. Four wolves were transferred to Mexico for direct release into the wild. Seventeen births and two deaths occurred at Sevilleta in 2021.

Ladder Ranch Wolf Management Facility

The Ladder Ranch Wolf Management Facility (Ladder Ranch), owned by R. E. Turner, is located on the Ladder Ranch near Truth or Consequences, New Mexico. The facility consists of five enclosures, ranging in size of 0.3 acre to approximately 0.70 acre. The caretaking of wolves at the facility is carried out by an employee of the Turner Endangered Species Fund, though the facility is managed and supported financially by the Service.

During 2021, fourteen individual wolves were housed at the Ladder Ranch. Nine wolves were transferred to the Ladder from the MWEPA. Eight wolves were transferred to a temporary constructed release enclosure on a remote part of the Ladder Ranch in July 2021 for subsequent translocation to the wild. As part of the breeding and transfer recommendations, three wolves were transferred to Ladder Ranch from an SSP facility, and two wolves were transferred from Ladder Ranch to an SSP facility. Four wolves were paired to be released in Mexico. No births and three deaths occurred at the facility in 2021.

2. RECOVERY PLAN IMPLEMENTATION / PROGRESS TOWARD RECOVERY

The Recovery Plan provides downlisting and delisting criteria for the Mexican wolf, as well as recovery actions that, if implemented, will achieve the criteria (Service 2017, pp. 18-20, 28-34). To assist the Service and our partners in the implementation of the Recovery Plan, we developed a Recovery Implementation Strategy (RIS) <https://www.fws.gov/program/conserving-mexican-wolf/library>. We intend to update the RIS as needed during recovery.

In 2021, we implemented a number of recovery actions associated with the objectives in the RIS; including: survey and monitor Mexican wolves to determine population status including Mexican wolves on the Fort Apache Indian Reservation and San Carlos Apache Reservation; reduce Mexican wolf-livestock conflicts; develop plans for and implement releases (via cross-fostering) and translocation of Mexican wolves; monitor the genetic health of the population; and, manage the captive breeding/SSP population. See Part B of this report for more detail on these activities as they pertain to management of the Mexican wolves in the MWEPA.

Recognizing the challenges inherent in Mexican wolf recovery, the Recovery Plan recommends progress evaluations at five and ten years into plan implementation to ensure the recovery strategy and actions are effective (Service 2017, pg. 26-27). For the five-year evaluation, the Recovery Plan provides the following demographic and genetic benchmarks:

- 145 wolves in the United States and 100 wolves in Mexico; and
- a sufficient number of wolves have been released or translocated to result in 9 released animals surviving to breeding age in the United States, and 25 released animals surviving to breeding age in Mexico.

We will conduct the five-year evaluation in 2023, using data through 2022, inclusive of the 2022 year-end annual population count. Because we will conduct the 2022 annual population count, in part, early in 2023, we will complete the evaluation six years after finalization of the Recovery Plan. As of this annual report, the minimum population in the MWEPA is 196 Mexican wolves and seven released or translocated wolves have survived to breeding age to count toward the genetic recovery criteria. Also as of this annual report, the estimated population in Mexico is 37 Mexican wolves and four released or translocated wolf has survived to breeding age to count toward the genetic recovery criteria.

3. SUMMARY OF LITIGATION

Plaintiffs: Center for Biological Diversity; Defenders of Wildlife

Defendants: Secretary of the Interior; US Fish and Wildlife Service

Intervenors: State of Arizona (Defendant)

Allegation: (APA) Violations of NEPA in revising the 10(j) Rule and issuance of associated 10(a)(1)(A) permit

Date NOI Filed: No NOI Filed on alleged APA violations; January 16, 2015 NOI pertaining to 10(a)(1)(A) permit

Date Complaint Filed: January 16, 2015; amended complaint filed March 23, 2015

Case Number/Court: 4:15-cv-00019-LAB (D. Ariz.)

Status: The Court entered Judgment in accordance with its March 31, 2018 Order remanding the 10(j) Rule. On 4/28/21, the Court granted Plaintiff's motion to modify the deadline for completion of the remand. The Service shall issue a final, revised 10(j) rule by July 1, 2022.

Plaintiffs: AZ and NM Coalition of Counties for Stable Economic Growth et al (18 plaintiffs)

Defendants: US Fish and Wildlife Service; Secretary of the Interior; Dan Ashe; Benjamin Tuggle

Intervenors: None

Allegation: Violations of APA, NEPA, Regulatory Flex Act. E.O. 12898 in implementing the Record of Decision/FEIS and 2015 10(j) Rule

Date NOI Filed: No NOI filed

Date Complaint Filed: February 12, 2015

Case Number/Court: 4:15-cv-00179-FRZ (D. Ariz.)

Status: Consolidated with District of Arizona case 4:15-cv-00019-JGZ

Plaintiffs: Wild Earth Guardians; New Mexico Wilderness Alliance; Friends of Animals

Defendants: Director of the US Fish and Wildlife Service; Secretary of the Interior

Intervenors: None

Allegation: Violation of ESA for not considering essential status for Mexican wolves; Violation of NEPA for not assessing revisions to final rule

Date NOI Filed: March 24, 2015

Date Complaint Filed: July 2, 2015

Case Number/Court: 4:15-cv-00285-JGZ (D. Ariz.)

Status: Consolidated with District of Arizona case 4:15-cv-00019-JGZ

Plaintiffs: Safari Club International

Defendants: Secretary of the Interior; US Fish and Wildlife Service

Intervenors: Center for Biological Diversity, Defenders of Wildlife (Defendants)

Allegation: Violations of ESA, APA, and NEPA promulgating the 2015 10(j) Rule and FEIS/ROD

Date NOI Filed: August 3, 2015

Date Complaint Filed: October 16, 2015

Case Number/Court: 4:16-cv-00094-JGZ (D. Ariz.)

Status: The Court entered Judgment in accordance with its March 31, 2018 Order remanding the 10(j) Rule. On 4/28/21, the Court granted Plaintiff's motion to modify the deadline for completion of the remand. The Service shall issue a final, revised 10(j) rule by July 1, 2022.

Plaintiffs: Center for Biological Diversity, Defenders of Wildlife, the Endangered Wolf Center, David R. Parsons, the Wolf Conservation Center

Defendants: Secretary of the Interior, US Fish and Wildlife Service, Amy Lueders

Intervenors: New Mexico Department of Game and Fish

Allegation: Violations of ESA and APA regarding the adequacy of the 2017 Mexican wolf Recovery Plan

Date NOI Filed: 11/29/17

Date Complaint Filed: 1/30/18

Case Number/Court: 4:18-cv-00047-BGM (D. Ariz.)

Status: District Court of Arizona issued 10/14/21 Order remanding the recovery plan to the Service. The Service shall produce a draft recovery plan within six months that includes site-specific management activities and a final plan six months thereafter.

Plaintiffs: WildEarth Guardians, Western Watersheds

Defendants: Secretary of the Interior, Acting Director of the US Fish and Wildlife Service, US Fish and Wildlife Service

Intervenors: New Mexico Department of Game and Fish

Allegation: Violations of ESA and APA regarding the adequacy of the 2017 Mexican wolf Recovery Plan

Date NOI Filed: 11/29/17 and 12/15/17

Date Complaint Filed: 1/30/18

Case Number/Court: 4:18-cv-00048-JGZ (D. Ariz.)

Status: Consolidated with District of Arizona case 4:18-cv-00047-BGM

4. MEXICAN WOLF EXPERIMENTAL POPULATION AREA MANAGEMENT STRUCTURE

The Memorandum of Understanding (MOU) that guides the reintroduction and management of the Mexican wolf population in the MWEPA was revised in 2019 to address the provisions of the revised 2015 10(i) Rule and 2017 Mexican Wolf Recovery Plan, First Revision. Signatories of this MOU included the Arizona Game and Fish Department, Bureau of Land Management, National Park Service, New Mexico Department of Game and Fish, US Department of Agriculture-Forest Service, US Department of Agriculture-Wildlife Services, White Mountain Apache Tribe, and the Service, as well as the cooperating counties of Gila, Graham, Greenlee, and Navajo in Arizona, Catron County in New Mexico, and the Eastern Arizona Counties Organization (ECO). A copy of this MOU can be found at <https://www.fws.gov/program/conserving-mexican-wolf/library>.

Each year the IFT produces an Annual Report, detailing Mexican wolf field activities (e.g., population status, reproduction, mortalities, releases/translocations, dispersal, depredations, etc.) in the MWEPA. The 2021 report is included as PART B of this document. Mexican Wolf Recovery Program Quarterly Updates are available at <https://www.fws.gov/program/conserving-mexican-wolf/library> or you may sign up to receive them electronically by visiting <http://www.azgfd.gov/eservices/subscribe.shtml>. Additional information about the management of wolves in the MWEPA can be found on the Service's web page at: <https://www.fws.gov/program/conserving-mexican-wolf> or AZGFD's web page at: <https://www.azgfd.com/wildlife/speciesofgreatestconservneed/mexicanwolves/>.

5. COOPERATIVE AGREEMENTS

In 2010, the Service funded cooperative agreements with AZGFD, the Mexican Wolf Fund, Turner Endangered Species Fund (TESF), The Living Desert, University of Idaho, University of New Mexico, and WMAT. The Service also provides funding to AZGFD and NMDGF for Mexican wolf recovery through Section 6 of the Act, which requires 25% percent matching funds from each state. These agreements convey funding for the monitoring and management of captive and wild Mexican wolves (AZGFD, TESF, The Living Desert, and WMAT), administration and facilitation of recovery planning and implementation efforts (Mexican Wolf Fund – when funded), and genetic analysis and preservation of biomaterials (University of Idaho and University of New Mexico).

Cooperator	U.S. Fish and Wildlife Service Mexican Wolf Project Funds Provided in 2021
AGFD	\$ 165,000
Cincinnati Zoo	\$ 40,000
TESF	\$ 40,000
University of New Mexico	\$ 15,000
University of Idaho	\$ 20,000
White Mountain Apache Tribe	\$ 225,000

In addition to the above agreements, the Service also provided funding for several miscellaneous contracts for veterinary, helicopter, mule packing and other services. For more information on Program costs to date visit <https://www.fws.gov/program/conserving-mexican-wolf/library>.

6. LIVESTOCK CONFLICT COMPENSATION PROGRAMS

There are currently two programs from which livestock producers can seek compensation for confirmed livestock losses due to predation by Mexican wolves, 1) the Livestock Indemnity Program authorized by the 2018 Farm Bill and administered by the U.S. Department of Agriculture's Farm Service Agency, and 2) the Wolf Livestock Demonstration Grants authorized by the Omnibus Public Lands Management Act of 2009 (P.L. 111-11) and awarded by the Service through a competitive process to qualifying States and Tribes.

Livestock Indemnity Program

The Livestock Indemnity Program (LIP) compensates livestock producers for losses in excess of normal mortality that are due to adverse weather or attacks by animals reintroduced to the wild by the Federal Government. LIP compensation payments are equal to 75% of the (national) average fair market value of the livestock. For more information see <https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/livestock-indemnity/index>.

Wolf-Livestock Demonstration Project Grants

The Service provides approximately \$1,000,000 annually through a competitive process to eligible states and tribes to (1) assist livestock producers in undertaking proactive, non-lethal activities to reduce the risk of livestock loss due to predation by wolves and (2) compensation to livestock producers for livestock losses due to wolf predation. P.L. 111-11 states that funding made available should be allocated equally between the two grant purposes (compensation and prevention), and that the Federal share of the cost does not exceed 50 percent (requires a 50% non-Federal match).

The Wolf-Livestock Demonstration Grant Project (WLDG) grants are applied for by AZGFD and New Mexico Department of Agriculture (NMDA) in Arizona and New Mexico, respectively, as well as by WMAT for the Fort Apache Indian Reservation. The Arizona Livestock Loss Board administers the funds received by AZGFD; the Mexican Wolf/Livestock Council assists in administering the funds received by NMDA. WMAT funds are managed and administered by the tribe. For more information on the Arizona Livestock Loss Board please visit <https://live-azlivestocklossboard.pantheonsite.io/>.

The following tables reflects annual WLDG amounts and disbursement of funds for associated activities. Note that these expenditures required at least a 1:1 non-Federal match.

Year	Direct Compensation for Livestock Lost - AZ	Direct Compensation for Livestock Lost - NM	Total
2011	\$5,400	\$12,781	\$18,181
2012	\$7,550	\$15,050	\$22,600
2013	\$14,581	\$13,013	\$27,594
2014	\$21,100	\$42,624	\$63,724
2015	\$33,070	\$77,133.90	\$110,203.90
2016	\$15,785	\$58,041.18	\$73,826.18
2017	\$29,880	\$29,942.50	\$59,822.5
2018	\$17,850	\$94,610.88	\$112,460.88
2019	\$99,312.37	\$185,797.46	\$285,109.83
2020	\$68,306.10	\$105,892.00	\$174,198.10
2021	\$98,016.32	\$80,931.00	\$178,947.32

Year	Wolf/Livestock Conflict Prevention & Pay for Presence - AZ		Wolf/Livestock Conflict Prevention & Pay for Presence - NM		Total
	Prevention	Pay for Presence	Prevention	Pay for Presence	
2011	N/A	N/A	N/A	N/A	N/A
2012	N/A	N/A	N/A	N/A	N/A
2013	N/A	\$38,000	N/A	\$47,500	\$85,500
2014	N/A	\$38,000	N/A	\$47,500	\$85,500
2015	N/A	\$51,000	N/A	\$32,300	\$83,300
2016	N/A	\$48,000	N/A	\$57,000	\$105,000
2017	\$10,000	\$50,000	N/A	\$57,000	\$117,000
2018	\$21,000	\$60,000	N/A	\$57,000	\$138,000
2019	\$156,043.80	N/A	N/A	\$57,000	\$213,043.80
2020	\$90,000.20	N/A	N/A	\$57,000	\$147,000.20
2021	\$94,500	N/A	N/A	TBD	\$94,500

7. LITERATURE CITED

US Fish and Wildlife Service. 1982, Mexican Wolf Recovery Plan 1982, US Fish and Wildlife Service, Albuquerque, New Mexico.

US Fish and Wildlife Service. 1998, Final Rule. Establishment of a Nonessential Experimental Population of the Mexican Gray Wolf in Arizona and New Mexico, 63 Federal Register 1752-1772.

US Fish and Wildlife Service, 2013, Proposed Rule. Removing the Gray Wolf (*Canis lupus*) From the List of Endangered and Threatened Wildlife and Maintaining Protections for the Mexican Wolf (*Canis lupus baileyi*) by Listing It as Endangered, 78 Federal Register 35664-35719.

US Fish and Wildlife Service, 2014. Final Environmental Impact Statement for the Proposed Revision to the Regulations for the Nonessential Experimental Population of the Mexican Wolf. 79 Federal Register 70154-70155.

US Fish and Wildlife Service, 2015. Revision to the Regulations for the Nonessential Experimental Population of the Mexican Wolf. 80 Federal Register 2512-2567.

US Fish and Wildlife Service, 2015. Endangered Status for the Mexican Wolf. 80 Federal Register 2488-2512.

US Fish and Wildlife Service, 2017. Mexican Wolf Recovery Plan, First Revision, US Fish and Wildlife Service, Albuquerque, New Mexico.

PART B: REINTRODUCTION

MEXICAN WOLF EXPERIMENTAL POPULATION AREA INTERAGENCY FIELD TEAM ANNUAL REPORT REPORTING PERIOD: JANUARY 1 – DECEMBER 31, 2021

Prepared by:

**Arizona Game and Fish Department, New Mexico Department of Game and Fish, U.S.
Department of Agriculture - Animal and Plant Health Inspection Service - Wildlife Services, U.S.
Fish and Wildlife Service, U.S. Forest Service, and White Mountain Apache Tribe.**

Lead Agencies:

Arizona Game and Fish Department (AZGFD)

New Mexico Department of Game and Fish (NMDGF)

USDA-APHIS Wildlife Services (USDA-WS)

U.S. Fish and Wildlife Service (Service)

U.S. Forest Service (USFS)

White Mountain Apache Tribe (WMAT)

1. KEY DEVELOPMENTS

- The Interagency Field Team (IFT) documented a minimum of 196 Mexican wolves in the Mexican Wolf Experimental Population Area (MWEPA) at the end of 2021 and a minimum of 25 breeding pairs.
- The IFT documented 5 new packs and 1 new pair in the MWEPA at the end of 2021.
- Pup survival decreased to 39% in 2021 (a 13% decrease from 2020), with 56 pups surviving until the end of the year. The pup survival rate in 2021 was lower than the previous ten-year (2011-2020) average of 62%.
- The IFT cross-fostered a total of 22 genetically diverse wolf pups from captive facilities across the United States into eight wild wolf dens in Arizona and New Mexico. By the end of 2021, ten cross-fostered wolves (from all years) were radio-collared and known to be alive, and four have reproduced.



Interagency Field Team members during a 2021 cross-foster event. Photo Credit: Mexican Wolf Interagency Field Team

- A modest adult mortality rate (0.18) combined with the number of pups that survived to December 31, resulted in a minor population growth (5% in 2021). While this falls short of the management objective for 2021 of a 10% increase in the minimum population count, five additional breeding pairs were documented in 2021. The slight increase in the population was likely due to the high number of pups recruited in the last two years, 64 and 56 in 2020 and 2021, respectively.
- In 2021, the overall survival rate (0.75) was approximately equivalent to the previous 10-year (2011 – 2020) period (0.73).
- At the end of 2021, seven released wolves counted toward the genetic criterion (AM1471, AF1578, F1692, AM1693, M1710, F1712, M1953). Three of these seven cross-fostered wolves produced pups in 2021 (AM1471, AF1578 and AM1693).
- The 2021 confirmed killed cattle rate of approximately 62.75 depredations/100 wolves is slightly higher than the previous 10-year (2011-2020) recovery program mean of 57.85 confirmed killed cattle per 100 wolves. While the 2021 rate is slightly above the previous 10-year average, the depredation rate decreased by 27% from 2020. The goal is to maintain the depredation rate at or below the previous 10-year recovery program mean.

2. INTRODUCTION

The Mexican Wolf Recovery Program (Recovery Program) is part of a larger recovery program that is intended to reestablish the Mexican wolf (*Canis lupus baileyi*) within its historical range in the United States and Mexico. The first releases of Mexican wolves occurred in March 1998 on the Alpine and Clifton Ranger Districts of the Apache-Sitgreaves National Forest, Arizona. In 2021, the wild population minimum count increased to 196 wolves; this report summarizes the results of Mexican Wolf IFT activities during 2021. The objective of this report is to document progress towards recovery goals set out in the 2017 Mexican Wolf Recovery Plan, First Revision (Recovery Plan) for the United States population.

More information on population metrics can be found at:

[https://www.fws.gov/program/conserving-mexican-wolf/library and](https://www.fws.gov/program/conserving-mexican-wolf/library-and)
http://www.azgfd.gov/w_c/es/wolf_reintroduction.shtml

a. Background

The Recovery Plan establishes several important metrics to gauge relative to progress towards recovery. First, the recovery criteria call for an average of at least 320 wolves over eight years in the United States population. Thus, a growing population is an important measure of success. The population viability model Miller (2017) used to help determine recovery criteria show scenarios with mean adult mortality rates less than 25%, combined with mean sub-adult mortality rates less than 33% and mean pup mortality (for radio-marked pups greater than four months old) less than 13% resulted in an increasing population that will meet the population abundance recovery criteria, under certain management regimes. In particular, Miller (2017) found that growth rates and recovery were sensitive to small changes in adult mortality. Thus, adult mortality will be an important metric for evaluation of the program. The recovery criteria also call for 22 wolves released from captivity to survive for one (sub-adults and adults) to two (pups) years following release. This recovery criterion allows for the incorporation of under-represented genes from captivity into the wild population. Thus, the Recovery Program will need to continually monitor the survival of animals released from captivity into the population.

Status reviews will be conducted five and ten years from the publishing of the Recovery Plan to determine the progress of the Mexican wolf population toward recovery goals. The five- and ten-year reviews will assess the status of the United States and Mexico populations toward recovery. The interim abundance target at the end of 2022 is 145 wolves in the United States and 100 wolves in Mexico. The interim release and translocation target at the end of 2022 is nine released wolves surviving to breeding age in the United States and 25 released or translocated wolves surviving to breeding age in Mexico. The interim abundance target in 2027 is 210 wolves in the United States and 167 wolves in Mexico. The interim release target in 2027 is 16 wolves released from captivity surviving to breeding age in the United States and 37 released or translocated wolves surviving to breeding age in Mexico. These status reviews will determine if the recovery strategy is proving effective and feasible or needs to be revised.

Management of wolves in the MWEPA is conducted in accordance with a nonessential experimental population Final Rule (Service 2015; 2015 10(i) Rule). This rule designates the reintroduced

population as experimental and nonessential and establishes the MWEPA within historical range south of Interstate 40 to the United States-Mexico border in Arizona and New Mexico, inclusive of three management areas (Zone 1, 2, and 3; Figure 1). Mexican wolves can occupy any portion of the MWEPA (Zones 1-3), can be released into Zone 1 (or in accordance with tribal or private land agreements in Zone 2), and/or translocated into Zones 1 and 2 (note; cross-fostering – considered a release - may be conducted in Zone 1 and on Federal lands in Zone 2). Zone 1 includes all of the Apache-Sitgreaves and Gila National Forests; the Payson, Pleasant Valley and Tonto Basin Ranger Districts of the Tonto National Forest; and the Magdalena Ranger District of the Cibola National Forest. In 2000, the WMAT agreed to allow free-ranging Mexican wolves to inhabit the Fort Apache Indian Reservation (FAIR). The FAIR is in east-central Arizona and provides 2,440 mi² (6,319 km²) of area that wolves may occupy. See the Final Rule (Service 2015; 2015 10(i) Rule) for more information.

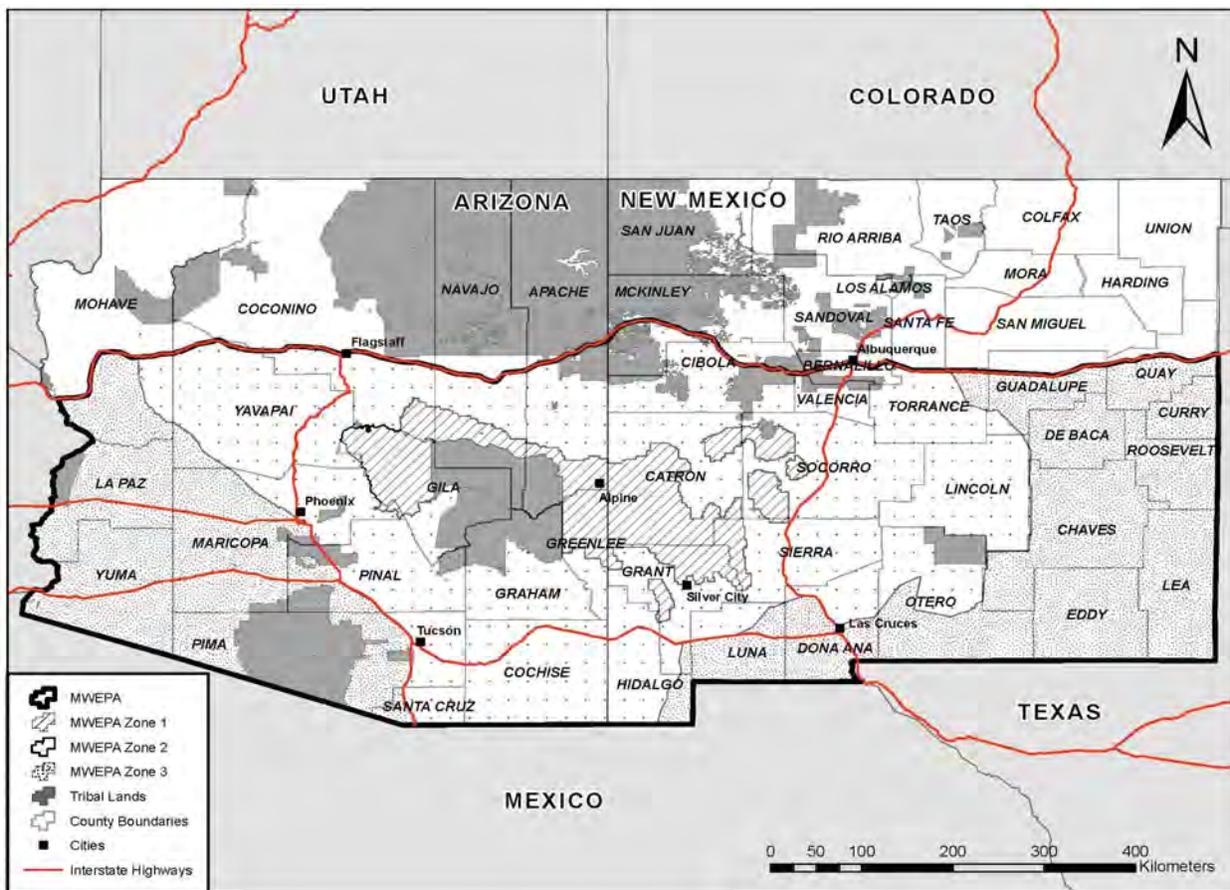


Figure 1: The Mexican Wolf Experimental Population Area (MWEPA) and Zones 1-3 in Arizona and New Mexico as described in the Final Rule.

Wolf age and sex abbreviations used in this document:

A = alpha/breeder (wolf that has successfully bred and produced/sired at least one pup)

M = adult male (> two years old)

F = adult female (> two years old)

m = subadult male (one - two years old)

f = subadult female (one - two years old)

mp = male pup (< one year old)

fp = female pup (< one year old)

Specific information regarding wolves on the FAIR and the San Carlos Apache Reservation (SCAR) is not included in this report in accordance with tribal agreements. However, wolves occurring on the FAIR and SCAR are included in total counts for depredations and population metrics.

3. POPULATION STATUS

a. Definitions

Breeding pair: a pack that consists of an adult male and female and at least one pup of the year surviving through December 31.

Wolf pack: two or more wolves that maintain an established territory. In the event that one of the wolves dies, the remaining wolf, regardless of pack size, usually retains the pack name.

New pair: a male and female wolf, traveling together for one month, that are likely to form a new pack.

b. Monitoring Techniques

The year-end minimum population count (population or population count) is derived from information gathered through a variety of methods deployed annually from November 1 through the year-end helicopter operation. The IFT continued to employ comprehensive efforts initiated in 2006 to make the 2021 year-end population count accurate, consistent, and repeatable. Management actions implemented to document Mexican wolves included: surveys and trapping for uncollared wolves, greater coordination and investigation of wolf sightings provided through the public and other agency sources, deployment of remote trail cameras, cameras at supplementary and diversionary food caches, and howling surveys in areas of suspected uncollared wolves.



A Mexican wolf captured via trail camera in the Mexican Wolf Experimental Recovery Area. Photo credit: Mexican Wolf Interagency Field Team

Wolf sign (e.g., tracks, scats) was documented by driving roads and hiking canyons, trails, or other areas closed to motor vehicles. Confirmation of uncollared wolves was achieved via visual observation, remote cameras, howling, scats, and tracks. Ground survey efforts for suspected packs having no collared members were documented using global positioning system (GPS) and geographical information systems (GIS) software and hardware. GPS locations were recorded and downloaded into GIS software for analysis and mapping.

In January and February 2022, aircraft were used to document wolves for the 2021 year-end population count and to capture wolves to affix radio collars. Including January and February count data in the December 31 population count (and in this 2021 annual report) is appropriate and consistent with previous years' annual counts, because wolves alive in these months were also alive in

the preceding December (i.e., whelping only occurs in spring, and any wolf added to the population via initial release or translocation after December 31 and before the end of the survey is not counted in the year-end population count). During the year-end count, fixed-wing aircraft were used to locate wolves and assess the potential for darting wolves from the helicopter. A helicopter was used to obtain a visual count of uncollared wolves associated with collared wolves in all areas and to capture priority animals (e.g., uncollared wolves, injured wolves, or wolves with failed or old collars) where the terrain and land ownership allowed.

As part of the 2021 year-end population count, the IFT coordinated with and surveyed members of the local public to identify possible wolf sightings. Ranchers, private landowners, wildlife managers, USFS personnel, and other agency cooperators were contacted to increase wolf sighting data for the database. All such sightings were reviewed by the IFT to determine those that most likely represented unknown wolves or wolf packs for purposes of completing the population count.

Documentation of wolves or wolf sign, obtained through the above methods, was also used to guide IFT efforts to trap uncollared single wolves or groups of wolves. The objective is to have at least one member (preferably two) of each pack collared. These various methods also allowed the IFT to count uncollared wolves not associated with collared wolves.



Three Mexican wolves seen on a trail camera. Photo credit: Mexican Wolf Interagency Field Team.

c. Minimum Population Count

At the end of 2021, the population count was 196 wolves, which was a 5% increase from the previous year's population (n=186; Figure 2). Pups comprised 29% of this population. Twenty-five packs were considered breeding pairs in 2021, compared to twenty in 2020.

At end of 2021, the functioning collared population consisted of 92 radio-collared wolves among 45 packs, one new pair and seven single wolves documented, which was an overall increase, with the exception of functioning collared population, from 2020 (Table 5). A total of 104 uncollared or failed collared wolves were documented in the MWEPA at the end of 2021 (*note: all the uncollared wolves captured during the January and February 2022 helicopter operation were included as uncollared animals associated with known packs above; Table 5*).

The IFT documented 13 uncollared wolves in 2021 (Figure 3) that were not associated with known packs. Searches for uncollared wolves occurred throughout the calendar year; however, only uncollared wolves documented between November and the annual helicopter count and capture operations are included in the population count for the year.

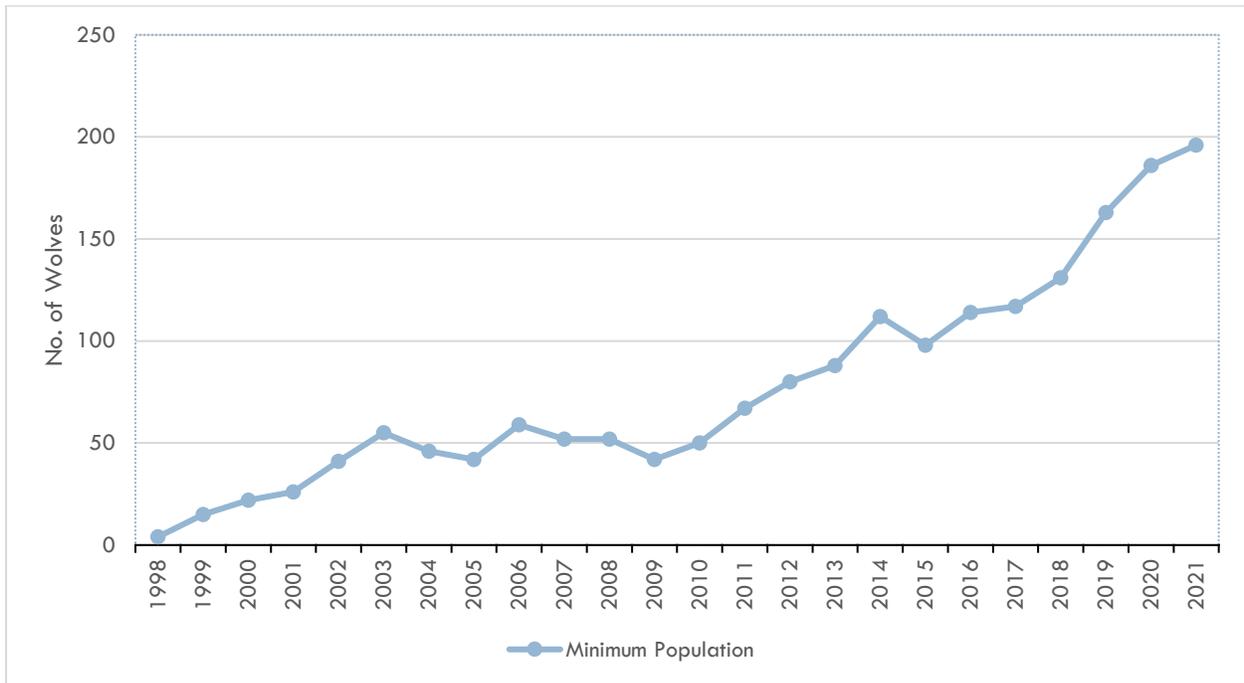


Figure 2: Mexican wolf minimum population counts from 1998 through 2021 in Arizona and New Mexico.

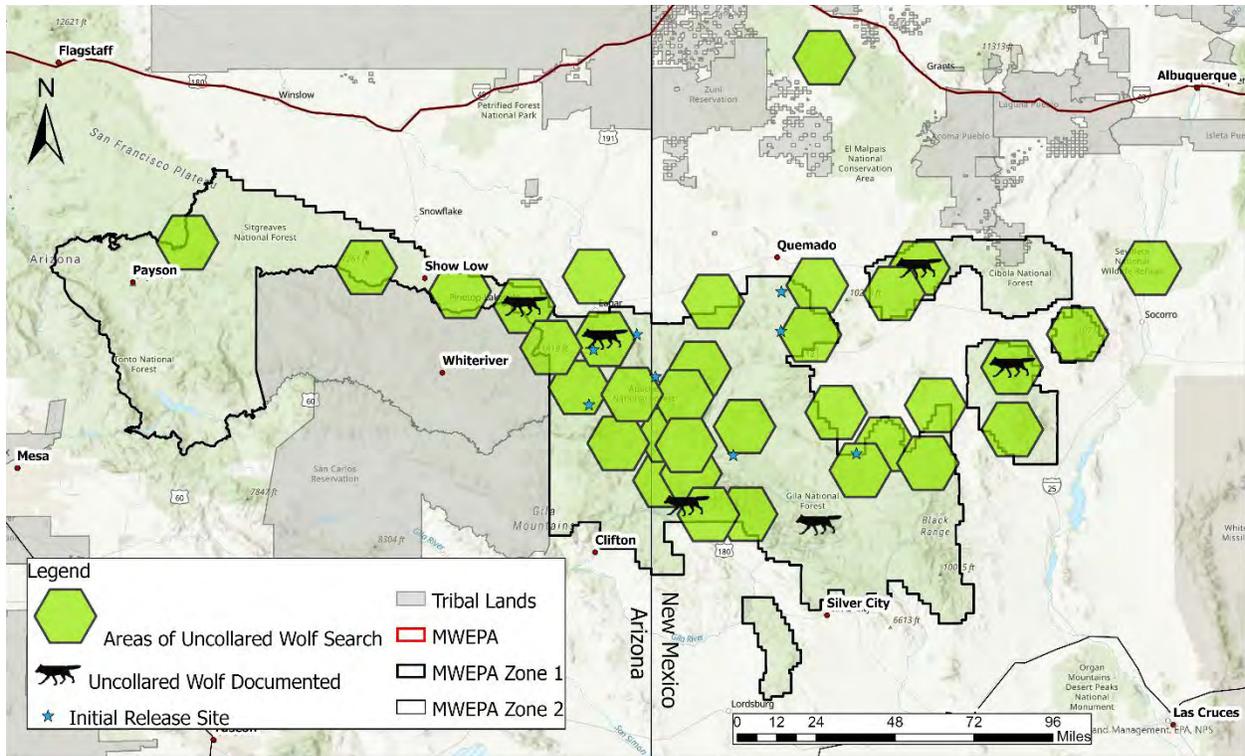


Figure 3: Areas searched for uncollared wolf sign within the Mexican Wolf Experimental Population Area (MWEPA). Areas where the uncollared wolves documented in a given area contributed to the year's total population count are indicated as uncollared wolves documented. Overlap of polygons with tribal lands do not necessarily indicate sign search conducted on tribal land. Eight initial release sites (dens for cross-fostering efforts) were used during 2021 in Arizona and New Mexico within the MWEPA.

d. Reproduction

In 2021, 31 packs exhibited denning behavior, which included 10 packs in Arizona and 21 packs in New Mexico. Of the 31 packs, 25 of those were considered breeding pairs at the end of the year. The IFT also cross-fostered a total of 22 captive-born pups into dens of eight wild packs in Arizona and New Mexico. The IFT documented a minimum of 144 pups in the MWEPA with a minimum of 56 surviving in the wild until year-end in Arizona ($n = 24$) and New Mexico ($n = 32$), which showed that 39% of the pups documented in early counts survived until the end of the year (Figure 4, Table 5).

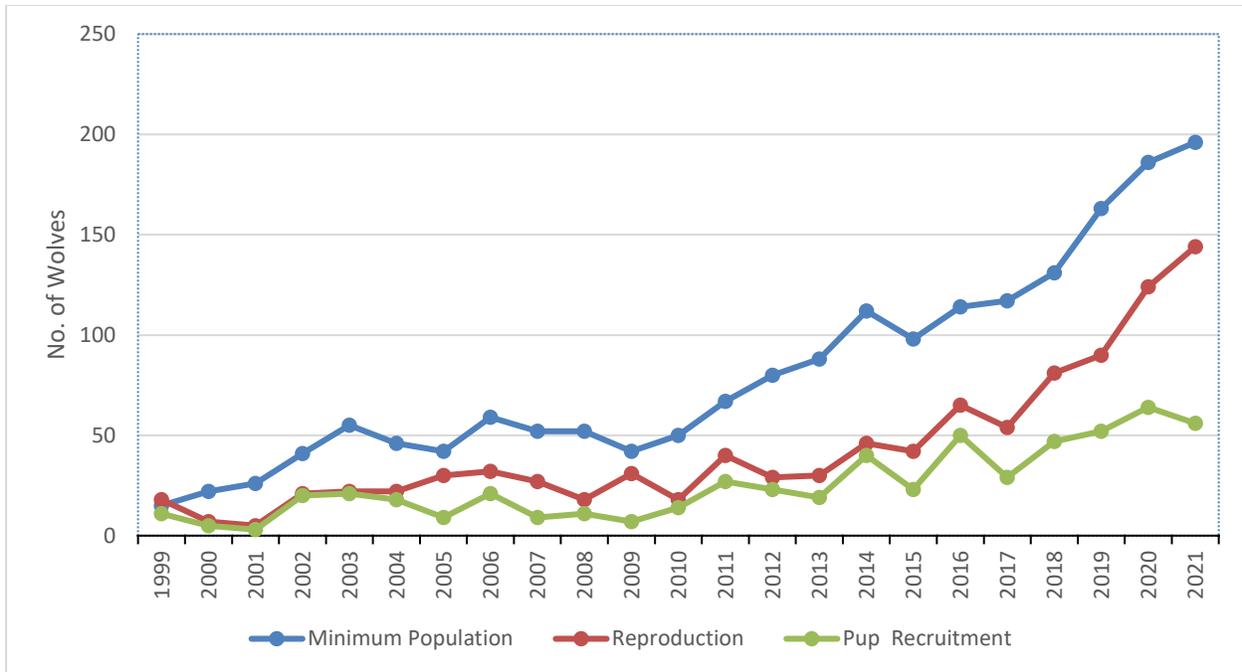


Figure 4: Mexican wolf minimum population estimate, reproduction, and recruitment documented in the MWEPA, 1998 - 2021.

e. Captures

In 2021, 47 wolves were captured a total of 50 times. Twenty-two wolves were captured, collared for the first time, processed, and released on site for routine population monitoring purposes. Nine wolves were captured, re-collared, processed, and released on site, or simply released on site with the current collar. Two 4-week-old wolf pups were captured by hand at a den site to monitor survival post cross foster release. One wolf was translocated within the MWEPA, and six wolves were removed to captivity. One wolf captured by the IFT required veterinary care and was released after treatment. Six wolves were captured by private trappers. One of these wolves was collared, processed, and released on site by the IFT. One of these wolves died from trauma due to the trapping event. One of these wolves required veterinary care and was released after treatment. Three of these wolves required an additional capture effort by IFT utilizing a helicopter to safely remove traps and treat injuries. All three of these wolves were released following veterinary treatment.

f. Releases and Translocations

Cross-Foster: the transfer of offspring from their biological parent(s) and placement with surrogate parent(s). If the offspring were in captivity at the time of the transfer, this is also considered an *Initial Release* (see definition below). If the offspring were in the wild at the time of their transfer this is also considered a *Translocation* (see definition below).

Initial Release: the release of Mexican wolves to the wild within Zone 1 (Figure 1), or in accordance with tribal or private land agreements in Zone 2 (Figure 1), that have never been in the wild, or releasing pups that have never been in the wild and are less than five months old within Zones 1 or 2. The initial release of pups less than five months old into Zone 2 allows for the cross-fostering of pups from the captive population into the wild, as well as enables translocation-eligible adults to be re-

released in Zone 2 with pups born in captivity (see 2015 10(i) Rule at <https://www.fws.gov/program/conserving-mexican-wolf/library>).

Translocations: the release of Mexican wolves into the wild that have previously been in the wild. In the MWEPA translocations will occur only in Zones 1 and 2 (Figure 1; see 2015 10(i) Rule at <https://www.fws.gov/program/conserving-mexican-wolf/library>).

Supplemental Food Cache: road-killed native prey carcasses or carnivore logs provided to wolves to assist a pack or remnant of a pack when extenuating circumstances reduce their own ability to do so (e.g., one animal raising young, or just after initial releases and translocations (including cross-fostering)).

In 2021, the IFT initially released 22 wolves (all 22 were cross-fostered pups; Table 1, Figure 3, Figure 5) into eight packs (Castle Rock, Dark Canyon, Elk Horn, Hoodoo, Lava, Leon, Owl Canyon, San Mateo). These captive-born pups came from three SSP facilities including: El Paso Zoo, Endangered Wolf Center, Sevilleta Wolf Management Facility. These cross-foster events occurred in April and May 2021. Additionally, the IFT translocated nine wolves in 2021 (Table 1). Translocations can occur throughout the year. We supplementally fed packs where cross-foster events occurred. Supplemental food assists the pack with the nutritional demand of additional pups. Of the 31 wolves that were initially released or translocated in 2021, three were radio collared and known to be alive during the end of year count (AM1693, AF1728, and m2520), and 28 were uncollared and considered fate unknown (mp2576, fp2579, mp2577, mp2578, fp2580, mp2594, mp2595, mp2596, mp2597, mp2598, mp2599, fp2615, fp2616, mp2617, mp2618, mp2617, mp2622, mp2621, fp2623, mp2649, mp2650, mp2651, mp2666, mp2667, mp2668, mp2669, fp2670, fp2671) as they had not been captured and collared by the IFT, nor were they documented as a mortality.

Table 1: Mexican wolves initially released from captivity or translocated in Arizona and New Mexico during January 1 – December 31, 2021.

Wolf pack	Wolf ID	Release site	Release date	Released or translocated
Owl Canyon	mp2576	Owl Canyon Den	4-13-2021	Released (Cross-fostered)
Owl Canyon	fp2579	Owl Canyon Den	4-13-2021	Released (Cross-fostered)
Elk Horn	mp2577	Elk Horn Den	4-13-2021	Released (Cross-fostered)
Elk Horn	mp2578	Elk Horn Den	4-13-2021	Released (Cross-fostered)
Elk Horn	fp2580	Elk Horn Den	4-13-2021	Released (Cross-fostered)
Lava	mp2594	Lava Den	4-26-2021	Released (Cross-fostered)
Lava	mp2595	Lava Den	4-26-2021	Released (Cross-fostered)
Lava	mp2596	Lava Den	4-26-2021	Released (Cross-fostered)
Hoodoo	mp2597	Hoodoo Den	4-26-2021	Released (Cross-fostered)
Hoodoo	mp2598	Hoodoo Den	4-26-2021	Released (Cross-fostered)
Hoodoo	mp2599	Hoodoo Den	4-26-2021	Released (Cross-fostered)
Castle Rock	fp2615	Castle Rock Den	4-30-2021	Released (Cross-fostered)
Castle Rock	fp2616	Castle Rock Den	4-30-2021	Released (Cross-fostered)
Castle Rock	mp2618	Castle Rock Den	4-30-2021	Released (Cross-fostered)
Leon	mp2617	Leon Den	5-1-2021	Released (Cross-fostered)
Leon	mp2622	Leon Den	5-1-2021	Released (Cross-fostered)
Leon	mp2624	Leon Den	5-1-2021	Released (Cross-fostered)
San Mateo	mp2621	San Mateo Den	4-30-2021	Released (Cross-fostered)
San Mateo	fp2623	San Mateo Den	4-30-2021	Released (Cross-fostered)
Dark Canyon	mp2649	Dark Canyon Den	5-18-2021	Released (Cross-fostered)
Dark Canyon	mp2650	Dark Canyon Den	5-18-2021	Released (Cross-fostered)
Dark Canyon	mp2651	Dark Canyon Den	5-18-2021	Released (Cross-fostered)
Seco Creek	AM1693	Pague Well	7-1-2021	Translocated
Seco Creek	AF1728	Pague Well	7-1-2021	Translocated
Seco Creek	mp2666	Pague Well	7-1-2021	Translocated
Seco Creek	mp2667	Pague Well	7-1-2021	Translocated
Seco Creek	mp2668	Pague Well	7-1-2021	Translocated
Seco Creek	mp2669	Pague Well	7-1-2021	Translocated
Seco Creek	fp2670	Pague Well	7-1-2021	Translocated
Seco Creek	fp2671	Pague Well	7-1-2021	Translocated
Single	m2520	Double Cienega	8-13-2021	Translocated

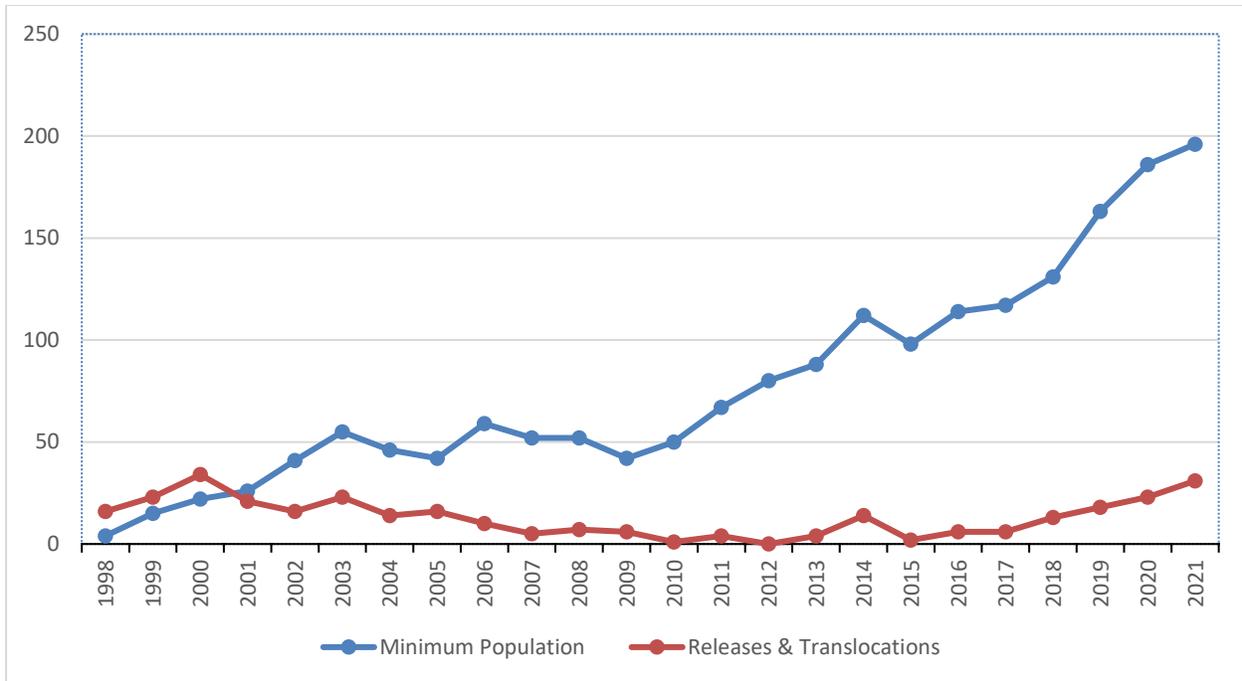


Figure 5: Mexican wolf minimum population estimates and associated releases and translocations including: initial releases (wolves released with no wild experience), translocations (wolves re-released from captivity back into the wild, and wolves in the wild that were captured, moved, and re-released in a different location for management purposes such as but not limited to boundary issues and conflicts with livestock).

g. Home Ranges and Movements

Home ranges were calculated using ≥ 20 individual locations on a pack, pair, or single wolf exhibiting territorial behavior over a period of greater than six months. Due to the large volume of deployed GPS collars, individual wolves were selected to represent a pack’s home range territory (Kittle et al. 2015). When possible, breeders were selected to represent the territorial behavior of the pack with preference given to the breeding female. To maximize sample independence, two locations per animal per day were used in the analysis. After any major pack disturbance that affected territorial behavior (i.e., death of a breeder), GPS locations were right-censored to avoid extra territorial movement. Home ranges were not calculated for wolves that displayed dispersal behavior or exhibited non-territorial behavior during 2021. Individual point selection was accomplished with program R (R Core Team 2015). Home range and core use polygons were generated using the 95% and 50% adaptive kernel method (Seaman and Powell 1996) with R and the adehabitatHR package in conjunction with ArcPro (Calenge 2019, ESRI 2018).

All wolves equipped with functioning radio collars were monitored by standard radio telemetry opportunistically from the ground and air (White and Garrot 1990). During all or portions of the year, 112 wolves were equipped with Global Positioning Collars (GPS) collars to provide more detailed location information and management capability.

The IFT calculated home ranges and core use areas for 37 packs or pairs exhibiting territorial behavior in 2021 using kernel density estimation (Seaman et al. 1999). These home ranges were between 64 square miles (Buzzard Peak pack) and 688 square miles (Centerfire pack), with an average home range size of 227 square miles (Figure 6).

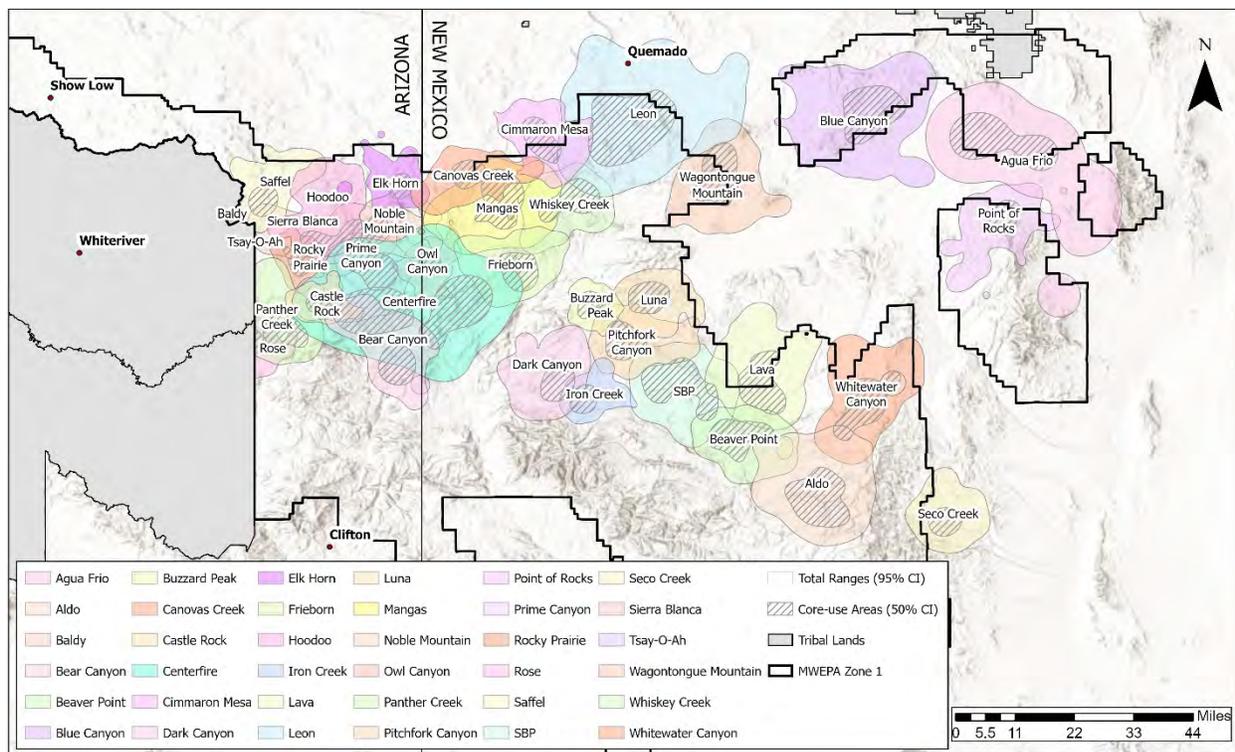


Figure 6: Mexican wolf home ranges (95% fixed kernel utilization distribution) and core use areas (50% fixed kernel utilization distribution) for 2021 in Arizona and New Mexico within the Mexican Wolf Experimental Population Area (MWEPA) excluding tribal lands.

h. Dispersals

In 2021, the IFT documented 7 collared wolves that dispersed from their natal packs (i.e., the pack the wolf was born into or raised by). These dispersing wolves were classified into one of three categories: 1) dispersed to form a new pack ($n = 3$); 2) dispersed into an existing pack ($n = 0$); or 3) became single wolves ($n = 4$).

i. Occupied Range

Occupied wolf range was calculated based on the following criteria: (1) a ten-mile radius around all aerial locations or GPS locations of radio monitored wolves over the past year; (2) a ten-mile radius around all uncollared wolf locations and wolf sign over the past year; and (3) in accordance with the 2015 10(i) Rule, occupied range is calculated within the 10(i) boundary of the MWEPA and does not include tribal lands or areas in management Zone 3.

Mexican wolves occupied 26,877 square miles of the MWEPA during 2021 (Figure 7). In comparison, Mexican wolves occupied 18,565 square miles during 2020. The Mexican wolf occupied range increased by 45% from 2020.

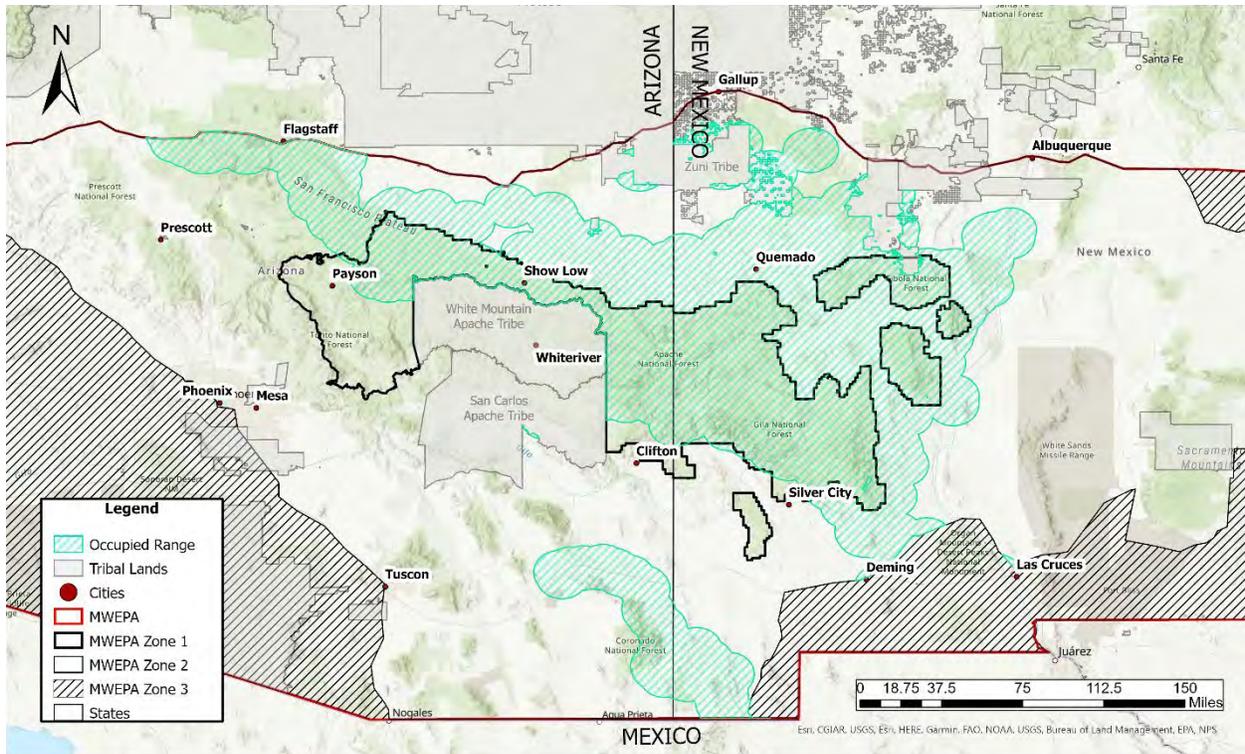


Figure 7: Mexican wolf occupied range in Arizona and New Mexico during 2021 within the Mexican Wolf Experimental Population Area (MWEPA).

j. Mortality and Removals

Wolf mortalities were detected via ground telemetry, GPS locations, and public reports. Mortality signals from radio collars were investigated within approximately 24 hours of detection to determine the status of the wolf. Carcasses were investigated by law enforcement personnel from the lead agencies and necropsies were conducted to determine cause of death (Table 2). The IFT has documented 240 wolf mortalities since 1998, 25 of which occurred in 2021 (Tables 2 and 3, Figure 8). Causes of death were classified into six categories including: 1) illegal mortality; 2) vehicle collision; 3) natural; 4) other; 5) unknown; and 6) pending necropsy. Twelve of the 25 (48%) documented wolf mortalities were considered illegal and accounted for the majority of deaths. Five of the 25 (20%) documented wolf mortalities were caused by a vehicle collision. Four of the 25 (16%) documented wolf mortalities died from natural causes (e.g., starvation, exposure, interspecific competition, intraspecific competition). Two of the 25 (8%) documented wolf mortalities were classified as other. Cause of death could not be determined for two of the 25 (8%) documented wolf mortalities. In total, 18 (72%) of the documented mortalities are considered human-caused (includes illegal mortality, vehicle collision, and trapping related). All causes of death should be considered minimum estimates of mortality, as uncollared wolves (of any age; including those with failed collars) may die without those mortalities being documented by the IFT.

Table 2: Wild Mexican wolf mortalities documented in Arizona and New Mexico, 1998-2021.

Year	Illegal mortality ^a	Vehicle collision	Natural ^b	Other ^c	Unknown	Awaiting necropsy	Annual total
1998	4	0	0	1	0	0	5
1999	0	1	2	0	0	0	3
2000	2	2	1	0	0	0	5
2001	4	1	2	1	1	0	9
2002	3	0	0	0	0	0	3
2003	7	4	0	0	1	0	12
2004	1	1	1	0	0	0	3
2005	3	0	0	0	1	0	4
2006	1	1	1	1	2	0	6
2007	2	0	1	0	1	0	4
2008	7	2	2	0	2	0	13
2009	4	0	4	0	0	0	8
2010	5	0	1	0	0	0	6
2011	3	2	3	0	0	0	8
2012	4	0	0	0	0	0	4
2013	5	0	0	2	0	0	7
2014	7	1	3	0	0	0	11
2015	8	0	3	0	2	0	13
2016	7	2	1	2	2	0	14
2017	6	1	4	0	1	0	12
2018	13	2	3	0	3	0	21
2019	9	1	1	2	2	0	15
2020	14	6	0	3	6	0	29
2021	12	5	4	2	2	0	25
Total	131	32	37	14	26	0	240

^aIllegal mortality causes of death may include but are not limited to known or suspected illegal shooting with a firearm or arrow, and illegal trap related mortalities by the public following necropsy.

^bNatural causes of death may include, but are not limited to predation, starvation, interspecific strife, lightening, and disease.

^cOther causes of death include capture-related mortalities, legal shootings and legal trap related mortalities by the public.

Wolves not located or otherwise documented alive for three or more months are considered missing or “fate unknown.” These wolves may have died, dispersed, or have a malfunctioned radio collar. Three wolves last located in Arizona (1042, 1488, 1791) and six wolves last located in New Mexico (1346, 1555, 1710, 1721, 2556, 2559) were designated fate unknown (e.g., not observed via sightings, remote cameras, or radio telemetry for >3 months during portions of 2021).

Table 3: Mexican wolf mortalities documented in Arizona and New Mexico during January 1 - December 31, 2021.

Wolf ID	Pack	Age (years)	Date found	Cause of death
M1342	Elk Horn	8	1/30/2021	Other
mp2560	Cerro Trigo	<1	2/1/2021	Illegal
M1681	Whiskey Creek	3	2/12/2021	Illegal
fp1887	Hoodoo	<1	2/19/2020	Illegal
mp1898	Single	<1	2/25/2021	Vehicle collision
mp2542	Castle Rock	<1	3/1/2021	Illegal
fp2568	Uncollared	<1	3/19/2021	Illegal
fp1869	Elk Horn	<1	3/23/2021	Vehicle collision
M1844	Blue Canyon	2	4/6/2021	Illegal
F1830	Hoodoo	4	4/21/2021	Unknown
M1950	Cimmaron Mesa	2	4/23/2021	Illegal
mp2505	Dark Canyon	<1	5/1/2021	Unknown
F2565	Colibri	2	5/9/2021	Natural
f1868	Elk Horn	1	7/24/2021	Natural
M2555	Cerro Trigo	3	7/26/2021	Illegal
F1919	Cerro Trigo	2	7/27/2021	Illegal
F1560	Baldy	5	8/21/2021	Vehicle collision
mp2695	Iron Creek	<1	9/14/2021	Vehicle collision
f2558	SBP	1	10/24/2021	Illegal
mp2628	Castle Rock	<1	11/6/2021	Natural
M1559	Tsay-O-Ah	5	11/9/2021	Other
F1951	Wagontongue Mountain	2	11/17/2021	Vehicle collision
f2541	Castle Rock	1	11/24/2021	Illegal
mp2692	Prime Canyon	<1	12/3/2021	Natural
M2696	Uncollared	3	12/9/2021	Illegal

For wolves equipped with radio collars, mortality, missing, and removal rates were calculated using methods presented in Heisey and Fuller (1985). Missing animals were censored at the date of the last signal/location of a functioning collar and classified as likely alive or dead based on the totality of the information associated with the failure (e.g., do we have subsequent photos of the animal, did the collar malfunction suddenly or fail in a predictable manner, etc.). Management removals can have an effect equivalent to mortalities on the population of Mexican wolves (Paquet et al. 2001). Thus, the IFT also calculated yearly cause-specific removal rates for wolves equipped with radio collars. Wolves are removed from the population for four primary causes: 1) livestock depredations; 2) nuisance to humans; 3) wolves are outside the boundary (e.g., north of I-40 or requested removal from tribal lands); and 4) other (e.g., pair with other wolves, veterinary treatment, move a wolf to a more appropriate area without any of the other causes occurring first). Each time a wolf was moved, it was considered a removal, regardless of the animal's status later in the year (e.g., if the wolf was

translocated or held in captivity). Thirty-seven wolves equipped with functioning radio collars were considered removed ($n = 6$), dead ($n = 18$), or missing ($n = 13$). Seventeen uncollared or wolves with failed collars that were documented dead ($n=7$) or removed ($n=10$) were not included in this analysis.

The IFT calculated an overall failure rate of wolves by combining mortality, missing (only those wolves that went missing under questionable scenarios), and removal rates to represent the overall yearly rate of wolves affected (i.e., dead, missing, or managed) in a given year. Uncollared or failed-collared wolves that were found dead or removed were not included in the survival analyses because these wolves were not consistently monitored throughout the year (e.g., many may die without being found and the individuals that are found are random occurrences that do not reflect overall population dynamics). In addition, wolves that died as a result of handling (no wolves with functioning radio collars died as a result of handling in 2021) were right-censored at the time of their death (e.g., radio days were counted until their death, but the death was not counted in survival estimates) in accordance with standard survival analyses methodology (Heisey and Fuller 1985).

The overall survival rate was 0.75 with a corresponding failure rate of 0.25. The overall failure rate was composed of human caused mortality rate (0.12; $n = 12$), natural mortality rate (0.05; $n = 5$), unknown/awaiting necropsy mortality rate (0.01; $n = 1$), boundary removal rate (0.04; $n = 4$), missing wolves' rate (0.02; $n = 2$), livestock depredation removal rate (0.01; $n = 1$), nuisance removal rate (0.00; $n = 0$), and other removal rate (0.01; $n = 1$). Much of the mortality was concentrated on sub-adult (radio days = 8,237, failures = 8, survival rate = 0.70), and pup (radio days = 2,786, failures = 6, survival rate = 0.46) components of the population relative to the adults (radio days = 21,676, failures = 12, survival rate = 0.82).

Based on meta-analysis of gray wolf literature, Fuller et al. (2003) identified a 0.34 mortality rate as the inflection point of wolf populations. Theoretically, wolf populations below a 0.34 mortality rate would increase naturally, and wolf populations above a 0.34 mortality rate would decrease. The Mexican wolf population had an overall failure (mortality plus removal plus missing rate) rate of 0.25 in 2021. Following Fuller et al. (2003), our failure rate would predict an increasing population which was the case in 2021. Further, Miller (2017) found that population growth was particularly sensitive to adult failure rates, which were lower in our population (0.18) than other components (sub-adults 0.30, pups 0.54) in 2021. The increase in the population was likely due to the high number of pups recruited in the last two years 64 and 56 in 2020 and 2021, respectively. While the number of management removals has remained low in the recent past, the majority of the population losses in 2021 were due to human-caused mortalities rather than management removals. Efforts will focus on reducing the mortality rate in 2022.

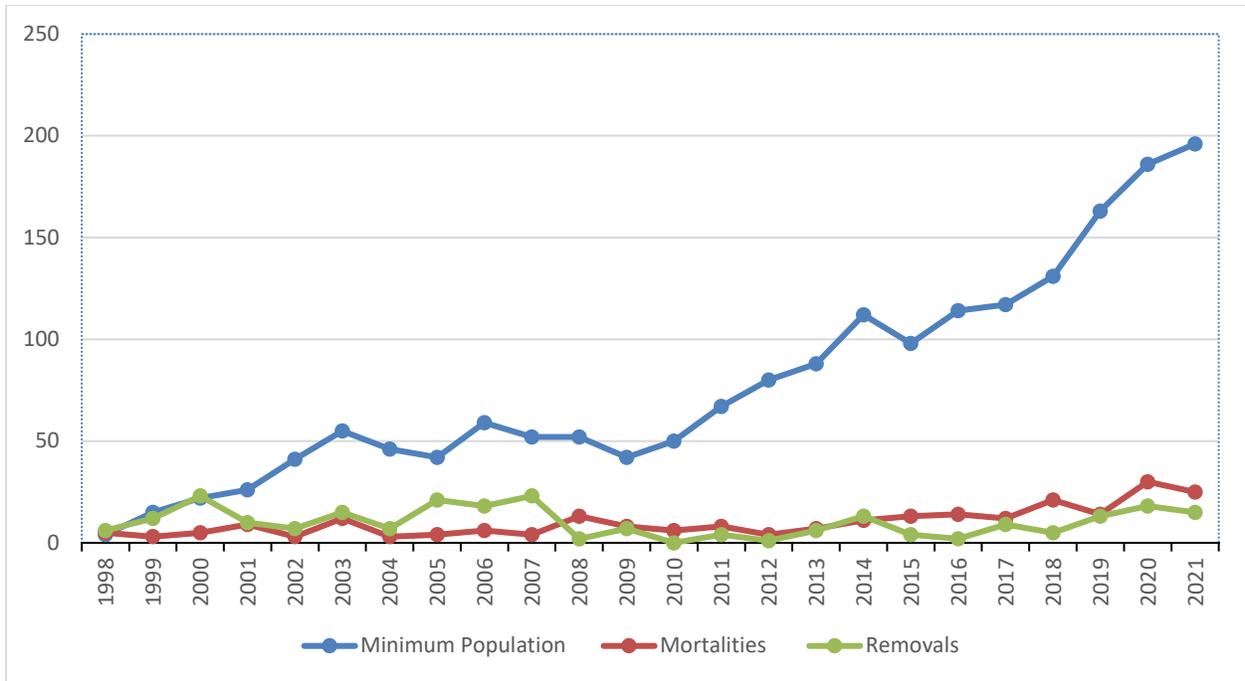


Figure 8: Mexican wolf minimum population estimates and associated removals and mortalities in the MWEPA, 1998 - 2021.

4. CONFLICT MANAGEMENT

Reports of wolf-caused livestock depredations are investigated and classified by USDA-WS as confirmed wolf, probable wolf, or determined as not having wolf involvement. A depredation is defined as a confirmed killing or wounding of lawfully present domestic animals by one or more Mexican wolves. A depredation incident is defined as the aggregate number of livestock killed or mortally wounded by an individual wolf or by a single pack of wolves at a single location within a one-day (24 hr.) period, beginning with the first confirmed kill, as documented in an initial IFT incident investigation. Depredation investigations of injuries that are confirmed or probable are not considered depredation incidents. Depredation investigations where an animal is killed, and the investigator determines the death was probably caused by wolves are also not considered depredation incidents.

USDA-WS investigated suspected wolf depredations on livestock, including dead and injured livestock located by the IFT, within 24 hours of receiving a report unless rare circumstances prevented arrival within 24 hours. Not all dead livestock were found or found and reported in time to document cause of death. Accordingly, depredation numbers in this report represent the minimum number of livestock confirmed by USDA-WS to have been killed by wolves.

a. Depredations

In 2021, investigators confirmed that wolves were responsible for the death of 123 cattle, two sheep, one donkey, and one horse and injuries to eight cattle. Additionally, three cattle were identified as probable wolf-caused deaths (Table 4). In 2021, the total number of confirmed depredation incidents decreased by 21% from 2020 (Figure 9). Investigations of dead and injured livestock conducted by USDA-WS that were determined to be from causes other than wolves (i.e., vehicle strike, illness, coyote predation, bear predation, or unknown cause) are not listed.

Table 4: USDA-WS confirmed and probable wolf depredations by type of incident and state in 2021.

	Confirmed Wolf		Probable Wolf	
	Killed or died from injuries	Injured	Killed or died from injuries	Injured
Arizona	48	4	1	0
New Mexico	79	4	2	0
Total	127	8	3	0

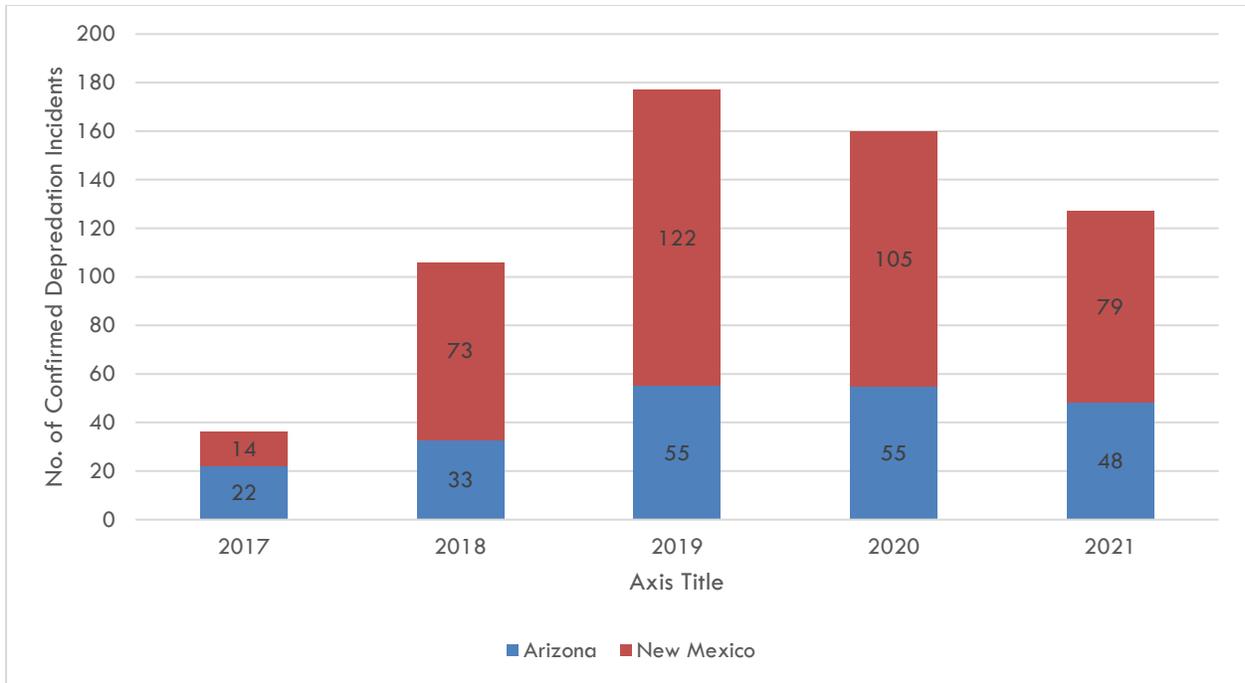


Figure 9: Total number of confirmed depredation incidents (animal killed or died from injuries) by state 2017 - 2021.

From 2011 to 2020 (10-year average), the mean number of cattle confirmed killed by wolves per year is 66.7 which extrapolates to 57.85 cattle killed per year per 100 Mexican wolves (Figure 10). The mean of 57.85 cattle killed per year per 100 wolves is useful for comparison purposes in 2021. The depredation rate for 2021 extrapolates to 62.75 confirmed killed cattle per 100 wolves using the number of confirmed killed cattle compared to the final population count. While the 2021 rate is slightly above the previous 10-year average (2011 to 2020) mean of 57.85 confirmed killed cattle/100 wolves/year, the 2021 depredation rate decreased by 27% from 2020

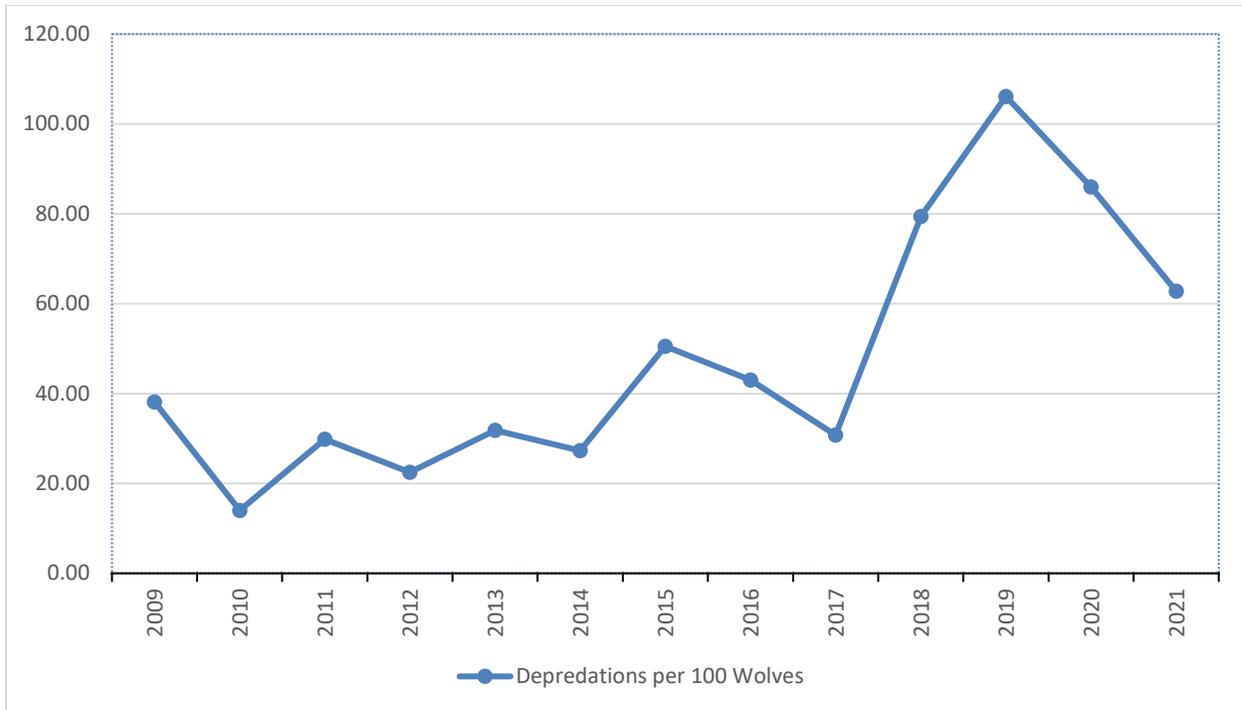


Figure 10: Mean number of cattle killed per year per 100 Mexican wolves, 2009 - 2021.

b. Wolf-Human Conflict

Wolf-human conflict incidents are categorized as: imminent threat to humans, potential threat to humans, or nuisance incidents in which a report is taken of unacceptable wolf behavior or a wolf sighting in an unacceptable area, such as near a residence, but not posing an imminent or potential threat to humans. Though wolf attacks on humans are very rare in North America, we recognize there is potential for wolves, as with all large predators, to pose a risk to human safety. For this reason and to build social tolerance of wolves, every effort is made to investigate such reports in a timely manner, determine what wolf/wolves were involved in the incident and implement management efforts to avert or resolve credible reports of wolf-public conflict. Some wolf-public conflict reports are determined to involve animals that are not wolves, such as dogs or coyotes. Other reports are classified as unknown if it cannot be determined that wolves were present or responsible.

In 2021, the IFT fielded 29 wolf-human conflict reports. Of the 29 reports, the IFT determined 19 reports (Figures 11 and 12) involved or may have involved Mexican wolves, seven reports involved species other than wolves (domestic dogs, coyotes, etc.) and three reports the IFT was unable to locate evidence to determine if wolves were involved or not. Of the 19 reports that involved or may have involved wolves, zero incidents posed imminent threat to humans, two incidents posed potential threat to humans, and 17 were nuisance incidents not posing an imminent or potential threat to humans. The first incident determined as having potential threat to humans involved an interaction in February where a wolf approached a human on the Gila National Forest in NM. The reporting party, discharged a firearm which caused the wolf to run off. The IFT investigated the incident and determined that due to the location of the incident (on a bench), that both parties (human/wolf) were surprised/startled, and both reacted as expected given the circumstance. Please see the Mexican Wolf Recovery Program Quarterly Update (First Quarter) for 2021 for complete details of this

incident. The second incident determined as having potential threat to humans involved a delayed report (September) of three sightings of an uncollared wolf observed following a vehicle at close distance on the Water Canyon Road, on the Apache-Sitgreaves National Forest in August. In response, the IFT initiated efforts to capture the wolf; however, the wolf was not captured and was never observed by the IFT during capture efforts. Please see the Mexican Wolf Recovery Program Quarterly Update (Third Quarter) for 2021 for complete details of this incident.

Following a report of wolf-human conflict, IFT members used on-site investigations, interviewing of reporting parties, trail cameras, tracking, telemetry, GPS locations, howling, and trapping during investigations to gather evidence of wolf involvement. Hazing was used to move wolves away from residences, recreational areas, or domestic animals in proximity to humans. Carcasses and other attractants were removed from affected areas when appropriate.

Wolf-human conflict reports were documented in the Mexican Wolf Recovery Program Quarterly Updates which can be accessed on the Service’s Mexican wolf web site at <https://www.fws.gov/program/conserving-mexican-wolf/library>.

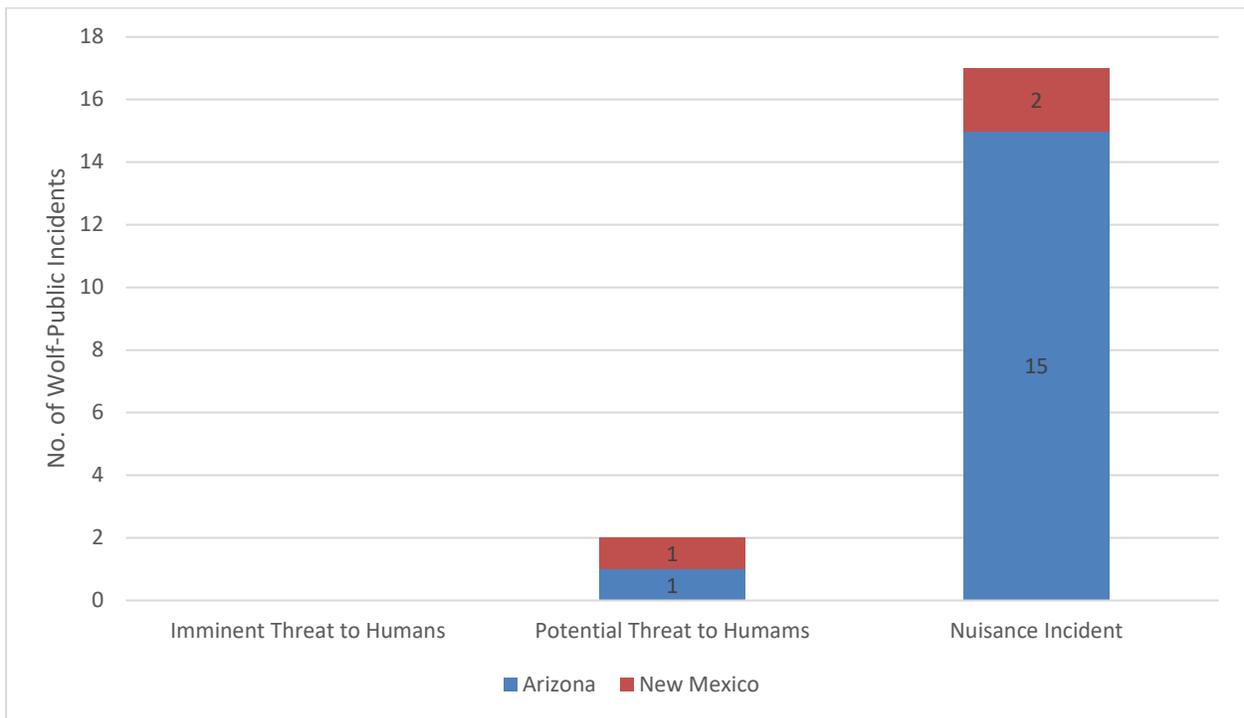


Figure 11: Total number of wolf-human conflict incidents by incident category and state in 2021

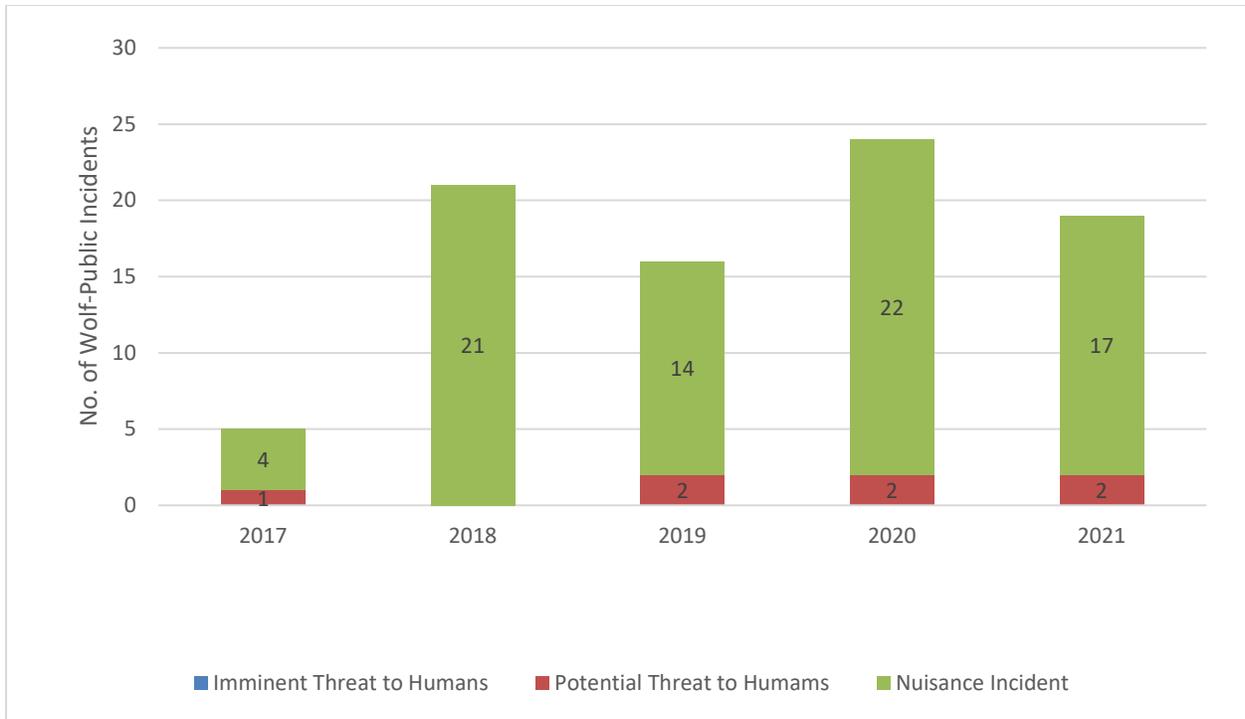


Figure 12: Number of confirmed wolf-human incidents by category 2017-2021

c. Proactive Management

Various proactive management activities were utilized to reduce wolf-livestock conflicts during 2021. These management approaches and tools may include:

- *Altering livestock grazing rotations:* moving livestock between different pastures within USFS grazing allotments to avoid areas of high wolf use or depredations. Project personnel met with USFS District Rangers, biologists, and range staff to discuss livestock management options during the wolf denning season and to address potential conflicts between livestock and wolves. During 2021, alteration of livestock grazing rotation schedules was not implemented to minimize wolf-livestock conflict.
- *Carcass Removals:* attractants such as livestock carcasses are removed when the presence of those attractants could draw in wolves and lead to increased conflict. Carcass removal is prioritized in areas with active calving and prior to denning season to reduce the likelihood that wolves will localize and den in an area where cattle are present. Carcass removal is not possible in some areas of the MWEPA due to access issues. During 2021, the IFT removed 29 livestock carcasses to minimize wolf-livestock conflict.
- *Diversionary food caches:* road-killed native prey carcasses or carnivore logs provided to wolves in areas to reduce potential wolf conflicts with livestock and potential nuisance incidents. Diversionary food caches were established in areas where depredations had occurred or were likely to occur for 11 known packs and one uncollared wolf area during 2021. Supplemental food caches were established in association with 11 packs during 2021.

These supplemental food caches can also act as diversionary food caches by reducing the potential wolf-livestock conflict.

- *Exclusionary fencing*: eight-foot-high fence enclosing areas of private property for the purposes of protecting especially vulnerable animals or to address other specific property protection purposes. The IFT did not collaborate with Non-Governmental Organizations' (NGO) or private landowners to initiate exclusionary fencing projects during 2021.
- *Hay and supplements*: feed and mineral supplements purchased for livestock producers who opt to contain livestock (e.g., cows with young calves) in smaller, more protected areas during livestock calving season or wolf denning periods to reduce the potential for conflict between wolves and cattle on grazing allotments or private property. Our partner agencies and NGOs did not purchase hay or supplements to mitigate conflicts between wolves and livestock in 2021.
- *Hazing*: human presence, rubber bullets, pyrotechnics or other combinations of light and sound used to scare wolves from an area. Wolves were hazed on foot or by vehicle in cases where wolves localized near areas of human activity, displayed nuisance behavior, were present in areas with recent depredations on livestock, or areas with potential for wolf-livestock conflict, or if found feeding on, chasing, or killing livestock. When necessary, wolves were hazed to encourage an aversive response to humans and to discourage nuisance and depredation behavior. In 2021, the IFT conducted hazing activities for 294 personnel days (e.g., multiple personnel hazing on the same day would count as 2 or more personnel days). These activities resulted in successful hazing on 87 occasions.
- *Permittee calls*: Permittees that request regular wolf location information are contacted every other week following the online posting of current GPS location data if wolves were located on or near their allotment. Permittees are provided the same wolf location information that is used to update the public internet-based location map. Permittees experiencing depredations are notified of wolf locations more frequently. The IFT maintained the public internet-based location map and called approximately 90 permittees every other week to discuss locations during 2021.
- *Radio telemetry equipment*: radio-collar monitoring equipment issued to livestock producers to facilitate their own proactive management activities and aid in the detection and prevention of conflict between wolves and cattle. The IFT issued/maintained radio telemetry equipment for livestock producers or residents in areas where wolf-livestock conflicts or nuisance incidents had occurred or were likely to occur. The IFT trained livestock producers to use the telemetry equipment to monitor wolves in the vicinity of cattle or residences and instructed them on hazing techniques. The IFT issued or updated 14 receivers during 2021.
- *Radio Activated Guard (RAG) boxes*: consists of radio-collar monitoring equipment that activates strobe lights and loudspeakers that makes various loud noises (sirens, gunshots, helicopters) when a collared wolf is detected in the area. The IFT uses RAG boxes to encourage an aversive response to humans and to discourage nuisance and depredation behavior. The IFT did not deploy any RAG boxes during 2021.

- *Range Riders*: persons who assist livestock producers in monitoring wolf activity in relation to livestock, provide human presence, and conduct hazing to deter wolves away from livestock. During 2021, our partner agencies and NGOs contracted 11 range riders, five in Arizona, and six in New Mexico to assist stakeholders in monitoring wolves in proximity to livestock. Additionally, the AZGFD employed two seasonal range riders in Arizona which were utilized in depredation hotspot areas to mitigate and reduce wolf-livestock conflict.
- *Removal of wolves*: The removal of a wolf or wolves associated with confirmed depredation incidents and/or conflict with humans. Wolves can be removed from an area using non-lethal (e.g., trapping, helicopter capture) and lethal methods. Live removals may include translocation to another area or removal to captivity. In 2021 two wolves were removed from the wild, and eight wolves were translocated to another area because of wolf-livestock conflict.
- *Trapping*: Foot-hold traps can be used as a method to haze wolves out of an area. Trapping and collaring previously uncollared wolves also allows the IFT to better manage conflict situations; collared wolves can be located and hazed, while uncollared wolves prove more difficult. In 2021, the IFT set 40 foot-hold traps for management purposes and/or in areas with potential uncollared wolves.
- *Turbo Fladry*: electric fence with colored flagging installed around livestock pastures and private property to discourage wolf presence inside the perimeter of the fencing. When necessary, the IFT uses electrical charged turbo fladry to encourage an aversive response to humans and to discourage nuisance and depredation behavior. The IFT installed two sets of turbo fladry in 2021.

d. Public Outreach

We are committed to engaging in effective communication, identifying various outreach mechanisms, and standardizing certain outreach activities. The goal is to ensure timely, accurate, and effective two-way communication between and among cooperating agencies, stakeholders, and the public.

Outreach activities were conducted on a regular basis as a means of disseminating information to concerned citizens, government and non-government organizations, and other interested stakeholders. Outreach was facilitated through quarterly updates, internet-based Mexican wolf location maps, phone calls to permittees, informational handouts, presentations, meetings, field trips and workshops, informational display booths, web page updates including press releases and public notices, responding to requests for information, recording public wolf reports, and conversing with the public over the phone and through email.

During 2021, the IFT posted quarterly updates in various public buildings (e.g., libraries, post offices). These quarterly updates were also posted on the AZGFD Mexican wolf website at http://www.azgfd.gov/w_c/es/wolf_reintroduction.shtml and the Service's Mexican wolf website at <https://www.fws.gov/program/conserving-mexican-wolf/library>. Interested individuals can sign up to receive the quarterly update electronically by visiting the AZGFD web site at <http://azgfd.gov/signup>.

A map consisting of the most recent general wolf locations was also posted online via a [web mapping](#) application every two weeks to inform cooperators and the public of areas occupied by wolves.

The IFT contacted campers, hunters, and other members of the public and provided them with information about the Mexican Wolf Recovery Program. These interactions focused on advising the public of the potential for encountering wolves, providing general recommendations for recreating in wolf-occupied areas, and explaining legal provisions of the 2015 10(j) Rule. The IFT also used these contacts to collect information on wolf sightings, tracks, and other wolf sign from the public.

Presentations and status reports were provided to federal and state agencies, conservation groups, rural communities, schools, wildlife workshops, and various other public, private, and tribal institutions. In addition, biweekly contacts to provide wolf locations were made to cooperating agencies and stakeholders. Outreach presentations can be scheduled by contacting the IFT at 1-888-459-WOLF (9653).

The IFT maintained informational signs and posters that provided information on how to minimize conflicts with wolves using available USFS kiosks and various road pullouts within the MWEPA in 2021. The IFT distributed informational flyers at several public offices and businesses in occupied range in the MWEPA to aid hunters in recognizing the differences between wolves and coyotes. The IFT also maintained Service reward posters at USFS kiosks and local businesses in the MWEPA, to provide notice of a \$10,000 reward for information leading to the apprehension of individuals responsible for illegally killing Mexican wolves.

Table 5: Status of Mexican wolf packs in Arizona and New Mexico, as of December 31, 2021.

Pack	Wolf ID	Reproduction ^a	Pups at year end ^b	Number collared	Number uncollared	Minimum pack size ^c
Agua Frio	AM1875, AF1936	1	0	2	0	2
Aldo	M2561, F1712	0	00	2	0	2
Baldy*	AM1347	N/A ^d	N/A ^d	N/A ^d	N/A ^d	N/A ^d
Bear Canyon*	AM2563, AF1823	5	2	2	2	4
Beaver Point*	AF1837	3	2	1	3	4
Blue Canyon	AM1844 ^e , AF1834 ^m , M1953	0 ^r	0	1	1	2
Buzzard Peak*	AM1831, AF1726	1	1	2	1	3
Canovas Creek	F2569	0	0	1	1	2
Castle Rock*	AM2696 ^e , AF1686, f2540, f2541 ^e , mp2628 ^e	10 ^h	2	2	4	6
Centerfire	AF1916	4	0	1	1	2
Cerro Trigo	AM2555 ^{e,w} , F1919 ^{e,w} , mp2560 ^{e,w}	0	0	0	0	0
Cimmaron Mesa	AF1705	0 ^r	0	1	1	2
Colibri	AM1555 ^f , M1856	0	0		2	41
Cottonwood Canyon	f2503	0	0	1	1	2
Dark Canyon*	AM1354, AF1456 ^l , M1855, mp2505 ^e	8 ^h	3	2	5	7
Datil Mountain	F1685 ^e	0	0	0	0	0
Eagle Creek	M1477, F1548	0	0	2	0	2
Elk Horn*	AM1342 ^e , AF1294, M1838, f1868 ^e , fp1869 ^e	10 ^h	1	1	3	5
Frieborn*	AF1443	3	2	1	4	5
Gatlin	M1838 ^u	0	0	0	0	0
Hail Canyon	f2690	0	0	1	1	2
Hoodoo*	AM1290, AF1333, M1789, F1830 ^e , f1887 ^e , f1889, f1890, mp2602, fp2603	10 ^h ,	4	7	4	11
Iron Creek*	AM1240, AF1278, F1670 ^f , M1710 ^f , F1721 ^f , m2545, m2549	6	2	4	2	6
Lava*	AM1285, AF1405	5 ^{h,i}	3	2	5	7
Leon	AM1824, AF1578	7 ^h	0	2	1	3

Pack	Wolf ID	Reproduction ^a	Pups at year end ^b	Number collared	Number uncollared	Minimum pack size ^c
Leopold	AM1293 ^{f,w} , AF1346 ^{f,w}	0	0	0	0	0
Luna	AM1158, AF1487, m2567	0 ^r	0	3	0	3
Mangas*	AM1296, AF1439 ^l , M1832, mp2687	5	4	2	6	8
Monument Saddle	M1953 ^u	0	0	0	0	0
Negrito	M1693 ^w , F1728 ^w	0	0	0	0	0
New Pair AZ	F1938	0	0	1	1	2
Noble Mountain*	AM1571, AF1918	2	1	2	2	4
Owl Canyon*	AM1790, AF1701, fp2588, fp2589, mp2590, fp2593	8 ^h	4	6	0	6
Panther Creek*	AM1382, AF1683	3	2	2	6	8
Pitchfork Canyon	AM2566, AF1853, mp2559 ^e	2	0	2	0	2
Poker	AM1582 ^{t,w} , F1841 ^{t,w}	N/A ^d	N/A ^d	N/A ^d	N/A ^d	N/A ^d
Point of Rocks*	AM1717, fp2688, mp2689	3	2	3	1	4
Prime Canyon*	AM1471 ^l , AF1488 ^m , F1791 ^e , F1920, M1921, mp2692 ^e	5	3	2	5	7
Rocky Prairie*	AM1383, AF1489, f2536	4	2	3	3	6
Rose	AM1704, F1828 ^t	N/A ^d	N/A ^d	N/A ^d	N/A ^d	N/A ^d
Saffel*	AM1854, AF1939, M1852, fp2694	2	2	4	1	5
San Mateo*	AM1345 ^l , AF1399, m1950 ^e , mp2636	6 ^h	2	2	2	4
SBP*	AF1553, f2558 ^e	3	1	1	2	3
Seco Creek*	AM1693, AF1728	6	5	2	5	7
Sierra Blanca	AF1550	0	0	1	0	1
Single, AZ	m2520	0	0	1	0	1
Single, AZ	f2534	0	0	1	0	1
Single, NM	F1692	0	0	1	0	1
Single, NM	M1857	0	0	1	0	1
Single, NM	M1859	0	0	1	0	1
Single, NM	m1888	0	0	1	1	2
Single, NM	M2557	0	0	1	0	1

Pack	Wolf ID	Reproduction ^a	Pups at year end ^b	Number collared	Number uncollared	Minimum pack size ^c
Slade*	fp2691	3	2	1	3	4
Squirrel Springs*	AF1788	7	0	1	2	3
Tsay-O-Ah	AM1559 ^e , AF1283	N/A ^d	N/A ^d	N/A ^d	N/A ^d	N/A ^d
Tu dil hil*	AM1338 ^m , AF1679	N/A ^d	N/A ^d	N/A ^d	N/A ^d	N/A ^d
Wagontongue Mountain	M1946, F1951 ^e	0	0	1	1	2
Whiskey Creek	AM1681 ^e , M1842, m2556 ^f	0	0	1	1	2
Whitewater Canyon*	F1684	2	1	1	2	3
Sawtooth Mountains, NM	Uncollared wolf	0	0	0	2	2
Northeast San Mateo Mountains, NM	Uncollared wolf	0	0	0	2	2
Pleasanton, NM	Uncollared wolf	0	0	0	1	1
Miller Springs, NM	Uncollared wolf	0	0	0	2	2
Alpine Divide, AZ	Uncollared wolf	0	0	0	2	2
Greens Peak, AZ	Uncollared wolf	0	0	0	2	2
Christmas Tree, FAIR	Uncollared wolf	N/A ^d	N/A ^d	N/A ^d	N/A ^d	N/A ^d
SCAR	Uncollared wolf	N/A ^d	N/A ^d	N/A ^d	N/A ^d	N/A ^d
	Totals	144	56	92	104	196

Pack	Wolf ID	Reproduction ^a	Pups at year end ^b	Number collared	Number uncollared	Minimum pack size ^c
<p>a Reproduction-maximum number of pups documented in 2021. b Pups at year end documented surviving until December 31, 2021. c Minimum pack size is the total number of wolves (collared, uncollared, pups) documented at year end. d Wolf numbers on FAIR and SCAR are not displayed at the request of the tribes. e A wolf that died during 2021. f A wolf that was considered fate unknown during 2021. g A radio collared wolf not missing for three months, but not located nor believed alive by IFT through December 31, 2021. h The litter size includes cross-foster (s) released or translocated into wild den during 2021. i The litter size includes pup(s) removed from wild den during 2021. l Radio collar no longer functions; but, documented alive through December 31, 2021, and counted in "No. Uncollared" column. m Radio collar slipped off; but, documented or presumed alive through December 31, 2021, and counted in "No. Uncollared" column. " n A breeding wolf displaced from pack by other wolves; retains original pack name. o Totals include wolves occurring on FAIR and SCAR. p Two females documented to have successfully reproduced within this pack. r A pack denned but a pup count was not obtained. s The radio collar failed, documented as alive in 2021, but dispersed and was not documented alive during the count period. t A wolf captured and placed into captivity or lethally removed. u A radio collared wolf dispersed into a new pack during 2021, pack no longer exists v A wolf that was considered fate unknown in 2020, found dead in 2021. w A pack no longer exists due to all members lethally removed, placed into captivity, died, or became fate unknown in 2021. *A pack that meets the definition of a breeding pair per the final rule.</p>						

5. LITERATURE CITED

- Calenge, Clement. 2019. adehabitatHR, Home Range Estimation. Version 0.4.16 CRAN R Project. <https://CRAN.R-project.org/package=adehabitatHR>
- ESRI (Environmental Systems Research Institute). 2018. ArcGIS ArcPro. Version 2.2.4. Environmental Systems Research Institute, Redlands, California.
- Heisey, D. M., and T. K. Fuller. 1985. Evaluation of survival and cause-specific mortality rates using telemetry data. *Journal of Wildlife Management* 49:668-674.
- Fuller, T. K., L. D. Mech, and J. F. Cochrane. 2003. Wolf population dynamics. Pages 161-191 in L. D. Mech and L. Boitani, editors. *Wolves: behavior, ecology, and conservation*. The University of Chicago Press, Chicago, Illinois, USA.
- Kittle, A. M., Anderson, M. , Avgar, T. , Baker, J. A., Brown, G. S., Hagens, J. , Iwachewski, E. , Moffatt, S. , Mosser, A. , Patterson, B. R., Reid, D. E., Rodgers, A. R., Shuter, J. , Street, G. M., Thompson, I. D., Vander Vennen, L. M. and Fryxell, J. M. 2015, Wolves adapt territory size, not pack size to local habitat quality. *J Anim Ecol*, 84: 1177-1186. doi:10.1111/1365-2656.12366
- Mexican Wolf Blue Range Adaptive Management Oversight Committee and Interagency Field Team. 2005. Mexican Wolf Blue Range Reintroduction Project 5-year review. U.S. Fish and Wildlife Service, Albuquerque, New Mexico, USA.
- Miller, P.S. 2017. Population viability analysis for the Mexican wolf (*Canis lupus baileyi*). Integrating wild and captive populations in a metapopulation risk assessment model for recovery planning. U.S. Fish and Wildlife Service. Albuquerque, New Mexico, USA.
- Paquet, P. C., J. Vucetich, M. L. Phillips, and L. Vucetich. 2001. Mexican wolf recovery: three year program review and assessment. Prepared by the Conservation Breeding Specialist Group for the U.S. Fish and Wildlife Service, Albuquerque, New Mexico, USA.
- R Core Team (2015). R: A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna, Austria. URL <https://www.R-project.org/>
- Seaman, D. E., and R. A. Powell. 1996. An evaluation of the accuracy of kernel density estimators for home range analysis. *Ecology* 77:2075-2085.
- Seaman, D. E., J. J. Millspaugh, B. J. Kernohan, G. C. Brundige, K. J. Raedeke, and R. A. Gitzen. 1999. Effects of sample size on kernel home range estimates. *The Journal of Wildlife Management* 63:739-747.
- U. S. Fish and Wildlife Service. 1996. Final environmental impact statement for the reintroduction of the Mexican wolf within its historic range in the southwestern United States. U.S. Fish and Wildlife Service, Albuquerque, New Mexico, USA.
- U. S. Fish and Wildlife Service. 1998. The final Mexican wolf experimental rule. 63 Federal Register. Pp 1763-1772.
- U. S. Fish and Wildlife Service. 2015. The final Mexican wolf experimental rule. 80 Federal Register. Pp 2512-2567.

White, G. C., and R. A. Garrott. 1990. Analysis of wildlife radio-tracking data. Academic Press Incorporated, New York, New York, USA.

6. PERSONNEL

We acknowledge and appreciate the assistance of all agency personnel and volunteers who provided data and support services for the operational field portion of the Mexican Wolf Recovery Program during this reporting period. The following is a list of personnel and volunteers from our cooperating agencies, and the Service directly involved in the Mexican Wolf Recovery Program.

Arizona Game and Fish Department

Jim deVos, Mexican Wolf Coordinator
Paul Greer, Field Team Leader
Jared Black, Wolf Biologist (outgoing)
Bailey Dilgard, Wolf Biologist
Annie Barken, Wolf Technician
Bailey Dilgard, Wolf Technician (outgoing)
Ashley Everroad, Range Rider
David Drever, Range Rider

New Mexico Department of Game and Fish

Stewart Liley, Chief of Wildlife Management
Don Young, Field Team Leader
Nicholas Riso, Wolf Biologist

USDA-APHIS Wildlife Services

Sterling Simpson, Wolf Management Specialist (AZ)
Jake Ure, Non-Lethal Specialist (AZ)
Stephen Gomez, Wildlife Services Agent (NM)

U.S. Forest Service

Vicente Ordonez – Forest Service Liaison to the Mexican Wolf Recovery Program

U.S. Fish and Wildlife Service

Brady McGee, Mexican Wolf Recovery Coordinator
Maggie Dwire, Deputy Mexican Wolf Recovery Coordinator
Tracy Melbiness, Mexican Wolf Policy, Planning, and Litigation Coordinator
John Oakleaf, Mexican Wolf Field Projects Coordinator
Melissa Kreutzian, Fish and Wildlife Biologist
Colby Gardner, Fish and Wildlife Biologist
Susan Dicks, DVM, Fish and Wildlife Biologist
Allison Greenleaf, Wildlife Biologist

Cyrene Piper, Wildlife Biologist
Sara Eno, Wildlife Biologist
Ed Davis, Wildlife Biologist
Dewey Wesley, Biological Technician

White Mountain Apache Tribe

Cynthia Dale, Sensitive Species Coordinator
Theo Guy, Wolf Technician
Deon Hinton, Wolf Technician
Manuelita Kessay, Sensitive Species Technician
Joseph Perez, Wolf Technician

Project Veterinarians

Susan Dicks, DVM
Ole Alcumbrac, DVM
Anne Justice-Allen, DVM

Mexican Wolf Project Volunteers

Nick Bontrager
Michael “Max” Morton
Bill Davenport
Evan Carlson
David Wimmer
Shana Olson
David Jacob
Charles Fox
David Hannrahan
Kendall Bancroft
Kylie Henslick
Annie Barken
Agapito Lopez
Scott Mill
Colin Martin
Hope Vince
Clara Jessup
Moed Gerverni