Mexican Wolf Recovery Program:
Progress Report #14

Reporting Period: January 1 – December 31, 2011

Prepared by: The U.S. Fish and Wildlife Service

Cooperators: Arizona Game and Fish Department, USDA-APHIS Wildlife Services, US Forest Service, and White Mountain Apache Tribe

M1049 released into the Blue Range Wolf Recovery Area. USFWS Photo

Table of Contents

Foreword
Background

Part A: Recovery Administration **Page**

1. Mexican Wolf Captive Breeding Program 3
   a. Mexican Wolf Species Survival Plan 3
   b. Mexican Wolf Pre-Release Facilities 3
2. Recovery Planning 5
3. Reclassification 6
4. Blue Range Wolf Reintroduction Project Structure 6
5. Cooperative Agreements and Contracts 8
6. Research 8
   a. Mexican Wolf Captive Breeding Program 8
   b. Blue Range Wolf Recovery Area 10
7. Litigation 11
   a. Wild Earth Guardians and Center for Biological Diversity 11
   b. Lawsuit from interested parties in New Mexico 12
8. Rule Amendment and Environmental Impact Statement 12
9. Mexican Wolf Interdiction Fund and Stakeholder Council 12
10. Literature Cited 13

Part B: Reintroduction

1. Introduction 14
2. Methods 15
3. Results 21
   a. Population Status 21
   b. Reproduction 21
   c. Releases and Translocations 22
   d. Home Ranges and Movements 23
   e. Mortality 23
   f. Wolf Predation 24
   g. Wolf Depredation 24
   h. Management Actions 25
   i. Proactive Management Activities 26
   j. Non-IFT Wolf Sighting Reports 29
   k. Uncollared Wolf Sign 29
   l. Outreach 29
4. Summary 30
5. Discussion 31
6. Literature Cited 32
7. Pack Summaries 55
8. Individual Wolf Summaries 59
9. Personnel 62

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. The Mexican Wolf Recovery Program essentially is separated into two, interrelated components: 1) Recovery – includes aspects of the program administered primarily by the Service that pertain to the overall goal of Mexican wolf recovery and delisting from the list of threatened and endangered species, and 2) Reintroduction – includes aspects of the program implemented by the Service and cooperating States, Tribes, and other Federal agencies that pertain to management of the reintroduced Mexican wolf population in the Blue Range Wolf Recovery Area (BRWRA), which consists of the entire Apache and Gila National Forests in Arizona and New Mexico. This report details all aspects of the Mexican Wolf Recovery Program. The reporting period for this progress report is January 1 – December 31, 2011.

Background

The Mexican wolf, or "lobo," is the smallest, rarest, southernmost occurring, and most genetically distinct subspecies of the North American gray wolf. It once occurred in the mountainous regions of the Southwest from central Mexico throughout portions of Texas, New Mexico, and Arizona, and perhaps even farther north, as suggested by more recent research. Mexican wolves were extirpated from the wild in the United States by 1970, primarily as a result of a concerted effort to eradicate them due to livestock conflicts. Recovery efforts for the Mexican wolf began when it was listed as an endangered species in 1976. A captive breeding program was initiated and saved the Mexican wolf from extinction with the capture of the last five remaining Mexican wolves in the wild in Mexico from 1977 - 1980.

A Mexican Wolf Recovery Team was convened in 1979 to write a recovery plan, which was approved by the Service in 1982. The recovery plan contains objectives for maintaining a captive population and reestablishing Mexican wolves within their historic range. In June 1995, with the captive population numbers secure, the Service released a draft Environmental Impact Statement (EIS) entitled: *Reintroduction of the Mexican wolf within its Historic Range in the Southwestern United States*. After an extensive public review and comment period, the Final EIS was released in December 1996.

In March 1997, the Secretary of the Interior signed a Record of Decision approving the Service's preferred alternative in the EIS to release captive-reared Mexican wolves into a portion of the BRWRA. The Mexican wolf Final Rule - Establishment of a Nonessential Experimental Population of the Mexican Gray Wolf in Arizona and New Mexico (Final Rule) - was published in the Federal Register on January 12, 1998, and provided regulations for how the reintroduced population would be managed (US Fish and Wildlife Service 1998). On March 29, 1998, the first Mexican wolves were released into the wild. All wolves within the BRWRA are designated as a nonessential experimental population under section 10(j) of the Endangered Species Act which allows for greater management flexibility to address potential conflicts such as livestock depredations and nuisance behavior. An Interagency Field Team (IFT) comprised of members from the Service, Arizona of Game and Fish Department (AGFD), New Mexico Department of Game and Fish (NMDGF), White Mountain Apache Tribe (WMAT), US Forest Service, and

U.S. Department of Agriculture-Wildlife Services (USDA-WS) has been formed to monitor and manage the reintroduced population.

Mexican wolf at the Sevilleta Wolf Management Facility. Photo courtesy of Dan Shaw.

PART A: RECOVERY ADMINISTRATION

1. Mexican Wolf Captive Breeding Program

a. Mexican Wolf Species Survival Plan

The 1982 Mexican Wolf Recovery Plan contains the objective of establishing and maintaining a captive breeding program as an essential component of recovery (US Fish and Wildlife Service 1982). A captive breeding program was initiated in 1977 through 1980 with the capture of the five remaining wild Mexican wolves in Mexico. The captive breeding program is managed for the Service under the American Zoological and Aquarium Association's (AZAA) Mexican Wolf Species Survival Plan (SSP) program. The SSP is a bi-national (United States and Mexico) captive breeding program. Its mission is to reestablish the Mexican wolf in the wild through captive breeding, public education, and research. The SSP designation is significant because it indicates to AZAA member facilities the need for the species to be conserved, and triggers internal support to member facilities to help conserve such imperiled species. Wolves in these facilities are managed in accordance with a Service approved standard protocol. The SSP is the sole source population to reestablish the species in the wild, thus, without the SSP recovery of the Mexican wolf would not be possible. The SSP has been extremely successful and has steadily expanded throughout the years. In 2011, there were approximately 283 captive Mexican wolves managed in 52 facilities in the United States and Mexico. The SSP members routinely transfer Mexican wolves to facilitate genetic exchange and maintain the health and genetic diversity of the captive population.

The SSP's goal of housing a minimum of 240 wolves with a target population size of 300 ensures the security of the species in captivity and produces surplus animals for reintroduction. In the United States, potential Mexican wolf release candidates are sent to one of three Service approved pre-release facilities (see below) where they are evaluated for release suitability and undergo an acclimation process. All wolves selected for release are genetically redundant to the captive population, meaning their genes are already well represented. This minimizes any adverse effects to the genetic integrity of the captive population, in the event that wolves released to the wild do not survive.

Each July, the SSP holds a bi-national meeting to plan and coordinate wolf breeding, transfers and related activities among facilities. The location of these meetings alternates between Mexico and the United States. In 2011, the annual SSP meeting was held in Mexico City and hosted by El Subcomité Técnico Consultivo Nacional de Recuperación del Lobo Mexican, SEMARNAT with CONANP and DGVS, and Universidad Autóma Metropolitana.

b. Mexican Wolf Pre-Release Facilities

Mexican wolves are acclimated prior to release to the wild at these Service-approved facilities, which are designed to house wolves in a manner that fosters wild characteristics and behaviors. These facilities are the Ladder Ranch and Sevilleta Wolf Management Facilities, located in New Mexico near the BRWRA, and Wolf Haven International, located in Tenino, Washington. At these facilities, wolves are managed with minimal exposure to humans for the purpose of

minimizing habituation to humans and maximizing pair bonding, breeding, pup rearing, and healthy pack structure development. Wolves are evaluated and selected for release to the wild based on genetic makeup, reproductive performance, behavior, physical suitability, and overall response to the adaptation process. These facilities have been successful in breeding wolves for release 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 sustained on a zoo-based diet of carnivore logs and a kibble diet formulated for wild canids. Diets of release candidates are supplemented with carcasses of road-killed ungulate species, such as deer and elk, and scraps from local game processors (meat, organs, hides, and bones) from wild game/prey species only. Release candidates are given annual examinations to vaccinate for canine diseases (e.g., parvo, adeno2, parinfluenza, 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 (SWMF)

The SWMF is located on the Sevilleta National Wildlife Refuge (SNWR) near Socorro, New Mexico and is the only Mexican wolf pre-release facility managed entirely 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. In 2011 the staff of SNWR continued to assist in the maintenance and administration of the SWMF. Through the course of the year, 24 individual wolves were housed at the SWMF. Of these, one wolf was transferred to the Ladder Ranch Wolf Management Facility, and two wolves were transferred to the Endangered Wolf Center, MO. Five pups were born and no deaths occurred at the SWMF. At year's end, the SWMF housed 21 wolves.

Ladder Ranch Wolf Management Facility (LRWMF)

The LRWMF, owned by R. E. Turner, is located on the Ladder Ranch near Truth or Consequences, New Mexico. There are a total of five enclosures, ranging in size of 0.25 acre to 1.0 acre. The LRWMF is maintained by an employee of the Turner Endangered Species Fund (TESF), though the facility is managed and supported financially by the Service to keep it operating and available for housing and pre-conditioning release candidates. During 2011, 8 individual wolves were housed at the LRWMF. Three wolves were transferred to the SWMF. No births or deaths occurred at the LRWMF. At year's end, the LRWMF housed 5 wolves.

Wolf Haven International (WHI)

The WHI is located in Tenino, Washington. There are 2 Mexican wolf pre-release enclosures at the facility, each just over 0.50 acre in size. Management and funding is supported entirely by WHI. The pre-release enclosures are entirely off exhibit, though WHI does house other gray wolves on display for viewing and educational purposes. During 2011, WHI housed 12 individual Mexican wolves in the pre-release enclosures. No births or deaths of pre-release candidates occurred at the WHI. At year's end, WHI housed 12 Mexican wolves in the pre-release enclosures.

M1037 at the Ladder Ranch Wolf Management Facility. USFWS Photo.

2. Recovery Planning

The current recovery plan for Mexican wolves was published by the Service in 1982. It recommends a two-pronged approach to recovery that includes establishment of a captive breeding program and reintroduction of wolves to the wild. This plan, however, does not establish recovery criteria for the Mexican wolf. Although substantial progress in implementing the 1982 Mexican Wolf Recovery Plan has been achieved, a revised recovery plan has never been developed to establish recovery criteria specific to the Mexican wolf subspecies or the gray wolf in the Southwest Region.

In December, 2010, the Service sent letters inviting participants to a new Mexican Wolf Recovery Team. This new team consists of four subgroups – Science and Planning, Tribal Liaisons, Stakeholder Liaisons, and Agency Liaisons. The Science and Planning subgroup is tasked with assisting the Service in writing the recovery plan, working together to update the scientific background and develop recovery strategies that include goals, objectives, criteria, and implementation of actions that promote successful Mexican wolf recovery and delisting. The Tribal and Agency Liaison subgroups provide applied management perspectives during recovery plan development with respect to both their natural resource expertise and their understanding of their respective communities and constituents. Those representing the Stakeholder Liaison subgroup provide a diverse source of expertise regarding their particular interest in wolf recovery. These perspectives may include discussions of human, social, and economic considerations.

During 2011 all four subgroups met together three times, and the Science and Planning subgroup met an additional two times. A draft version of a new recovery plan is expected in November, 2012.

3. Reclassification

On August 11, 2009, the Service received a petition from the Center for Biological Diversity requesting that the Mexican wolf be listed as an endangered subspecies or DPS and critical habitat be designated under the Endangered Species Act. On August 12, 2009, we received a petition dated August 10, 2009, from WildEarth Guardians and The Rewilding Institute requesting that the Mexican wolf be listed as an endangered subspecies and critical habitat be designated under the Endangered Species Act. On August 4, 2010, the Service announced a 90-day finding on the two petitions, stating the petitions presented substantial scientific or commercial information indicating that the Mexican wolf subspecies may warrant listing such that reclassifying the Mexican wolf as a separate subspecies may be warranted. The Service is conducting a status review and will issue a 12-month finding on the petitions to address whether the petitioned action is warranted (see section 7, Litigation).

At the end of 2008, a team of Service biologists and administrators, led by experts in structured decision making from the United States Geological Survey, began a comprehensive evaluation of a suite of alternative gray wolf listing classifications using decision analytical techniques. This process continued through 2010 and included a national workshop of Service managers, technical experts, and state management partners. Although this team did not reach consensus for wolf listing nationwide, additional smaller workshops have included convening experts and partners in Mexican wolf biology and management to apply a DPS or subspecies tradeoff analysis to the Mexican wolf. In 2011, the United States Geological Survey led Service managers and biologists, together with state management partners, through another such iterative process.

4. Blue Range Wolf Reintroduction Project Structure

Beginning in 2003, the BRWRA Reintroduction Project was managed jointly by the AGFD, NMDGF, USDA-Forest Service, USDA-WS, WMAT, and the Service. These agencies and additional cooperating counties worked together under a Memorandum of Understanding (MOU), and a member from each formed the Adaptive Management Oversight Committee (AMOC) that provided guidance to the IFT on policy issues related to the BRWRA. Under this structure the IFT was guided by Standard Operating Procedures, which provided management for the free-ranging population (see the Arizona Game and Fish Department website at http://www.azgfd.gov/w_c/wolf/sop.shtml)

In December 2009 the Service finalized a settlement agreement with plaintiffs Wild Earth Guardians and Defenders of Wildlife, agreeing to make no further decisions that relate to the Mexican Wolf Recovery Program pursuant to the MOU that created AMOC, and to Standard Operating Procedure 13.0: Control of Mexican Wolves. In 2010, the Service worked with its partners and cooperators to prepare and establish a new MOU that adheres to the Consent Decree while upholding its commitment to the many agencies involved in the recovery of the Mexican wolf. The 2010 MOU was signed by AGFD, NMDGF, USDA-Forest Service, USDA-WS, WMAT, and the Service, as well as the New Mexico Department of Agriculture and Graham, Greenlee, and Navajo counties in Arizona, and Sierra County in New Mexico. Signatories to the 2010 MOU formally met twice during 2011.

On June 9, 2011, the New Mexico State Game Commission directed the NMDGF to suspend its participation in the Mexican Gray Wolf Restoration Program as of June 30, 2011. NMDGF subsequently withdrew their participation in the New Mexico Wolf/Livestock Demonstration program on October 31, 2011, and on December 6, 2011, the Director of the NMDGF issued a letter to the Service formally withdrawing from the 2010 MOU.

On December 2, 2011, the Arizona Game and Fish Commission voted to continue both its financial and infrastructure support of Mexican wolf conservation in the state, but voted not to support the release of any new wolves until the Service completes a new recovery plan, management plan, and a new 10(j) rule is in place. Previously, all initial releases of captive Mexican wolves in the U.S. have occurred in Arizona with the concurrence and support of the Game and Fish Department. *Note: on January 13, 2012, the Arizona Game and Fish Commission amended this policy stating the AGFD Director has the authority to approve a wolf release in cases where an animal is lost from the population due to an unlawful act, and when a wolf is lost to any other cause of mortality the Arizona Game and Fish Commission must approve a release*.

Middle Fork Pack. Mexican Wolf Interagency Field Team trail camera photo.

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 BRWRA. The 2011 report is included as PART B of this report. Monthly BRWRA project updates are available at *http://www.fws.gov/southwest/es/mexicanwolf* or you may sign up to receive them electronically by visiting *http://azgfd.gov/signup*. Additional information about the BRWRA Reintroduction Project can be found on the Service's web page at: *http://www.fws.gov/southwest/es/mexicanwolf* or AGFD's web page at: *http://azgfd.gov/wolf*.

5. Cooperative Agreements and Contracts

In 2011, the Service continued funding cooperative agreements with AGFD, NMDGF, TESF, WMAT, and the San Carlos Apache Tribe (SCAT). Agreements with AGFD and NMDGF have been matching agreements where the Service provides 75% of costs and each state agency provides 25%. Funding to NMDGF ceased when its participation in the program was suspended. The Service also provided funding through cooperative agreements to the University of New Mexico for curatorial services, to The Living Desert for services associated with the captive breeding program, and to the Mexican Wolf Fund for contribution toward the administration and facilitation of recovery planning efforts.

Cooperator	Amount Funded in 2011 by USFWS from Mexican Wolf Project Funds
WMAT	$ 205,000
NMDGF	$ 0
AGFD	$ 165,000
Mexican Wolf Fund	$ 30,000
SCAT	$ 40,000
TESF	$ 29,000
The Living Desert	$ 15,000
University of New Mexico	$ 7,000

In addition to the above agreements, the Service also provided funding for several miscellaneous contracts for veterinary and other services.

6. Research

a. Mexican Wolf Captive Breeding Program

The Mexican Wolf SSP program conducts a variety of research projects on behalf of the conservation of captive Mexican wolves as well as the reintroduction program.

Dr. Cheryl Asa and the Research Department at the Saint Louis Zoo and J. Arturo Rivera at San Juan de Aragon Zoo in Mexico City continued reproductive research on Mexican wolves in 2011. In 1991, the Mexican Wolf Recovery Team selected the Saint Louis Zoo to establish and maintain a semen bank to preserve germplasm of genetically important males. Since that time the lab has been collecting, evaluating and freezing semen samples from individual wolves as directed by the Service and the SSP. In 2008 oocyte vitrification (freeze drying of eggs) was added so that female gametes could be preserved. As part of their ongoing reproductive research efforts, several projects were conducted during 2011. These included semen collection and freezing, oocyte vitrification, testing two new semen extenders, examination of the female ovulatory cycle hormone profiles to establish a database of normal pregnant and non-pregnant cycles to help diagnose female infertility, deslorelin (Suprelorin) for use as a contraceptive.

Dr. Cheryl Asa and Karen Bauman at the Saint Louis Zoo, and Anneke Moresco with the University of California, Davis, examined the identification of factors related to uterine endometrial hyperplasia (EH) and incidence of pyometra (a potentially fatal uterine infection) in canids. The research surveyed several canid SSPs for historic incidence of EH and pyometra, and also looked retrospectively at factors associated with the risk of EH and pyometra. Results

indicated the risk of EH or pyometra was highest based on the number of years a female was treated with deslorelin only. An intermediate risk was associated with females that were not contracepted but also not reproducing, and the number of years a female was treated with melengestrol acetate implants. The lowest risk of EH or pyometra was associated with the number of years a female gave birth, and the number of years a female was treated with deslorelin plus melengestrol acetate to prevent the initial deslorelin stimulation phase.

Dr. Melanie Culver and Ph.D. candidate Robert Fitak with the University of Arizona are examining the effects of extirpation and reintroduction on the Mexican wolf through genome-wide association. The study has the potential to characterize the genetic loci responsible for any lost adaptive and accrued detrimental variation. The results will potentially aid in optimizing the management strategies of captive and wild populations of Mexican wolves to protect against concerns like inbreeding. A final report submitted for publication is expected in 2012.

In 2008 Dr. Dan Moriarty, University of San Diego, and Lowell Nicolaus, Northern Illinois University, began work analyzing thiabendazole as an aversion agent for use in Mexican wolves. This research focused on the potential to mitigate wolf conflicts with domestic livestock via conditioned taste aversion. A captive application of the study was completed at the California Wolf Center, near Julian, CA in October 2008. This study was performed on generic gray wolves and had the support of the Humane Society of the United States. Results demonstrated the safety and efficacy of thiabendazole-based aversions in a captive setting. During 2010 the Service made preparations to replicate this effort on several Mexican wolves at the SWMF, and conducted two trials during 2011 that resulted in the treatment of 8 animals.

F1108 at the Sevilleta Wolf Management Facility during CTA trials. USFWS Photo

Krista Hausig, USDA-APHIS-Wildlife Services continued research efforts to determine the efficacy of various rabies vaccines used in gray wolves by correlating rabies antibody titer levels with the known vaccination history for each animal. Currently, there is no rabies vaccine labeled for gray wolves. During 2011 facilities participating in the Mexican Wolf SSP continued to collect data (wolf ID, age, sex, vaccination history, route of administration, etc.) and serum for use in this study.

The USDA-APHIS-Wildlife Services has initiated a canine measurement study in order to provide scientific information useful for potentially identifying the species of predator involved in a depredation. In 2011, the Service requested that SSP facilities capable of measuring wolf canine tooth spread during annual handling events do so to increase the reliability of identifications that would otherwise rely on qualitative evidence.

Itzel Yanez , Universidad Autónoma Metropolitana, continued researching an explanation for the higher than expected incidence of nasal squamous cell carcinoma in Mexican wolves. Current research is looking chromosomal alterations that might indicate a genetic relationship that could link the susceptibility of Mexican wolves to this specific neoplasia.

In 2011 the Service, with the assistance of Stewart Breck, Ph.D., USDA National Wildlife Research Center, proposed a study to look at methods that might boost wild wolf pup survival. The four hypotheses cited that might lead to reduced pup survival were inbreeding, disease, malnourishment, and inadvertent illegal shootings due to a resemblance to coyotes at certain ages. In order to minimize negative consequences to wild pups, a pilot study occurred in 2011 in which two litters of captive-born pups were fitted with expandable radio collars. The collar used had good success on mountain lion cubs, and if deemed safe and effective the goal is to deploy them on wild wolf pups to examine pup movement and mortality. Unfortunately 100 percent of the collars failed on the captive Mexican wolves. In one litter all of the collars fell or were pulled off, perhaps in part due to the presence of yearling animals in the pack. In the other litter the collars did not expand as anticipated and were all eventually removed by a veterinarian as they began to cause injury to the pups. The Service is currently working on modifications to the collars in hopes of deploying them on captive wolves again in the future.

b. Blue Range Wolf Recovery Area

A publication was completed by Dr. Stewart Breck and colleagues entitled “Domestic calf mortality and producer detection rates in the Mexican wolf recovery area: Implications for livestock management and carnivore compensation schemes.” This article was accepted by Biological Conservation and published in 2011.

C.A. Cariappa and Warren Ballard, Texas Tech University, and Stewart Breck, National Wildlife Research Center, are attempting species and individual identification using DNA extracted from wolf scat as a potential noninvasive technique to estimate population size. The lab tested the ability to identify individual Mexican wolves using scat collected from eight wolves at the SWMF and was successful in obtaining individual genotypes for all eight wolves. In September 2007 scat was collected within an area of the BRWRA known to share occupancy of four wolf packs. The area was surveyed again in late 2007, February 2008, and April 2008. The

dissertation involving this research was completed in 2010. This work is expected to be published in 2012.

Sarah E. Rinkevich, Ph.D. candidate at the University of Arizona's School of Natural Resources and the Environment conducted her field work in 2008 and 2009 using non-invasive genetic sampling to estimate the population size of Mexican wolves on the Fort Apache Indian Reservation. Tribal members were hired as field technicians and scat samples from large carnivores were collected using scat detection dogs. A low sample size of wolf scats were detected thus, a minimum number of wolves on the reservation for 2008 and 2009 will be reported. Due to a large amount of coyote scat collected incidentally, analyses will include coyote diet and abundance. Rinkevich also interviewed 32 tribal members knowledgeable about the wolf in order to understand the cultural significance of the wolf. These interviews revealed cultural consensus (shared knowledge) about the wolf's role in Apache culture as well as documenting Traditional Ecological Knowledge regarding wolf ecology. Rinkevich is expected to defend her dissertation in April of 2012.

John K. Oakleaf senior wolf biologist with the Service and Ph.D. candidate at Texas Tech University, in collaboration with Dr. Warren Ballard, Dr. Stewart Breck, Dr. James Cain, and Dr. Phil Gipson, began looking at the population dynamics and reintroduction characteristics of Mexican wolves in the BRWRA. The objective of this study is to investigate: 1) habitat colonization preferences of Mexican wolves and the distribution of preferred wolf habitat across the southwestern United States, 2) factors that promote successful initial releases and translocations of Mexican wolves, 3) factors that contribute to increased reproduction rates, 4) survival of Mexican wolves, and 5) dispersal patterns of Mexican wolves. Mr. Oakleaf is expected to complete this work in 2015.

7. Litigation

a. WildEarth Guardians and Center for Biological Diversity

The Service submitted to the U.S. District Court for the District of Columbia a multi-year listing work plan that will enable the agency to review and address the needs of more than 250 species listed on the 2010 Candidate Notice of Review. The multi-year listing work plan was first developed through an agreement with the plaintiff group WildEarth Guardians and filed in the U.S. District Court for the District of Columbia on May 10, 2011. On July 12, 2011, the Service reached an agreement with plaintiff Center for Biological Diversity that reinforced the multi-year work plan.

On August 4, 2010, the Service announced in the Federal Register a positive 90-day finding on two petitions to list the Mexican wolf as a subspecies. Pursuant to the above court-approved settlement agreements, "the Service shall submit a proposed listing rule or a not-warranted finding to the Federal Register for the Mexican wolf no later than the end of FY 2012."

b. Lawsuit from interested parties in New Mexico

On August 20, 2010, Americans for the Preservation of the Western Environment, Adobe Ranch, Beaverhead Ranch, Alan Tackman, the Gila National Forest Livestock Permittees' Association, Inc., the Otero County Board of Commissioners and the Catron County Board of Commissioners filed a lawsuit against the Service and the NMDGF in the U.S. District Court for the District of New Mexico alleging National Environmental Policy Act and Administrative Procedures Act violations relative to the Service's management decisions regarding Mexican wolves, specifically claiming the Service violated the enabling rules and altered the program without completing the environmental review required by NEPA (*Americans for the Preservation of the Western Environment, et al.* v. *U.S. Fish and Wildlife Service*, No. 1:10-CV-00788 (D. N.M.). NMDGF's motion to dismiss was granted on December 16, 2010. On February 1, 2011, the parties stipulated to voluntarily dismiss the case without prejudice as to the Federal Defendants.

8. Rule Amendment and Environmental Impact Statement

On August 7, 2007, the Service issued a notice of scoping meetings and intent to prepare an EIS and socio-economic assessment for the proposed amendment of the rule establishing a nonessential experimental population of the Arizona and New Mexico population of the gray wolf (72 Federal Register 44065-44069). The Service held scoping meetings in 12 Arizona and New Mexico communities in 2007, and received approximately 13,500 written comments from the public, non-governmental organizations and government agencies at the local, state and federal levels. Work has been temporarily suspended on the EIS, and is now pending the completion of a new Mexican Wolf Recovery Plan, which will guide the revisions to the experimental population boundaries and management actions.

9. Mexican Wolf Interdiction Fund and Stakeholder Council

The Service, in cooperation with the National Fish and Wildlife Foundation, established the Mexican Wolf /Livestock Interdiction Trust Fund (Interdiction Fund) on September 23, 2009. The objective of the Interdiction Fund is to generate long-term funding for prolonged financial support to livestock operators within the framework of conservation and recovery of Mexican gray wolf populations in the Southwest. Funding will be applied to initiatives that address management, monitoring, and other proactive conservation needs for Mexican gray wolves as they relate to livestock, including alternative livestock husbandry practices, grazing management alternatives, livestock protection, measures to avoid and minimize depredation, habitat protection, species protection, scientific research, conflict resolution, compensation for damage, education, and outreach activities.

In April, 2011, the Service appointed an 11-member Interdiction Fund Stakeholder council (ISC), which has the authority to identify, recommend, and approve conservations activities, identify recipients, and approve the amount of the direct disbursement of funds to qualified recipients. In 2011, the ISC developed an interim program to compensate livestock producers for wolf depredations and continued to work on a long-term strategic interdiction plan that focuses more on coexistence than direct compensation for livestock losses.

10. 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. 1996, Reintroduction of the Mexican wolf within its Historic Range in the Southwestern United States, 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. 2003, Final Rule To Reclassify and Remove the Gray Wolf From the List of Endangered and Threatened Wildlife in Portions of the Conterminous United States; Establishment of Two Special Regulations for Threatened Gray Wolves, 68 *Federal Register* 15803-15875.

US Fish and Wildlife Service. 2006, Proposed Rule, Western Great Lakes Population of Gray Wolves, 71 *Federal Register* 15265-15305.

US Fish and Wildlife Service. 2007, Final Rule Designating the Western Great Lakes Populations of Gray Wolves as a Distinct Population Segment; Removing the Western Great Lakes Distinct Population Segment of the Gray Wolf From the List of Endangered and Threatened Wildlife, 72 *Federal Register* 6051-6103.

Luna Pack pup. Mexican Wolf Interagency Field Team trail camera photo.

PART B: REINTRODUCTION

Mexican Wolf Blue Range Reintroduction Project
Interagency Field Team Annual Report
Reporting Period: January 1 – December 31, 2011

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

Lead Agencies:
Arizona Game and Fish Department (AGFD)
USDA-APHIS Wildlife Services (USDA-WS)
U.S. Fish and Wildlife Service (USFWS)
U.S. Forest Service (USFS)
White Mountain Apache Tribe (WMAT)

As of July 1, 2011 following a New Mexico Department of Game and Fish (NDGF) commission vote, NDGF terminated participation as a cooperating agency on the Mexican Wolf Blue Range Reintroduction Project.

1. Introduction

This report summarizes results of Mexican Wolf Interagency Field Team (IFT) activities during 2011. The Mexican Wolf Blue Range Reintroduction Project (Reintroduction Project) is part of a larger recovery program that is intended to reestablish the Mexican wolf (*Canis lupus baileyi*) across its historical range.

The Reintroduction Project is conducted in accordance with a nonessential experimental population final rule (USFWS 1998) that established the 6850 mi^2 (17,740 km^2) Blue Range Wolf Recovery Area (BRWRA) (Fig. 1). In 2000, the White Mountain Apache Tribe (WMAT) agreed to allow free-ranging Mexican wolves to inhabit the Fort Apache Indian Reservation (FAIR). The reintroduction area lies within the Alpine, Clifton, and Springerville Ranger Districts of the Apache-Sitgreaves National Forests (ASNF) and the FAIR in east-central Arizona, and the Gila National Forest (GNF) in west-central New Mexico.

In March 1998, the first release of Mexican wolves occurred on the Alpine and Clifton Ranger Districts of the Apache-Sitgreaves National Forest, Arizona. At the end of 1998, the wild population in Arizona and New Mexico consisted of four wolves in two packs. The wild population grew to its highest minimal count of 59 wolves in 2006 through natural reproduction, translocations, and initial releases. At the end of 2011, the wild population totaled a minimum of 58 wolves, 7 breeding pairs, and 13 packs. More information on population statistics can be found at http://www.fws.gov/southwest/es/mexicanwolf/

Wolf age and sex abbreviations used in this document:
A = alpha
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)

2. Methods

The IFT followed Standard Operating Procedures (SOPs) approved by the Lead Agencies. These SOPs can be found at http://azgfd.gov/wolf. Note: In December 2009 the USFWS finalized a settlement agreement and in a Consent Decree agreed to make no further decisions that relate to the Mexican Wolf Recovery Program pursuant to SOP 13.0: Control of Livestock. All other SOPs are considered valid. The following definitions apply to the SOPs and to this report:

Breeding pair: an adult male and an adult female that have produced at least two pups during the previous breeding season and which survived until December 31 of the year of their birth (USFWS 1998).

Operational breeding pair: an adult male and an adult female that have produced at least two pups during the previous breeding season and of which at least 2 pups survived until December 31 of the year of their birth, despite the loss and replacement of at least one biological parent of the offspring. This is a modification of the "Breeding pair" definition per the final 10j rule, to include pairs where alphas (one or both of the breeding adults in a pack) have been replaced but are functioning as a biological unit with a high probability of breeding success in the subsequent year.

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

Releases: wolves released directly from captivity, with no previous free-ranging experience. These "initial releases" may only occur in the Primary Recovery Zone, which is entirely within Greenlee County, Arizona (see Fig. 1 and Fig. 2).

Translocations: free-ranging wolves that are captured and moved to a location away from their site of capture; this includes captured free-ranging wolves that have been temporarily placed in captivity. Unlike initial releases, translocations can occur in the Primary Recovery Zone or in the Secondary Recovery Zone (Fig. 1). The Secondary Recovery Zone contains portions of Apache and Greenlee counties in Arizona, and portions of Catron, Sierra, and Grant counties in New Mexico (Fig. 2).

Depredation: confirmed killing or wounding of lawfully-present domestic livestock by one or more wolves.

Depredation incident: means 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 pursuant to SOP 11.0.

Releases and Translocations

Initial release candidates are genetic surpluses to the captive breeding program. Once selected for release, wolves are acclimated in USFWS-approved facilities prior to release. These facilities include the Ladder Ranch Wolf Management Facility, managed by the Turner Endangered Species Fund, and the Sevilleta Wolf Management Facility, managed by the USFWS at Sevilleta National Wildlife Refuge. Both facilities are located in New Mexico.

In management facilities, contact between wolves and humans is minimized. Carcasses of road-killed native prey species primarily deer (*Odocoileus* spp.) and elk (*Cervus elaphus*) supplement the routine diet of processed canine food. Genetically and socially compatible breeding pairs are established and evaluated for physical, reproductive, and behavioral suitability for direct release into the wild. Single wolves are also evaluated for release and potential pairing with wolves in the wild.

Prior to release, wolves may be adversely conditioned to food types (i.e., domestic livestock) and human presence. In management facilities, as close to release as possible, wolves may be subjected to taste aversion conditioning in efforts to deter their use of domestic livestock as a food source. Separately, or in addition to taste aversion conditioning, wolves at management facilities may be hazed prior to release in efforts to increase their avoidance of humans and/or inhabited areas.

Wolves are released using either a soft release or a hard release method. The soft release method holds wolves at the release site for one day to several months to acclimate them to the specific area. Soft release pens are constructed of chain link A modified soft release consists of placing the wolves in an acclimation pen approximately 0.13 acres (526 m^2) in size and built of nylon mesh, with electric fencing interwoven into the structure. Flagging is also attached to the pen walls approximately every two feet, as a visual barrier to discourage wolves from running into pen walls. Wolves generally self release within a few days. A hard release is a direct release of a wolf (or wolves) from a crate into the wild or into an enclosure built of fladry (flagging hanging on a rope surrounding a small protected area; sometimes the fladry “fence-line” is electrified).

Radio Telemetry Monitoring

In 2011 all radio-collared wolves were monitored by standard radio telemetry from the ground and once weekly from the air as opportunity allowed. Visual observations, wolf behavior, evidence of a kill site, associated uncollared wolves, and fresh sign were also noted when possible. Location data were entered into the project’s Access database for analysis.

Aerial locations of wolves were used to develop home ranges (White and Garrott 1990), which were calculated based on the definition in the final rule (USFWS 1998). Home ranges were calculated using $\geq$20 individual aerial locations on a pack, pair, or single wolf exhibiting

territorial behavior over a period of ≥ six months. To maximize sample independence, individual radio-collared wolf locations were included in home range calculations only if individual wolf locations were spatially or temporally separated from other radio-collared pack members. This limited pseudo-replication of locations. Home range polygons were generated at the 95% confidence level, using the minimum convex polygon (MCP) method (White and Garrott 1990) in the animal movement extension in the program ArcView (Hooge et al. 1999; ESRI, Redlands, CA, USA). Home ranges were not calculated for wolves that had <20 aerial radio locations, displayed dispersal behavior, or exhibited non-territorial behavior during 2011.

Occupied Range

Occupied wolf range was calculated based on the definition in the Final Rule (USFWS 1998) and using the following criteria: (1) a five mi (eight km) radius around all locations of non radio monitored wolves and wolf sign occurring in an area consistently used over a period of at least one month; (2) a five mi (eight km) radius around radio locations of resident wolves when < 20 radio locations are available (for radio monitored wolves only); (3) a five mi (eight km) radius around radio monitored wolf locations (for wolves exhibiting dispersal or non-territorial behavior); and (4) a three mi (five km) radius around the minimum convex polygon developed from ≥20 radio locations of a pack, pair, or single wolf exhibiting territorial behavior.

Predation and Depredation Investigations

Throughout the year, project personnel investigated ungulate carcasses as they were discovered to determine sex, age, general body condition, and whether the carcass had been scavenged or was a wolf kill. USDA-WS wolf specialists investigated suspected wolf depredations on livestock within 24 hours of receiving a report. On occasion, USFWS biologists conducted parallel investigations to determine if any discernable events caused the depredation to occur. Not all dead livestock were found, or found in time to document cause of death. Accordingly, depredation numbers in this report represent the minimum number of livestock killed by wolves.

The 1996 Final Environmental Impact Statement (FEIS) predicted 1-34 confirmed killed cattle per year with a population of 100 Mexican wolves. This represents <0.05 % of all cattle present on the range (USFWS 1996). The Mexican Wolf Blue Range Reintroduction Project 5-year Review (AMOC and IFT 2005) reported, between 1998 and 2003, the mean number of cattle confirmed killed per year by wolves was 3.8, which extrapolates to 13.8 cattle killed per year from a population of 100 Mexican wolves. From 2005 to 2009, the number of confirmed cattle killed by wolves exceeded the predicted rate by the FEIS, and ranged between 36.5 depredations per 100 wolves in 2008 to 50 depredations per 100 wolves in 2007. In 2010 and 2011, the number of confirmed cattle killed by wolves was less than or equal to the predicted FEIS depredation rate at 14 depredations and 34 depredations per 100 wolves, respectively.

Wolf Management

The IFT hazed (purposefully harassed) wolves on foot or by vehicle if the wolves localized near areas of human activity or were found feeding on, chasing, or killing livestock. When necessary, the IFT used rubber bullets, cracker shells, and fladry to encourage aversive response to humans and to discourage nuisance and depredation behavior. The IFT captured wolves with leg hold traps. In addition, wolves that established themselves outside the BRWRA were captured and

brought back into the BRWRA or temporarily held in captivity, per the final rule (USFWS 1998).

Proactive Management Activities
The IFT utilized proactive management activities in an attempt to reduce wolf-livestock conflicts in the BRWRA. These activities included:

> *Turbo Fladry*: electric fence with red flagging installed around livestock holding pastures and private property to discourage wolf utilization inside the perimeter.
>
> *Hay*: feed purchased for livestock owners who opted to keep livestock on private property during calving season.
>
> *Range Riders*: contract employees with radio telemetry equipment to assist stakeholders in monitoring wolf movements in relation to cattle on USFS grazing allotments. Range Riders without telemetry equipment provided additional human presence to deter wolves.
>
> *Livestock Grazing Rotation*: moving livestock between different pastures within USFS grazing allotments in order to avoid areas of high wolf use including den and rendezvous sites.
>
> *Exclusionary Fencing*: eight-foot-high fence enclosing areas of private property for the purposes of protecting especially vulnerable animals or other specific reasons.
>
> *Radio Telemetry Equipment:* monitoring equipment used by the IFT and in some cases issued to stakeholders to facilitate their own proactive management activities and aid in the detection and prevention of depredations.
>
> *Diversionary Food Cache*: road-killed native prey carcasses or carnivore logs provided to wolves in areas so as to reduce potential conflicts with livestock.
>
> *Supplemental Food Cache:* road-killed native prey carcasses or carnivore logs provided to wolves in order to assist a pack or remnant of a pack in feeding young of the year when extenuating circumstances reduce their own ability to do so. Supplemental food caches also serve to reduce potential conflicts between wolves and livestock.

Population Estimation
The IFT continued the expanded efforts that were initiated in 2006 to make the 2011 year-end population estimate more comprehensive. Actions included increased ground surveys and trapping for uncollared wolves, greater coordination of wolf sightings by the public and other agencies, and use of remote cameras.

Wolf sign (i.e. 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, but uncollared packs, 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. Survey data were also recorded daily on forms and a dedicated survey effort spreadsheet.

In January 2012, aircraft were used to document free-ranging wolves for the end-of-year 2011 population count and to capture wolves as necessary to affix radio-collars. Including January data in the December 31 end-of-year count (and in this 2011 annual report) is appropriate, because wolves alive in January were also alive in December (i.e. whelping does not occur in mid-winter). Fixed-wing aircraft were used to locate wolves and assess the potential for darting wolves from the helicopter. A helicopter was used to more accurately count the number of uncollared wolves associated with collared wolves in all areas and to capture target animals (e.g. uncollared wolves, injured wolves, wolves with old collars, or wolves outside the 10j boundary) where the terrain allowed.

As part of the 2011 population estimate, members of the local public were also surveyed for possible wolf sightings. Ranchers, private landowners, wildlife managers, USFS personnel, and others were contacted to develop a wolf sighting database. Sighting reports from agency cooperators were also collected. All sightings were analyzed to determine those that most likely represented unknown wolves or packs.

Remote digital cameras (regular flash and infrared) were used to document wolf presence. Information gleaned from public reports, surveys, and wolf sign were used to guide IFT efforts to trap uncollared single wolves or groups. The objective was to have at least one member of each pack collared. Using these methods, the IFT counted the number of uncollared wolves not associated with collared wolves.

Mortality

Wolf mortalities were identified via telemetry and public reports. Mortality signals from radio collars were investigated within 12 hours of detection to determine the status of the wolf. Carcasses were investigated by law enforcement agents and necropsies were conducted to determine proximate cause of death. Causes were summarized for all known deaths. For radio-collared wolves, mortality, missing, and removal rates were calculated using methods presented in Heisey and Fuller (1985).

The IFT calculated yearly cause-specific mortality rates (i.e. human-caused versus natural/unknown mortality). Management removals have an effect equivalent to mortalities on the free-ranging population of Mexican wolves (see Paquet et al. 2001). Thus, the IFT also calculated yearly cause-specific removal rates for radio-collared wolves. Wolves are removed from the population for four primary causes: (1) dispersal outside the BRWRA, (2) cattle depredations, (3) nuisance to humans, and (4) other (principally to pair with other wolves or to move a wolf to a better 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). The IFT calculated an overall failure rate of wolves in the wild 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.

Outreach

The IFT outreach efforts affirm the project's commitment to engage in effective communication, identify various outreach mechanisms, and standardize certain outreach activities. These goals help ensure timely, accurate, and effective two-way communication between, and among, cooperating agencies and the public. Project personnel conducted outreach activities on a regular basis, as a means of disseminating information to stakeholders, concerned citizens, and government and non-government organizations. This was facilitated through weekly and monthly updates, field contacts, handouts, informational display booths, web page updates, and phone contacts. The IFT gave formal presentations at local livestock producer meetings and conducted two public meetings to gather comment on proposed Mexican wolf translocation actions within the BRWRA.

The IFT conducted outreach activities by continuing to utilize the Mexican Wolf Blue Range Reintroduction Project Outreach Plan developed during 2007. The plan provides an outline of activities the IFT uses to inform various target audiences about the reintroduction project and stimulate productive dialogue between stakeholders and cooperating agencies.

During 2011, the IFT posted Mexican wolf reintroduction project updates within the BRWRA once each month, at places such as USFS offices, US post offices, and libraries, as well as on the AGFD Mexican wolf web site at http://azgfd.gov/wolf and the USFWS Mexican wolf web site at http://www.fws.gov/southwest/es/mexicanwolf. Interested parties could sign up to receive the update electronically by visiting the AGFD web site at http://azgfd.gov/signup. The IFT faxed monthly project updates to primary cooperating agencies, stakeholders and interested citizens.

The IFT produced a location map to inform cooperators and the public of areas occupied by wolves. The map was updated quarterly and contained the previous three months of wolf aerial locations. The map was posted on the AGFD web site at http://azgfd.gov/wolf. In addition to the map, a description of wolf locations from weekly flights was posted to this web site within 48 hours of each flight per SOP 26. IFT personnel conducted weekly contacts of specific grazing permittees to provide the general locations of wolves on or adjacent to their grazing allotments or private lands.

Project personnel made contact with campers, hunters, and other members of the public within the BRWRA and provided them with information about the wolf project. These contacts advised the public of the potential for encountering wolves, provided general recommendations for recreating in wolf-occupied areas and explained legal provisions of the non-essential experimental population rule. The IFT collected information on wolf sightings, tracks and scat from these public contacts.

In May 2011, the IFT hosted three proactive livestock and wolf management workshops with Tim Kaminski from the Mountain Livestock Cooperative in Montana. Workshops were held at the Ranching Heritage Alliance meeting in South Fork, Arizona, the community center in Reserve, New Mexico and at the conference center at the Hon Dah casino on the FAIR. The workshops were designed to examine efforts in the northwest where Tim Kaminski and livestock producers are working together; designing and implementing management approaches to reduce

livestock vulnerability to wolves. Discussions regarding practices that could be implemented in the BRWRA also occurred.

3. Results

Information on the number of wolves and specific locations from the FAIR and the San Carlos Apache Reservation (SCAR) is not included in this report in accordance with Tribal agreements.

a. Population Status

The minimum population estimate at the end of 2011 was 58 wolves and 7 breeding pairs; one of which was an "Operational Breeding Pair". Pups comprised 33% (19 of 58) of this population which is an increase from the previous year.

At the beginning of 2011, the collared population consisted of 23 wolves among 10 packs and 3 singles. More intensive and focused trapping efforts increased the collared population to 34 wolves among 13 packs at the end of 2011 (20 adults, 5 subadults, and 9 pups).

Twenty-four uncollared wolves were documented in the Mexican Wolf Nonessential Experimental Population Zone (MWNEPZ) (note: uncollared wolves captured during the January 2012 helicopter operation would have been included as uncollared animals associated with known packs above). Ten of the 24 uncollared wolves were associated with seven radio-collared packs (Table 1).

The IFT observed wolf sign and other information indicating the potential for five single uncollared animals (two in AZ, three in NM) not associated with known collared packs. Additional uncollared animals were found on the FAIR and on the SCAR. These areas will be priorities for IFT trapping efforts in the spring and summer of 2012.

Two natural pairings occurred in 2011. In the Hawks Nest pack f1208 replaced AF1110, following AF1110s death, and in September began exhibiting behaviors suggesting a pair-bond with AM1038. The natural pairing of M1185 with an unknown uncollared female wolf resulted in the designation of the Willow Springs pack.

There were four radio-collared single wolves (f1211, f1212, m1248, m1252) for a portion of the year. Three of the wolves (f1212, m1248, m1252) were known to be alive at the end of the year. The three remaining single wolves began dispersing in the fall and were all located away from their natal packs during the 2012 population count; f1212 was located with an uncollared wolf during the January count and m1248 was located with f1246. Approximately 91% (31 out of 34 wolves) of the radio-collared individuals alive at the end of the year and 95% (55 out of 58 wolves) of all documented wolves at the end of the year were born in the wild.

b. Reproduction

In 2011, 12 packs exhibited denning behavior; 6 packs in Arizona (Hawks Nest, Bluestem, Paradise, Rim, Maverick, Tsay-O-Ah) and 6 packs in New Mexico (Luna, Dark Canyon, Middle

Fork, San Mateo, Fox Mountain, Willow Springs). All but Rim, Fox Mountain, and Willow Springs were confirmed to have produced wild-conceived, wild-born litters. The IFT documented a minimum of 38 pups born with a minimum of 19 pups (12 in Arizona, 7 in New Mexico) surviving in the wild until year-end (Table 1); a 50% survival rate of documented pups. This marked the tenth consecutive year in which wild born wolves bred and raised pups in the wild. Of the 13 known packs at the end of 2011, all were formed naturally and all but one (Middle Fork pack) was composed of at least one wild-born breeding wolf.

Hawks Nest Pack. Mexican Wolf Interagency Field Team trail camera photo.

c. Releases and Translocations

The IFT conducted one soft release and one hard release translocation in an attempt to increase genetic diversity, the number of breeding pairs and the number of wolves in the wild. Two hard release translocations were conducted for boundary issues.

On January 26, the IFT captured Morgart's pack M1155 outside the BRWRA near Railroad Canyon on New Mexico State Lands. The IFT translocated M1155 to the SA Creek release site inside the BRWRA in an effort to facilitate a pair-bond with subsequently released F1105. On January 26, while the IFT was preparing F1105 for translocation, M1155 self-released from the release site.

On January 27, the IFT translocated F1105 from captivity. This wolf was hard released at the SA Creek release-site, in close proximity to M1155. These animals did not pair-bond and subsequently traveled in separate directions.

On January 18, the IFT translocated M1049 from captivity to the Engineer Springs release site on the ASNF. M1049 was held at the release site while the IFT conducted efforts to capture AF1110 of the Hawks Nest pack. The IFT hoped to facilitate a pair-bond between M1049 and AF1110 following the illegal shooting of AM1044. Efforts to capture AF1110 were not successful, thus, on January 28, the IFT hard released M1049 in proximity to AF1110 on the ASNF near St. Mary's Lake. These animals did not pair-bond and subsequently traveled in separate directions. In February, M1049 was captured and returned to captivity following unsuccessful efforts by the IFT to deter the wolf's use of inhabited areas in Nutrioso, Arizona.

On March 8, while trapping for removal of the Rim pack from the SCAR, the IFT captured an uncollared yearling female. This animal was collared, assigned studbook number F1213, and hard released inside the BRWRA on the ASNF near Blue Vista.

d. Home Ranges and Movements

The IFT calculated home ranges for 12 packs exhibiting territorial behavior. The MCP method produced an average home range size of 178 mi^2 (461 km^2), with home ranges varying from 50 mi^2 to 620 mi^2 (130 km^2 to 1607 km^2) (Fig. 4, Table 3). The Morgart's pack exhibited a larger home range as compared to the previous year (204 mi^2 in 2010 vs. 620 mi^2 in 2011). Morgart's pack M1155 displayed larger movements adjacent to the 2010 home range following the death of F1106 in October 2010. Home ranges were not calculated for 5 wolves (f1211, F1105, m1248, m1252 and M1253) that dispersed, traveled alone during all or portions of 2011, had less than 20 aerial locations or were deceased by the end of 2011 (see Appendix A for detailed summaries of these individuals).

Mexican wolves occupied 4434 mi^2 (11,484 km^2) of the Mexican Wolf Nonessential Experimental Zone (MWNEPZ) during 2011 (Fig. 5). Within the BRWRA there were 2687 mi^2 (6,959 km^2) of occupied range. On the SCAR there were 150 mi^2 (388 km^2) of occupied range. Outside of the BRWRA 1037 mi^2 (2,686 km^2) of occupied range was documented. Occupied wolf range occurred and was documented on the FAIR; however, this information is not displayed on the map and specific area values are not provided as requested by the WMAT. In comparison, Mexican wolves occupied 5245 mi^2 (13,579 km^2) of the MWNEPZ during 2010.

e. Mortality

The IFT has documented 88 wolf mortalities in the wild since 1998 (Table 4), 8 of which occurred in 2011 (Table 5). Mortalities in 2011 included: mp1210, f1211, and mp1242 from illegal shooting; mp1209 and F1187 from vehicle strikes; M1214 from pneumonia, AF1110 from a lightning strike and F1213 from complications associated with a wound most likely caused by an elk antler. This should be considered a minimum estimate of mortalities, since some pups and uncollared wolves die without being documented. One wolf from New Mexico (AM1156) is "fate unknown".

The IFT monitored 44 individual radio-collared wolves for a total of 10,212 radio days during 2011. A total of 10 radio-collared wolves were considered removed (*n* = 2), dead (*n* = 7), or missing (*n* = 1). The overall survival rate was 0.70, or a corresponding failure rate of 0.30.

The overall failure rate was composed of the human caused mortality rate (0.15; *n* = 5), natural mortality rate (0.06; *n* = 2), unknown/awaiting necropsy mortality rate (0.00; *n* = 0), boundary removal rate (0.00; *n* = 0), missing radio-collared wolves rate (0.03; *n* = 1), cattle depredation removal rate (0.00; *n* = 0), nuisance removal rate (0.06; *n* = 2), and other removal rate (0.00; *n* = 0).

f. Wolf Predation

A total of 14 carcasses (14 elk, 0 mule deer) were investigated opportunistically. Age determinations of the elk revealed: nine adults, five calves and no yearlings. Sex determinations of elk revealed one male, five females and eight of unknown sex.

Of the 14 carcasses investigated: 13 elk were confirmed or probable wolf kills; and one elk was determined to be a possible wolf kill.

g. Wolf Depredation

USDA-WS members of the IFT completed 36 investigations on 54 animals with potential Mexican wolf involvement. Of these 36 investigations, 34 involved cattle (*n* = 52), 1 involved horses (*n* = 1) and 1 investigation involved sheep (*n* = 1). Average IFT response time between the reporting of an incident to the initiation of an on-site investigation was < 24 hours.

Of the 36 investigations, 22 (61%) were confirmed as being wolf related. Twenty cattle deaths, one horse and one sheep were confirmed as wolf depredations, 4 cattle deaths were probable wolf depredations, and 4 injured cows were confirmed as being wolf related. Sixty-four percent (*n* = 14) of these occurred in New Mexico and 36% (*n* = 8 occurred in Arizona (Table 7). Twenty-eight percent of the investigations (*n* = 10) were determined to be unknown or non-wolf related. These mortality causes included: unknown (*n* = 5), black bear (n = 3), shipping fever (*n* = 1), and lightning strike (*n* = 1).

Ninety-two percent (*n* = 33) of the 36 investigations conducted were in response to reports from ranchers and the public and the remaining 8% (*n* = 3) were initiated by the IFT. Nine percent (*n* = 2) of the confirmed or probable wolf-caused livestock mortalities were found and reported by the IFT (Table 7).

In total, 8 of the 22 (36%) confirmed depredations involved uncollared wolves (Table 7). No wolves were permanently removed in 2011 for repeated depredations. The confirmed killed cattle rate for 2011 extrapolates to 34 depredations/100 wolves using the number of confirmed killed cattle (*n* = 20; Table 7) compared to the final population count (*n* = 58). This projected number of depredations is within the 1-34 confirmed killed cattle per 100 wolves predicted in the FEIS.

In September 2010, Defenders of Wildlife ended its long standing wolf compensation trust fund program. This program had provided compensation to livestock producers for confirmed or probable livestock kills that were attributable to wolves. They are now shifting their focus to collaborative efforts to help livestock producers coexist with wolves.

In March 2010, the Farm Service Agency (FSA) Emergency Livestock Assistance Program (ELAP) added wolf depredation as one of a list of potential events for which compensation funds can be dispersed to agricultural growers. Percentage (likely 25% up to 75%) reimbursed depends upon the total demand for ELAP funds nationally. This fund targets agency confirmed livestock losses that have not been reimbursed by another method of compensation. The ELAP Program was part of the Farm Bill and the authority for this program expired on November 30, 2011

The US Fish and Wildlife Service (Service) in cooperation with the National Fish and Wildlife Foundation established the Mexican Wolf / Livestock Interdiction Fund (Interdiction Fund) on September 23, 2009. The objective of the Interdiction Fund is to generate long-term funding for prolonged financial support of livestock operators within the framework of cooperative conservation and recovery of the Mexican wolf population in the Southwest. In April 2011 the Service appointed an 11 member Interdiction Fund Stakeholder Council (Stakeholder Council) which has the authority to identify, recommend, and approve conservation activities, identify recipients, and approve the amount of direct disbursement of funds to qualified recipients.

Arizona and New Mexico were each granted $60,000, and the San Carlos Apache Tribe was granted $4,000, from the Wolf Livestock Demonstration Project (Omnibus Bill/Tester Bill). The grant requires a state or tribal match of 100%. So far, neither state has spent a large amount of these funds.

h. Management Actions

In 2011, 26 wolves were captured, collared, processed, and released on site for routine monitoring purposes for a total of 33 times (Table 8). Two captured wolves were held overnight prior to release at the capture site, to ensure recovery from anesthesia. Two wolves, M1049 and F1105, were caught for management actions. M1214 and mp1242 were caught for needed medical attention. Five wolves, AM795, AF1056, mp1240, mp1241 and fp1247, were caught twice. M1155 and F1213 were caught for being outside of the boundary. M1155 was also translocated to facilitate pair-bonding with F1105. M1155 self-released prior to implementation of the pairing with F1105. F1105 was subsequently released in the immediate vicinity of M1155, but pair-bonding was not documented.

During the summer, the IFT conducted pup counts in Arizona and New Mexico utilizing remote trail cameras placed at den sites (Arizona) and diversionary food caches (New Mexico). In Arizona, six pups were documented produced by the Hawks Nest pack, five pups by the Paradise Pack, and three pups by the Bluestem pack. In New Mexico, seven pups were documented produced by the Middle Fork pack, six pups by the Luna pack, and five by the San Mateo pack. Two pups were documented produced by the Dark Canyon pack in New Mexico via visual observation during October. Trapping efforts to capture and collar pups were initiated in August. A total of ten pups and three yearlings were captured and collared during these operations.

Captures included two pups and one yearling from the Hawks Nest pack, two pups from the Paradise pack, two pups from the Bluestem pack, one pup and one yearling from the Luna pack, one pup and one yearling from the San Mateo pack, and two pups from the Dark Canyon pack. No pups were documented having been produced by the Rim pack, Fox Mountain pack, or Willow Springs pack. Trapping was also conducted on the FAIR, however, wolf numbers on the FAIR are proprietary and are not provided as requested by the WMAT.

One wolf was lethally removed (F1105) and one was temporarily removed (M1049) from the wild in 2011. Three wolves were translocated (M1155, F1105, M1049) in an attempt to facilitate pair-bonding. M1155 remained in the wild as a single wolf as of December 31. F1105 was lethally removed on December 14, 2011. M1049 was temporarily removed on February 2, 2011. Both removals were the result of continued nuisance behavior.

The IFT conducted investigations in response to 18 cases of nuisance wolf behavior in 2011 (Table 9). Nuisance reports of collared animals involved wolves near residences or livestock. The remaining reports concerned possible uncollared wolves; however, IFT personnel could not confirm these sightings. The IFT issued cracker shells to two private individuals who had reported nuisance behavior near livestock or residences. One wolf was captured and returned to captivity (M1049) and another was lethally removed (F1105) after repeated nuisance incidents. Trail cameras, tracking, telemetry, and howling were used to gather evidence about reported nuisance problems.

i. Proactive Management Activities

The IFT, working with Non Governmental Organizations (NGO), used proactive management to assist in eliminating or reducing wolf livestock conflicts in the BRWRA (Table 10). The Project and NGOs spent approximately $89,100 on proactive management activities affecting an estimated 10,930 livestock (6720 in Arizona, 4210 in New Mexico), representing about 23% of the permitted livestock grazing in the BRWRA. The IFT, agency contract employees, and NGO contract employees spent approximately 6290 hours implementing proactive management activities.

The IFT installed and maintained turbo fladry around one large pasture for one stakeholder in Arizona to protect livestock (sheep) on both public land and private property. No livestock depredation incidences occurred within the enclosed area. Additional fladry was installed in smaller areas for night enclosures. One ram was killed by wolves when it got out of a night enclosure.

The Project and NGOs purchased hay during the calving season for one stakeholder in Arizona, one stakeholder in NM, and supplements for two stakeholders. Two livestock depredation incidents occurred on grazing lands associated with these ranches, one in AZ and one in NM. The project assisted another rancher in the purchase of water, allowing grazing in an allotment away from an active wolf den in NM. No depredations are known to have occurred on the used allotment during 2011.

Project personnel met with District Rangers, biologists and range staffs, to discuss livestock management during the wolf denning season. The Project coordinated with the Alpine, Clifton, Springerville, Black Range, Quemado, and Reserve Ranger Districts and stakeholders in AZ and NM to address potential conflicts between livestock and wolves. In several of these cases, livestock were scheduled to graze in or near pastures where wolves were denning. In efforts to reduce interactions between livestock and denning wolves, the Districts and ranchers changed pasture rotations and moved livestock into alternate pastures for the denning season. A total of three depredations occurred on two of the seven alternate pastures, however, there would likely have been additional depredations if livestock had grazed near the den-sites. In one case, there were no options for moving livestock away from a den site; the den site was near the intersection of three pastures. This particular allotment sustained 3 depredations in 2011.

The Project and NGOs contracted seven range riders (five in Arizona, two in New Mexico) to assist nine stakeholders (five in Arizona, four in New Mexico) in monitoring wolves in relation to cattle. Range riders monitored approximately 6050 livestock within seven wolf pack home ranges, and provided additional oversight of livestock and light hazing of wolves when they were among the livestock. Two depredations occurred on allotments (1 in Arizona, 1 in New Mexico) while ranger riders were under contract.

The IFT issued radio telemetry equipment to stakeholders in areas where wolf-livestock conflicts were prevalent. Six sets of telemetry equipment were issued to ranches in Arizona and four sets were issued in New Mexico. Equipment loans were often in response to past conflicts between livestock and wolves on specific allotments. The IFT trained stakeholders to use the telemetry equipment to monitor wolves in the vicinity of cattle or residences. The IFT instructed stakeholders on non-injurious hazing techniques. Stakeholders were encouraged to contact the IFT for assistance and were required to report any wolf-livestock conflicts requiring intensive hazing efforts. These measures resulted in stakeholders increasing their vigilance over livestock when wolves were in the vicinity and stakeholders felt the equipment helped them to reduce the potential for livestock depredations.

Cracker shells were allocated to two stakeholders for use in hazing wolves that entered private land. IFT personnel hazed wolves on a number of occasions when they were creating nuisances to private landowners or were in close proximity to livestock on private and public land. In many cases, the wolves moved away though a few were persistent in returning.

Supplemental food caches are utilized to assist a pack or remnant of a pack in feeding young of the year when extenuating circumstances (such as a death of one of the adults) reduce their own ability to do so. Supplemental food caches also serve to reduce potential conflicts between wolves and livestock. Supplemental food caches were utilized for three packs in 2011.

Middle Fork Pack. Mexican Wolf Interagency Field Team trail camera photo.

In two instances, a breeding adult wolf (Luna pack AM1156, Hawks Nest pack AF1110) was documented to no longer be active in raising pups produced in 2011. In April, the IFT could no longer document the presence of AM1156 on the landscape and he was considered fate unknown, leaving AF1115 as the only breeding animal in the pack providing for six pups. In August, AF1110 was confirmed dead, leaving AM1038 as the only adult animal in the pack providing for six pups. The IFT established supplemental food caches within a reasonable distance of the den and rendezvous sites to help the remaining adult and sub adult wolves in each pack feed the young of the year and to reduce the likelihood of livestock depredations. In both situations, two or more pups survived until the end of the year. During the Wallow Fire, two packs, the Bluestem and Hawks Nest packs were located denning within the fire perimeter. The Wallow Fire was the largest fire in Arizona history, and was an active fire for nearly six weeks. Because wildfires temporarily displace native prey species (Singer et al. 1989), the IFT collaborated with fire personnel to establish supplementary food caches for these denning packs. The Bluestem pack used a supplementary food cache though the Hawks Nest pack did not. Although both packs moved their dens during the fire, the IFT documented the same number or more pups after the fire as they had prior to the fire. Supplemental feeding likely contributed to the survival of pups until the end of the year, in all of these cases. Although the Rim pack was displaying denning behavior prior to and during the Wallow Fire, no pups were documented with this pack immediately after the fire and throughout the remainder of the summer and fall seasons.

Diversionary food caches are utilized to reduce potential conflicts between wolves and livestock, primarily in areas where depredations have occurred in the past. Diversionary food caches were established for the Paradise, San Mateo, and Middle Fork packs during the 2011 denning season. Additional caches were established to draw F1105 away from private property and to determine whether she was travelling with an uncollared wolf. Another cache was established for a short

period (2 weeks) for the Fox Mountain pack following two confirmed depredations. They moved away from the area after a short time.

The IFT implemented additional proactive management activities in 2011. During the Wallow Fire, IFT personnel accompanied Incident Management Team personnel on reconnaissance flights to monitor the Hawks Nest, Bluestem, and Rim packs within the fire perimeter. Following the containment of the fire, the Forest Service received funds for activities and supplies to help reduce the fires impact on wolves and to replace or supplement equipment destroyed by the fire. These funds supplied the IFT with a freezer, carnivore logs, radio collars, telemetry equipment, and remote cameras. In addition, materials were purchased to replace three water catchments for wild ungulates that were destroyed by the fire.

Often, livestock die of many causes within wolf territories. To reduce the possibility that wolves would be attracted to the carcasses where livestock were grazing, the IFT covered several livestock carcasses with lime in Paradise, San Mateo, and Luna pack territories.

j. Non-IFT Wolf Sighting Reports

In 2011, the IFT received a total of 66 wolf-sighting reports from the public, which included 42 reports from Arizona and 24 reports from New Mexico (Appendix B). The IFT determined 23 reports were non-wolf sightings (coyote, dogs, etc.), 13 reports were sightings from known wolves within established territories (Arizona n = 10, New Mexico n = 3), eight reports were likely uncollared/unknown wolves (Arizona n = 3, New Mexico n = 5), with three reports being probable wolf sightings (wolves located in area; however, weak sighting descriptions cannot be proven) (Arizona n = 3, New Mexico n = 0), and 19 reports did not have enough information to make a determination. To report a sighting of a Mexican wolf, please call 1-888-495-WOLF (9653). The public is encouraged to report Mexican wolf sightings to help the IFT locate undocumented packs and track movements of wolves within and around the BRWRA.

k. Uncollared wolf sign

The IFT used uncollared wolf sign and sighting reports to target 15 core areas (Fig. 6) in an effort to document and/or radio collar unknown wolves in and around the BRWRA. The IFT searched a total of 2438 mi (3924km) of roads and trails. Two single wolves were documented in Arizona and three single wolves were documented in New Mexico (Fig. 7).

l. Outreach

The IFT and other project personnel gave 20 presentations and status reports to approximately 777 people in federal and state agencies, conservation groups, rural communities, schools, wildlife workshops, and various other public and private institutions throughout Arizona, New Mexico and White Mountain Apache Tribal lands. Sixty-five percent of the presentations were for the BRWRA target audience. In addition, 6078 weekly contacts were made to cooperating agencies and stakeholders. Project updates were faxed to, or posted at, 41 different individuals/locations monthly across the BRWRA. Endangered Species Updates containing current project and recovery program information also went out to an average of 1,284 people a

month. The AGFD Mexican wolf website was visited 9,666 times throughout 2011. Outreach presentations can be scheduled by contacting the IFT at 1-888-495-WOLF (9653).

At available USFS kiosks and various road pullouts in the BRWRA, the IFT maintained metal signs and laminated posters that provide information on how to minimize conflicts with wolves. The IFT also maintained USFWS reward posters at USFS kiosks and local businesses in the BRWRA as necessary, to provide notice of a $10,000 reward for information leading to the apprehension of individuals responsible for illegal Mexican wolf killings.

The IFT organized three rancher workshops conducted by Timm Kaminski from the Mountain Livestock Cooperative in Montana which were attended by 81 people (31 in South Fork, AZ, 40 in Reserve, NM, 10 in Hon Dah, FAIR). Mr.Kaminski outlined his work with producers in the northwest to design and implement management approaches to reduce livestock vulnerability to wolves. Participants discussed how practices could be implemented in the BRWRA.

4. Summary

The 2011 end-of-year count confirmed 34 radio-collared wolves (20 adults, 5 subadults, and 9 pups). The population consisted of 13 packs (6 in Arizona, 7 in New Mexico). Twenty-four uncollared wolves, including uncollared singles and groups were documented throughout 2011. Ten of the 24 uncollared wolves were associated with seven radio-collared packs (Table 1). Three radio-collared single wolves (f1212, m1248, m1252) were still alive. There are likely more undocumented free-ranging wolves in the population, but most of these are likely single animals, as a wolf pack generally leaves more sign and its existence is easier to document.

The IFT conducted one soft release and three hard release translocations of one wolf each. Two wolves, M1155 and F1213, were translocated for being outside the boundary. M1155 was subsequently transported and held temporarily to facilitate pair-bonding with F1105. Two wolves, M1049 and F1105, were translocated in attempt to increase genetic diversity, the number of breeding pairs, and the number of wolves in the wild.

Nine packs produced wild-conceived, wild-born litters. This is the tenth consecutive year wild-born Mexican wolves bred and raised pups in the wild. In addition, 91% of the radio-collared individuals and 95% of all documented wolves were wild-born.

The IFT documented eight mortalities of free-ranging wolves in 2011, including four adults and four subadults.

Home ranges were calculated for 12 packs exhibiting territorial behavior. The MCP method produced an average home range size of 178 mi^2 (461 km^2), with home ranges varying from 50 mi^2 to 620 mi^2 (130 km^2 to 1607 km^2).

Native prey used by wolves consisted primarily of elk; however, there were also twenty-two confirmed livestock depredations and four probable livestock depredations. There were three confirmed livestock injuries attributed to wolves.

The IFT captured 26 wolves a total of 33 times for routine monitoring (*n* = 21), management actions (*n* = 2), medical attention (*n* = 2), movement outside the BRWRA boundary (*n* = 2) and incidental catch (*n* = 6). Two wolves, M1049 and F1105, were caught for management actions. M1214 and mp1242 were caught for medical attention. Five wolves, AM795, AF1056, mp1240, mp1241 and fp1247, were caught a second time while the IFT trapped for uncollared wolves in associated packs. M1155 and F1213 were outside of the boundary and translocated back into the BRWRA; M1155 was also translocated to facilitate pair-bonding with F1105. AF1056 was caught three times, twice for recollaring and once while trapping for an unknown alpha male traveling with the pack.

The IFT analyzed 66 reports of wolf sightings from the public; 35% of these reports were non-wolf sightings (coyote, dogs, deer, etc.), 20% were sightings of known wolves within established territories, <1% were probable wolf sightings, 12% were likely uncollared/unknown wolves, and the remainder was categorized as unknown due to insufficient information. In response to these sightings, the IFT searched 2438 mi (3924 km) of roads, trails, and canyons looking for unknown wolves in and around the BRWRA. As a result, the IFT was successful in documenting two single wolves in AZ and three single wolves in New Mexico.

Project personnel gave 20 presentations and status reports to approximately 777 people in federal and state agencies, conservation groups, rural and urban communities, guide/outfitter organizations, livestock associations, schools, fairs, and various other public and private institutions. In addition, 6078 weekly contacts were made to cooperating agencies and stakeholders. *Endangered Species Updates* containing current project and recovery program information went out to an average of 1,284 people a month.

The IFT acknowledges the assistance of all agency personnel and volunteers who provided data and support services for the operational field portion of the Mexican wolf reintroduction project during this reporting period. Individuals listed in Appendix C collected data or provided other information for this report.

5. Discussion

The IFT documented the Mexican wolf population at a minimum population of 58 wolves in 2011 (Table 1, Fig. 8). The minimum number of breeding pairs increased from two in 2010 to seven in 2011, one of which was an "Operational Breeding Pair" (Table 1, Fig. 4). The Hawks Nest pack AF1110 died from lightning strike in August and in September the IFT observed Hawks Nest f1208 exhibiting behavior suggesting that f1208 replaced AF1110 as the dominant female in the pack.

The minimum total number of pups alive at the end of the year was higher (*n* = 19: Table 1) than the previous year (*n* = 14) and the number of known mortalities increased from six in 2010 to eight in 2011 (Table 4). Of the four single wolves: one died (f1211) and three remain in the wild with functioning radio-collars (f1212, m1248, M1252). The three remaining single wolves began dispersing in the fall and were all located away from their natal packs during the 2012 population count; f1212 was located with an uncollared wolf during the January count.

Two natural parings occurred in 2011. In the Hawks Nest pack f1208 replaced AF1110 following its death by lightning strike and M1185 paired with an uncollared female wolf. Fewer known adult wolves available for pair formation are likely a compounding result of low pup survival in the previous years in addition to human caused mortality and lack of initial releases and successful translocations from captivity.

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) rate of 0.30 in 2011, largely due to minimal (n = 2) management removals of wolves in the population. While the significant reduction in the number of management removals is encouraging, the majority of the population losses in 2011 were due to human-caused mortalities rather than removals. In 2011, the IFT documented five human-caused mortalities (three illegal shootings and two vehicle collisions) and three natural mortalities. Efforts to document the uncollared wolf component of the population will continue to be a priority activity. The project will also continue to attempt to reduce the level of mortality, while replacing the individual animals lost through initial releases and translocations.

The 2011 confirmed killed cattle rate extrapolates to approximately 34 depredations/100 wolves using the number of confirmed killed cattle (n = 20) compared to the final 2011 population count (n = 58). This projected number of depredations was within the 1-34 confirmed killed cattle per 100 wolves predicted in the FEIS. It is important to note the standard for extrapolating the annual confirmed killed cattle rate/100 wolves uses the end of year wolf population count, which does not include wolves that died during 2011. Thus, the confirmed killed cattle rate per 100 wolves, as a matter of practice, underestimated the denominator which inflates the total rate.

A high number of mortalities may exceed growth from natural recruitment, translocations, and initial releases in a given year. Nonetheless, a combination of initial releases, translocations, natural pair formations, and reproduction in 2012 could result in another increase in the Mexican wolf population. The Project management objective for 2012 is a 10% increase in the minimum wolf population counts and/or the addition of at least two breeding pairs, while minimizing negative impacts of wolves. Critical suggested changes to the Mexican wolf reintroduction project are outlined in the Five Year Review. The Project will continue to work on implementing these improvements in 2012.

6. Literature Cited

Heisey, DM and TK Fuller. 1985. Evaluation of survival and cause-specific mortality rates using telemetry data. Journal of Wildlife Management 49:668-674.

Hooge, PN, W Eichenlaub, and E Solomon. 1999. The animal movement program. USGS. Alaska Biological Science Center.

Fuller, TK, LD Mech, and JF 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.

Mexican Wolf Blue Range Adaptive Management Oversight Committee and Interagency Field Team. 2005. Mexican wolf Blue Range reintroduction project 5-year review. USFWS, Albuquerque, New Mexico, USA.

Paquet, PC, J Vucetich, ML Phillips, and L Vuetich. 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.

Singer, F. J., W. Schreier, J. Oppenheim, and E. O. Garton. 1989. Drought, fires, and large mammals. BioScience. 39:716-722.

US 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. USFWS, Albuquerque, New Mexico, USA.

US Fish and Wildlife Service. 1998. The final Mexican wolf experimental rule. 63 Federal Register. Pp 1763-1772.

White, GC and RA Garrott. 1990. Analysis of wildlife radio-tracking data. Academic Press Incorporated, New York, New York, USA.

Mexican Wolf Interagency Field Team trail camera photo.

Table 1. Status of Mexican wolf packs in Arizona and New Mexico, as of December 31, 2010.

Pack	Wolf ID	Reproduction[a]	Pups at Year End[b]	No. Collared	No. Uncollared	Min pack Size[c]
Bluestem, AZ*	AM806, AF1042, mp1240, mp1242[e]	3	2	3	1	4
Dark Canyon, NM*	AM992, AF923, fp1250, fp1251	2	2	4	0	4
Fox Mountain, NM	M1158, F1188	0	0	2	0	2
Hawks Nest, AZ[m]	AF1110[e], AM1038[j], f1208, mp1209[e], mp1210[e] , mp1244, fp1247	6	3	4	0	5
Luna, NM	AF1115, AM1156[f], f1246, mp1241	6	2	3	1	4
Middle Fork, NM*	AM871, AF861	7	2	2	2	4
Paradise, AZ*	AM795, AF1056, mp1243, mp1245	5	3	4	1	5
Rim, AZ	AM1107, AF858, F1187[e], F1213[e]	0	0	2	0	2
San Mateo, NM	AM1157, AF903, mp1249	5	1	3	0	3
Willow Springs, NM	M1185[h]	0	0	1	1	2
Morgart, NM	M1155	0	0	1	0	1
Radio collared wolf, AZ	f1211[e]	0	0	0	0	0
Radio collared wolf, NM	f1212[i]	0	0	1	1	2
Radio collared wolf, NM	m1248[i]	0	0	1	0	1
Radio collared wolf, NM	m1252[i]	0	0	1	0	1
Radio collared wolf, NM	M1214[e]	0	0	0	0	0
Sipe Wildlife Area, AZ	Uncollared wolf	0	0	0	1	1
Beaver Creek, AZ	Uncollared wolf	0	0	0	1	1
Indian Creek, NM	Uncollared wolf	0	0	0	1	1
Indian Peaks, NM	Uncollared wolf	0	0	0	1	1
Poverty Flat, NM	Uncollared wolf	0	0	0	1	1
FAIR*	Uncollared wolves	N/A[d]	N/A[d]	N/A[d]	N/A[d]	N/A[d]
SCAR	Uncollared wolves	N/A[d]	N/A[d]	N/A[d]	N/A[d]	N/A[d]
Totals[l]		38	19	34	24	58

[a]Reproduction-maximum number of pups documented in 2011.
[b]Pups at year end documented surviving until December 31, 2011.
[c]Min pack size-total number of wolves (collared, uncollared, pups) documented at year end.
[d]Wolf numbers on FAIR and SCAR are proprietary and therefore not displayed.
[e]Died during 2011.
[f]Fate unknown during 2011.
[h] Dispersed to form new pack.
[i] Dispersed off and on throughout year; counted as single in table.
[j]Telemetry collar not functioning, but counted as collared in table.
[l] Totals include wolves occurring on FAIR and SCAR..
[m] A pack that meets the definition of an *operational breeding pair*.
*A pack that meets the definition of a breeding pair per the final rule.

Table 2. Mexican wolves translocated from captivity or the wild in Arizona and New Mexico during January 1 – December 31, 2011.

Wolf pack	Wolf #	Release Site	Release Date	Released or Translocated
Morgart's	M1155	SA Creek, NM	January 26	Translocated from wild
Single	F1105	SA Creek, NM	January 27	Translocated from captivity
Single	M1049	St. Mary's Lake, AZ	January 28	Translocated from captivity
Rim	F1213	Blue Vista, AZ	March 8	Translocated from wild

Table 3. Home range sizes of free-ranging Mexican wolf packs in Arizona and New Mexico, January 1 – December 31, 2011.

Wolf ID	Home Range Size 95% Min. Convex Polygon mi^2 (km^2)	Number of Independent Aerial Locations	Duration of Time Radio Locations were Available during 2011
Paradise	91 (235)	47	12 months
Hawks Nest	137 (355)	60	12 months
Bluestem	182 (471)	52	12 months
Rim	141 (366)	67	12 months
Fox Mountain	145 (376)	39	11 months
San Mateo	232 (600)	71	12 months
Dark Canyon	131 (340)	54	12 months
Luna	155 (403)	57	12 months
Middle Fork	50 (130)	48	12 months
Morgart's	620 (1607)	37	11 Months
Willow Springs	108 (280)	38	11 months
Maverick	142 (367)	45	12 months
Average[a]	**178 (461)**	**51**	**11.8 months**

[a]Averages were based on packs with enough locations to calculate home ranges.

Table 4. Wild Mexican wolf mortalities documented in Arizona and New Mexico, 1998-2011.

Year	Illegal shooting	Vehicle collision	Natural[a]	Other[b]	Unknown	Awaiting necropsy	Annual Total
1998	4	0	0	1	0	0	5
1999	0	1	2	0	0	0	3
2000	1	2	1	0	0	0	4
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	1	0	1	0	2	0	4
2008	6	2	2	1	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
Total	**43**	**14**	**17**	**4**	**9**	**1**	**88**

[a]Includes three wolves lost to predation, two to starvation, two to disease (canine parvovirus and chronic bacterial pleuritis), and one each to asphyxiation (snake bite), euthanasia, toxemia, and ingestion of a foreign object.
[b]Includes 2 capture-related mortalities and 1 legal public shooting.

Table 5. Mexican wolf mortalities documented in Arizona and New Mexico during January 1 - December 31, 2011.

Wolf ID	Pack	Age (years)	Date Found	Cause of Death
mp1209	Hawks Nest	<1	February 27	Vehicle
mp1210	Hawks Nest	<1	April 1	Illegal shooting
M1214	Single	2-3	May 6	Pneumonia
AF1110	Hawks Nest	5-6	August 23	Lightning Strike
F1187	Rim	2	September 22	Vehicle
F1213	Rim	2	November 15	Elk related injury
f1211	Single	<2	November 22	Illegal Shooting
mp1242	Bluestem	<1	December 3	Illegal Shooting

Table 6. Mexican wolf depredations of livestock documented in Arizona and New Mexico during January 1 – December 31, 2011.

	Confirmed	Probable	Total
Fatal	22	4	26
Injury	4	0	4

Table 7. Investigations of confirmed and probable depredation and injuries caused by Mexican wolves to livestock during 2011 in New Mexico and Arizona. Depredation incidents are defined as the aggregate number of livestock confirmed killed or mortally wounded by an individual wolf or a single pack of wolves at a single location within a 1-day (24-hour) period, beginning with the first confirmed kill, as documented in the initial IFT incident investigation pursuant to SOP 11.0.

	Wolves in Area	Investigation Date	Located By IFT	Species	State	Killed/ Injured	Call	Wolves Responsible	Depredation Incident	No. of Incidents for 2011	Management Action
1	Unknown	January 15	No	Cattle	NM	Killed	Confirmed	Uncollared	Yes	1	
2	Unknown	January 18	No	Cattle	NM	Killed	Confirmed	Uncollared	Yes	1	
3	1105	February 7	No	Cattle	NM	Killed	Confirmed	1105	Yes	1	Set camera in area
4	Unknown	February 7	No	Cattle	NM	Killed	Confirmed	Uncollared	Yes	1	Set traps in area
5	Unknown	February 10	No	Cattle	NM	Killed	Confirmed	Uncollared	Yes	1	Set traps in area
6	Unknown	March 18	No	Cattle	AZ	Killed	Confirmed	Uncollared	Yes	1	Set traps in area
7	Unknown	April 17	No	Cattle	AZ	Killed	Probable	Uncollared	No	0	Monitoring
8	Rim	April 22	No	Cattle	AZ	Killed	Confirmed	858, 1107	Yes	1	Monitoring
9	Rim	April 22	No	Cattle	AZ	Killed	Probable	Rim	No	0	Monitoring
10	San Mateo	May 24	No	Cattle	NM	Killed	Confirmed	1157, 1212	Yes	1	Monitoring
11	San Mateo	May 24	No	Cattle	NM	Killed	Probable	1157, 1212	No	0	Monitoring
12	Morgart's (1155), and 1211	June 9	No	Cattle	NM	Killed	Confirmed	1211	Yes	1	Ranger rider extended, increased monitoring
13	Morgart's (1155), and 1211	June 9	No	Cattle	NM	Killed	Confirmed	1211	Yes	2	Ranger rider extended, increased monitoring
14	Fox Mountain	June 17	No	Cattle	NM	Killed	Confirmed	1188, 1158	Yes	1	Increased Monitoring
15	Paradise	July 3	No	Sheep	AZ	Killed	Confirmed	795	Yes	1	Intensive Monitoring
16	Fox Mountain	July 6	No	Cattle	NM	Killed	Confirmed	1188, 1158	Yes	2	Intensive Monitoring, food cache established
17	Middle Fork (871)	July 9	Yes	Cattle	NM	Killed	Confirmed	871	Yes	1	Provided range rider, established additional food cache, monitoring

Table 7. Continued.

Wolves in Area		Investigation Date	Located By IFT	Species	State	Killed/ Injured	Call	Wolves Responsible	Depredation Incident	No. of Incidents for 2011	Management Action
18	Middle Fork (871)	July 9	No	Cattle	NM	Killed	Confirmed	871	Yes	2	Provided range rider, established additional food cache, monitoring
19	Dark Canyon, F1211	July 12	No	Horse	NM	Killed	Confirmed	923, 992	Yes	1	Increased monitoring
20	Rim	July 19	Yes	Cattle	AZ	Killed	Confirmed	858, 1107	Yes	2	Monitoring
21	Fox Mountain	August 11	Yes	Cattle	NM	Killed	Probable	Fox Mountain	No	0	Monitoring
22	Fox Mountain	August 22	No	Cattle	NM	Killed	Confirmed	Uncollared	Yes	1	Increased Monitoring
23	Middle Fork and 1105	September 1	Yes	Cattle	NM	Killed	Confirmed	1105	Yes	2	Established 2 food caches, intensive monitoring
24	Unknown	November 13	No	Cattle	AZ	Killed	Confirmed	Uncollared	Yes	0	Increased monitoring
25	Unknown	November 17	No	Cattle	AZ	Killed	Confirmed	Uncollared	Yes	0	Set traps and camera in area, increased monitoring
26	Morgart's (1155)	November 21	No	Cattle	NM	Killed	Confirmed	1155	Yes	1	Increased Monitoring

Table 8. Mexican wolves captured in Arizona and New Mexico from January 1, 2010 – December 31, 2011.

Pack	Wolf ID	Capture Date	Reason for Capture
Bluestem	AF1042	January 20	Helicopter capture, re-collared and released on January 21.
Paradise	AF1056	January 20	Helicopter capture, re-collared and released.
Middle Fork	fp1211	January 21	Helicopter capture. Collared and released.
Dark Canyon	AM992	January 22	Helicopter capture, re-collared and released on January 23.
San Mateo	fp1212	January 24	Helicopter capture. Collared and released.
Morgart's	M1155	January 25	Helicopter capture. Outside of BRWRA and translocated to pair with F1105
San Mateo	AF903	January 30	Helicopter capture, re-collared and released.
Single	M1049	February 2	Excessive nuisance behavior. Captured and temporarily removed from wild
Rim	F1213	March 8	Captured on SCAR for boundary issues. Translocated to the Blue Vista area in AZ and released.
Paradise	AF1056	April 4	Captured during efforts to catch an unknown alpha male. Re-collared, blood drawn for pregnancy testing and released on site.
Saddle	M1214	May 6	Captured for medical treatment. Uncollared, Died during transport to veterinarian.
Paradise	AM795	June 20	Routine monitoring purposes. Captured, re-collared and released on site.
Single	F1105	July 20	Captured for management purposes. Re-collared and released.
Bluestem	mp1240	August 13	Routine monitoring purposes. Captured, collared and released on site.
Luna	mp1241	August 17	Routine monitoring purposes. Captured, collared and released on site.
Bluestem	mp1242	August 21	Routine monitoring purposes. Captured, collared and released on site.
Bluestem	mp1240	August 21	Routine monitoring purposes. Released on site.
Paradise	mp1243	September 14	Routine monitoring purposes. Captured, collared and released on site.
Paradise	AM795	September 16	Routine monitoring purposes. Released on site.
Hawks Nest	mp1244	September 21	Routine monitoring purposes. Captured, collared and released on site.
Paradise	mp1245	September 25	Routine monitoring purposes. Captured, collared and released on site.

Table 8. Continued.

Pack	Wolf ID	Capture Date	Reason for Capture
Luna	mp1241	September 26	WS captured wolf while coyote trapping. Vaccinated and released on site.
Luna	F1246	September 27	WS captured wolf while coyote trapping. Vaccinated, collared and released on site.
Hawks Nest	fp1247	September 27	Routine monitoring purposes. Captured, collared and released on site.
Paradise	AF1056	October 1	Routine monitoring purposes. Captured and re-collared after slipping collar in June, released on site.
Hawks Nest	M1248	October 2	Routine monitoring purposes. Captured, collared and released on site.
San Mateo	mp1249	October 5	Routine monitoring purposes. Captured, collared and released on site.
Hawks Nest	fp1247	October 6	Routine monitoring purposes. Captured, collared and released on site.
Dark Canyon	fp1250	October 10	Routine monitoring purposes. Captured, collared and released on site.
Dark Canyon	fp1251	October 10	Routine monitoring purposes. Captured, collared and released on site.
San Mateo	M1252	October 14	WS captured wolf while coyote trapping. Vaccinated, collared and released on site.
Tsay-Oh-Ah	AM1253	October 21	Routine monitoring purposes. Captured, collared and released on site.
Bluestem	mp1242	December 3	Captured for medical treatment. Died during transport to veterinarian.

Table 9. IFT management actions resulting from Mexican wolf nuisance activities in Arizona and New Mexico during 2011.

Date	Wolf ID	General Location	Type of Activity	IFT Response	Management Result
January 29	M1049	Rudd Creek/Benton Creek	Wolf unafraid of humans, approached IFT member	Shot off 3 Cracker Shells	Wolf moved away
February 1	M1049	Nutrioso, AZ	Wolf playing with domestic dogs, showed no fear of people, chased colt in corral, at least 6 reports	Hazed wolf throughout the day, with 7 cracker shells and 8 rounds of bean bags	Wolf ran off, on 3 separate occasions
February 2	M1049	Nutrioso, AZ	Wolves near residences and playing with dogs.	IFT investigated the report.	M1049 was captured and taken back to captivity.
February 18	F1105	Old Horse Springs, NM	Near Church	IFT investigated and hazed with 1 cracker shell	F1105 ran off
February 20	Bluestem	Alpine, AZ	Pair walked through yard, interacted with dog, left yard when chased.	IFT investigated the report, walked in on wolves.	Wolves moved off and away from residence.
February 21	Bluestem	Alpine, AZ	Wolf near private residence	IFT investigated the report.	No action taken, wolves had left area.
March 2011	F1105	Horse Springs, NM	Wolf entering Private Elk Ranch fenced area	IFT set up a carcass with field camera, got wolf pictures, worked on exclosure fence, hazed	F1105 located within the exclosure fence on several occasions. No dead elk found within exclosure.
March 27	Hawks Nest	South Fork, AZ	Wolf on private property near calving area	IFT investigated the report but no signals heard.	Staff continued to monitor area.
March 29	San Mateo	Mangas Mountain, NM	Wolves on private property chasing cows	IFT investigated and hazed wolves out of area.	Staff continued to monitor area and haze when required.
April 15	Middle Fork	Yellow Mountain, NM	Wolves on private property near livestock	IFT investigated and hazed wolves away from area.	Staff continued to monitor area. No dead livestock were found.

Table 9. Continued.

Date	Wolf ID	General Location	Type of Activity	IFT Response	Management Result
May 17	Uncollared	Pinetop, AZ	Wolf filmed on video camera near private residence area	IFT investigated the report.	Staff attempted to trap animal but were unsuccessful.
May 19	Uncollared	Pie Town, NM	Wolves reported on private property	IFT investigated report.	No wolf tracks documented.
May 20	Uncollared	Blue River, AZ	Wolves reported traveling through private property	IFT investigated the report.	Potential wolf tracks and scat observed on property.
July 11	Uncollared	Nutrioso, AZ	Wolf reported on private property	IFT investigated the report.	Set up trail camera. No wolves documented in area.
July 16	Uncollared	San Antonio, NM	Wolf reported on private property	IFT investigated the report	No wolf tracks documented.
November 15	F1105	Beaverhead, NM	Wolf interacting (non-aggressive) with a dog in campground	IFT investigated the report.	Staff monitored the area for hazing and/or capture opportunities.
December 13 and 14	F1105	Beaverhead, NM	Wolf on private residence loitering near house and interacting with domestic dogs	IFT investigated the report.	USFWS issued a lethal removal order. Order carried out by WS.
December 15	Dark Canyon	Negrito, NM	Wolves reported on private property	IFT investigated the report.	No action taken, wolves left the area.
May 17	Uncollared	Pinetop, AZ	Wolf filmed on video camera near private residence area	IFT investigated the report.	Staff attempted to trap animal but were unsuccessful.
May 19	Uncollared	Pie Town, NM	Wolves reported on private property	IFT investigated report.	No wolf tracks documented.

Table 10. IFT proactive management activities in Arizona and New Mexico during 2011.

Proactive Management Activity	Purpose	Date	Location	Wolf ID	Management Result
Fladry – 3 miles	Reduce the probability of livestock depredation within a small area.	May to June	Sheep Springs, AZ	Paradise, uncollared?	No known livestock depredations
Fladry – variable	Reduce the probability of livestock depredation on sheep at night.	May to September	Sheep Springs, AZ	Paradise, uncollared?	1 Ram killed outside of exclosure
Fladry -	Reduce the probability of livestock depredation within a small area.	March	Indian Creek, NM	Middle Fork	Problem with elk in area, taken down
Hay	Reduce the probability of livestock depredation during calving season.	January through September	Collins Park, NM	Luna	1 depredation in September
Hay and Supplements	Reduce the probability of livestock depredation during calving season.	January to March	Blue River, AZ	Uncollared Wolves	No confirmed livestock depredations
Water and Feed	Allow use of alternate Allotment during drought, to reduce problems	April	Glenwood, NM	Dark Canyon	No known livestock depredations
Range Rider	Reduce the probability of predator depredation on free-ranging livestock.	January through May	Eagle Creek, AZ	Rim	No known Livestock depredations
Range Rider	Reduce the probability of predator depredation on free-ranging livestock.	June through October	Mangas, NM	San Mateo	No known livestock depredations
Range Rider	Reduce the probability of predator depredation on free-ranging livestock.	June through August	Springerville AZ	Paradise	No known livestock depredations
Range Rider	Reduce the probability of predator depredation on free-ranging livestock.	July to October	Greens Peak, AZ	Paradise, Uncollared Wolves	No known livestock depredations
Range Rider	Reduce the probability of predator depredation on free-ranging livestock.	July to October	Greens Peak, AZ	Paradise, Uncollared Wolves	No known livestock depredations
Range Rider	Reduce the probability of predator depredation on free-ranging livestock.	June through August	Beaverhead NM	Morgart, Middle Fork	1 depredation with RR, 2 without RR
Range Rider	Reduce the probability of predator depredation on free-ranging livestock.	January through May	Strayhorse, AZ	Uncollared wolves	One known livestock depredations

Table 10. Continued

Proactive Management Activity	Purpose	Date	Location	Wolf ID	Management Result
Flights and Supplemental Feeding	Monitor wolves being impacted by Wallow Fire and provide food for feeding pups	June	Alpine and Springerville AZ	Hawks Nest, Bluestem, Rim	Pups in 2 of the 3 packs survived the Wallow Fire
Purchase of radio collars, trail cameras, carnivore logs, freezer	Provide food for wolves during Wallow Fire, and equipment to monitor wolves and enhance management	July	Springerville AZ	Hawks Nest, Bluestem, Rim	Gained insight into how wolves react to large fires
Purchase of materials to build water catchments	Replace water catchments for wild ungulates destroyed in the Wallow Fire	July	Springerville, AZ	Hawks Nest, Bluestem, Rim	Catchments will be rebuilt in 2012
Proactive Measures Workshops	IFT hosted 3 workshops for producers to learn about potential proactive measures	May	Eagar AZ Hondah AZ Reserve NM		81 people attended the workshops
Cover Livestock Carcasses with Lime	Render Carcasses unpalatable so wolves not attracted	July-Sept	AZ and NM	Paradise, Luna, San Mateo	Unknown

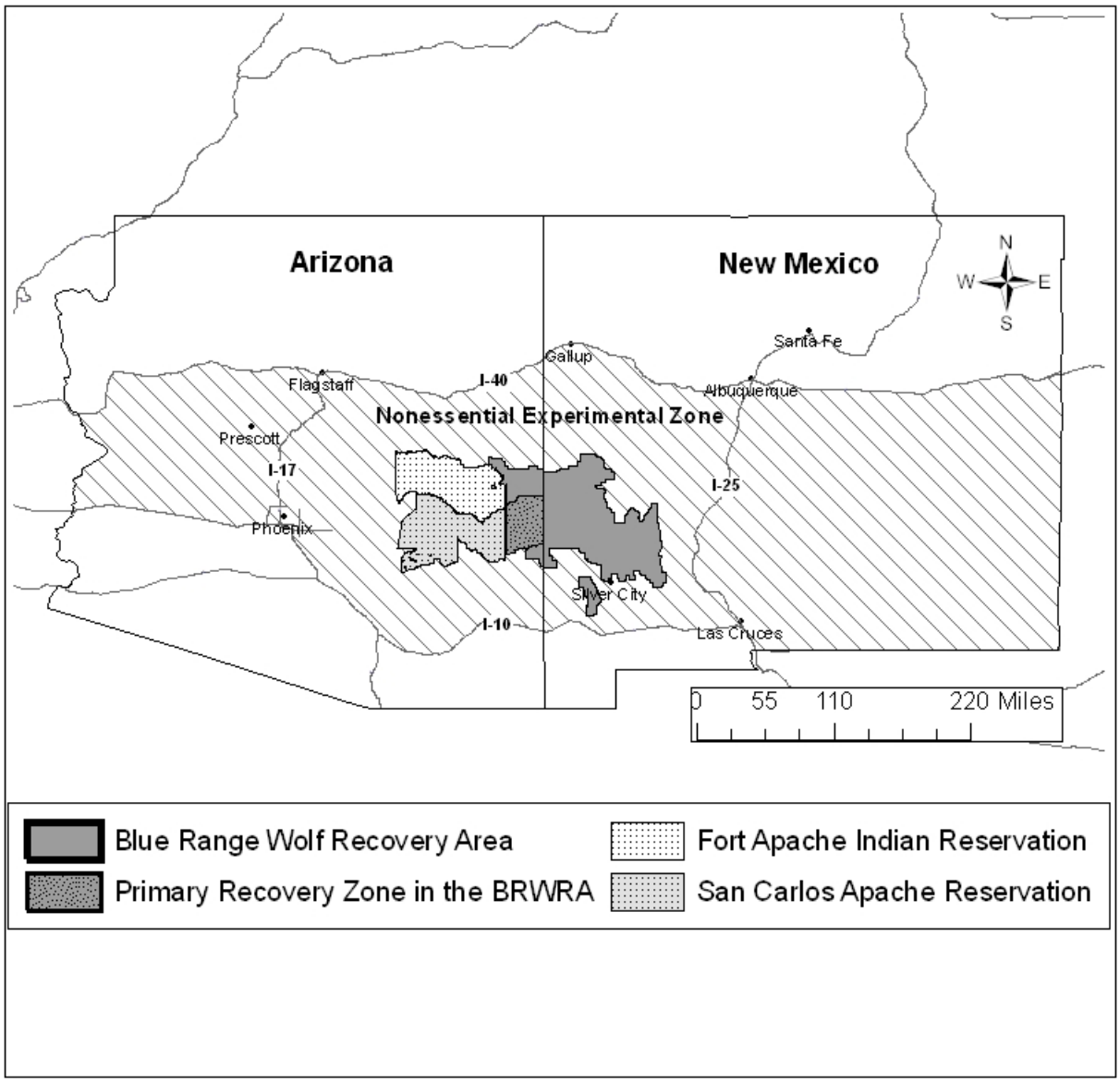

Figure 1. The Blue Range Wolf Recovery Area and Mexican wolf nonessential experimental zone (cross-hatched area) in Arizona and New Mexico.

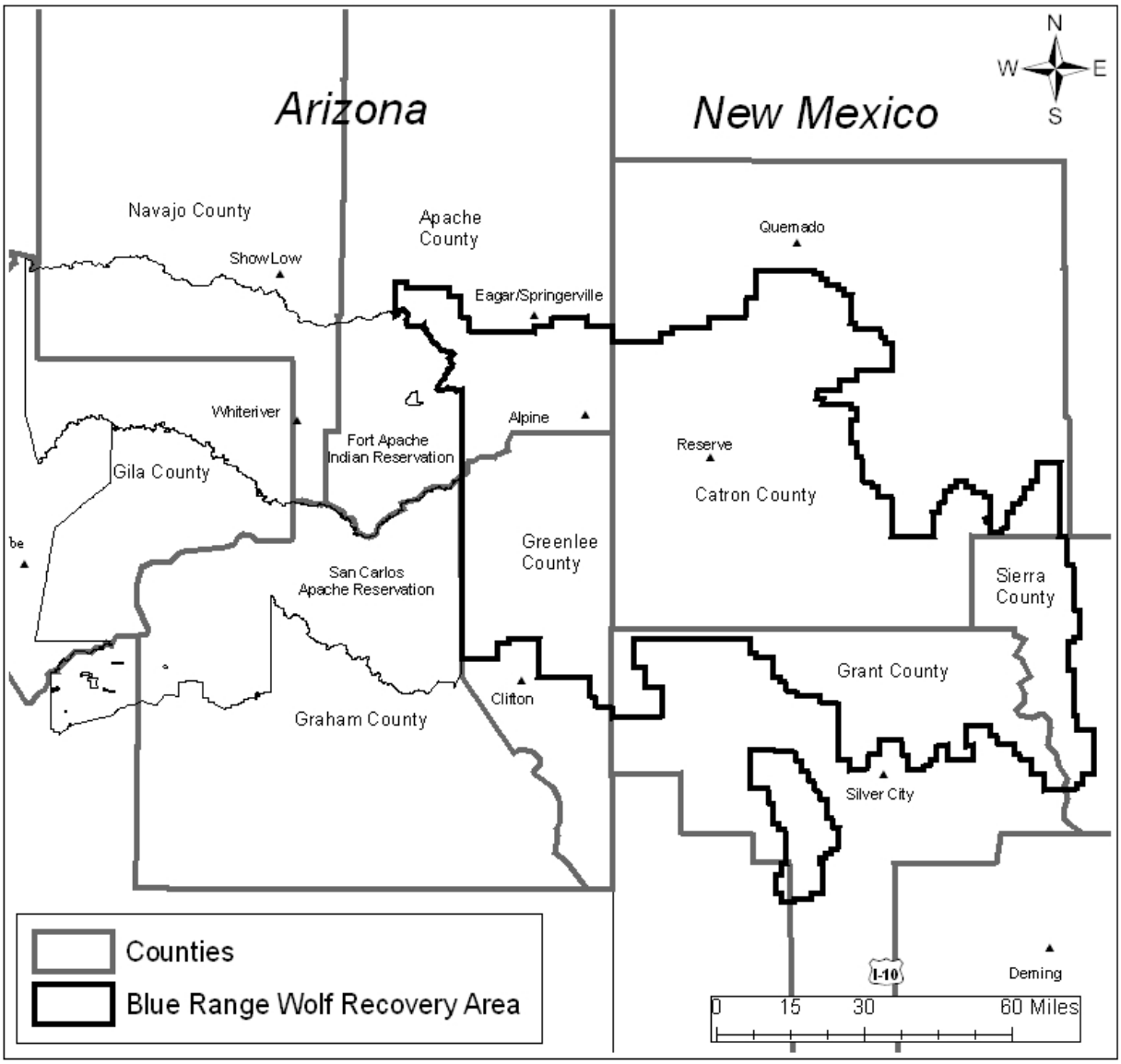

Figure 2. Counties that occur in or adjacent to the Blue Range Wolf Recovery Area in Arizona and New Mexico.

Figure 3. Translocation sites used during 2011 in Arizona and New Mexico within the Blue Range Wolf Recovery Area.

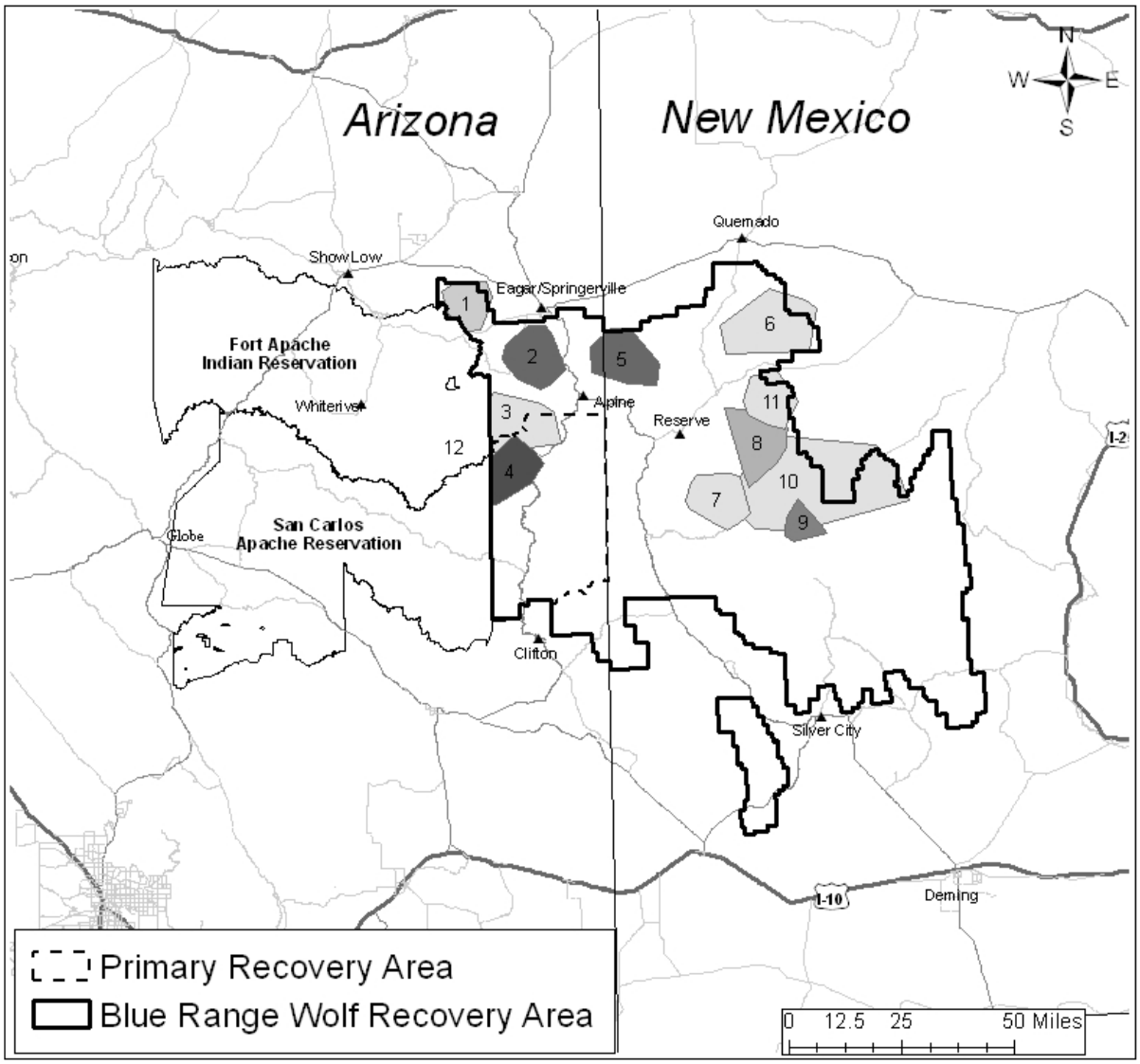

Figure 4. Mexican wolf home ranges for 2011 in Arizona and New Mexico. The shaded polygons and corresponding numbers on the map represent wolves having >20 independent radio locations and exhibiting movement characteristics consistent with a home range during 2011. See the following page for information regarding the wolf packs and home ranges.

Figure 4. Continued.

Map Number	Wolf Pack	Number of Wolves	Wolf Fate at the End of 2011	Breeding Pair Status	Home Range Size (mi^2)
1	Paradise	5	Free-ranging	Yes	91
2	Hawks Nest	5	Free-ranging	Yes[a]	137
3	Bluestem	4	Free-ranging	Yes	182
4	Rim	2	Free-ranging	No	141
5	Fox Mountain	2	Free-ranging	No	145
6	San Mateo	3	Free-ranging	No	232
7	Dark Canyon	4	Free-ranging	Yes	131
8	Luna	3	Free-ranging	No	155
9	Middle Fork	4	Free-ranging	Yes	50
10	Morgart's	1[b]	Free-ranging	No	620
11	Willow Springs	2	Free-ranging	No	108
12	Maverick	N/A[c]	Free-ranging	Yes	142

[a]This pack did not meet the strict definition of a breeding pair as per the definition in the 10j rule, however they did meet the definition of an "operational breeding pair."
[b]This wolf spent the majority of 2011 as a single wolf however it retained the pack name Morgart because it continued to utilize a specific territory on the BRWRA throughout the year.
[c]Wolf information (including numbers) on the Fort Apache Indian Reservation is proprietary and is not displayed.

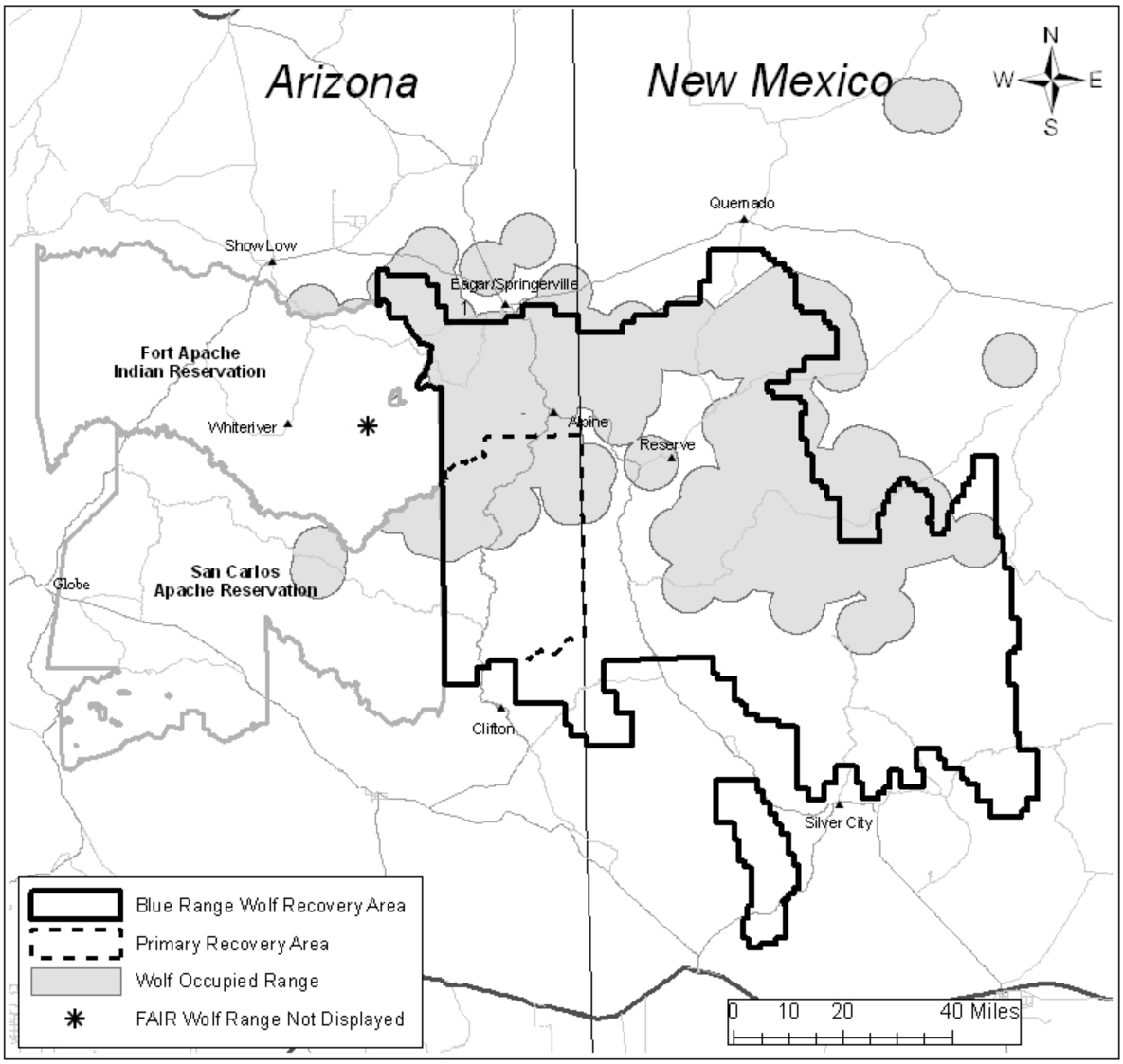

Figure 5. Mexican wolf occupied range in Arizona and New Mexico (2011) within the Mexican Wolf Nonessential Experimental Zone as defined in the Final Rule (USFWS 1998).

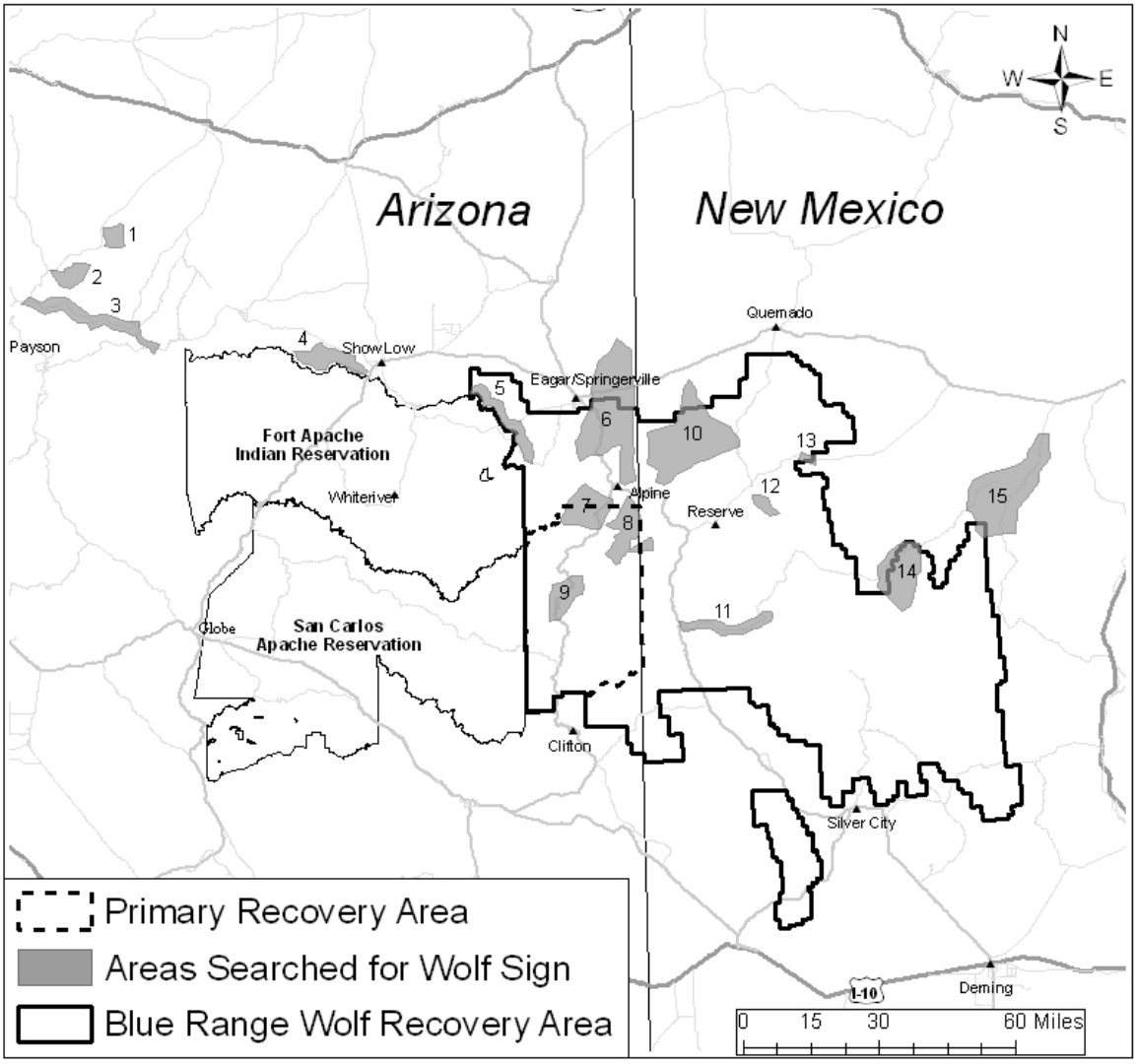

Figure 6. Areas searched and corresponding miles searched (driven or hiked) for uncollared wolf sign in Arizona and New Mexico during 2011. Search areas corresponding to "map numbers" as follows:

Figure 6 continued.

Map Numbers	Search Area	Miles Searched in AZ	Miles Searched in NM
1	Macks Crossing	17	0
2	McCarty Ridge	16	0
3	Mogollon Plateau	44	0
4	Juniper Ridge	51	0
5	Sunrise	87	0
6	Escudilla	509	0
7	Campbell Blue Creek	803	0
8	Blue River	399	17
9	Strayhorse	132	0
10	Spur Lake Basin	0	190
11	Whitewater	0	34
12	Cold Springs	0	5
13	Tularosa	0	2
14	Indian Peaks	0	60
15	San Mateo Mountains	0	72
	Total	**2058**	**380**
	Grand Total for AZ and NM	**2438**	

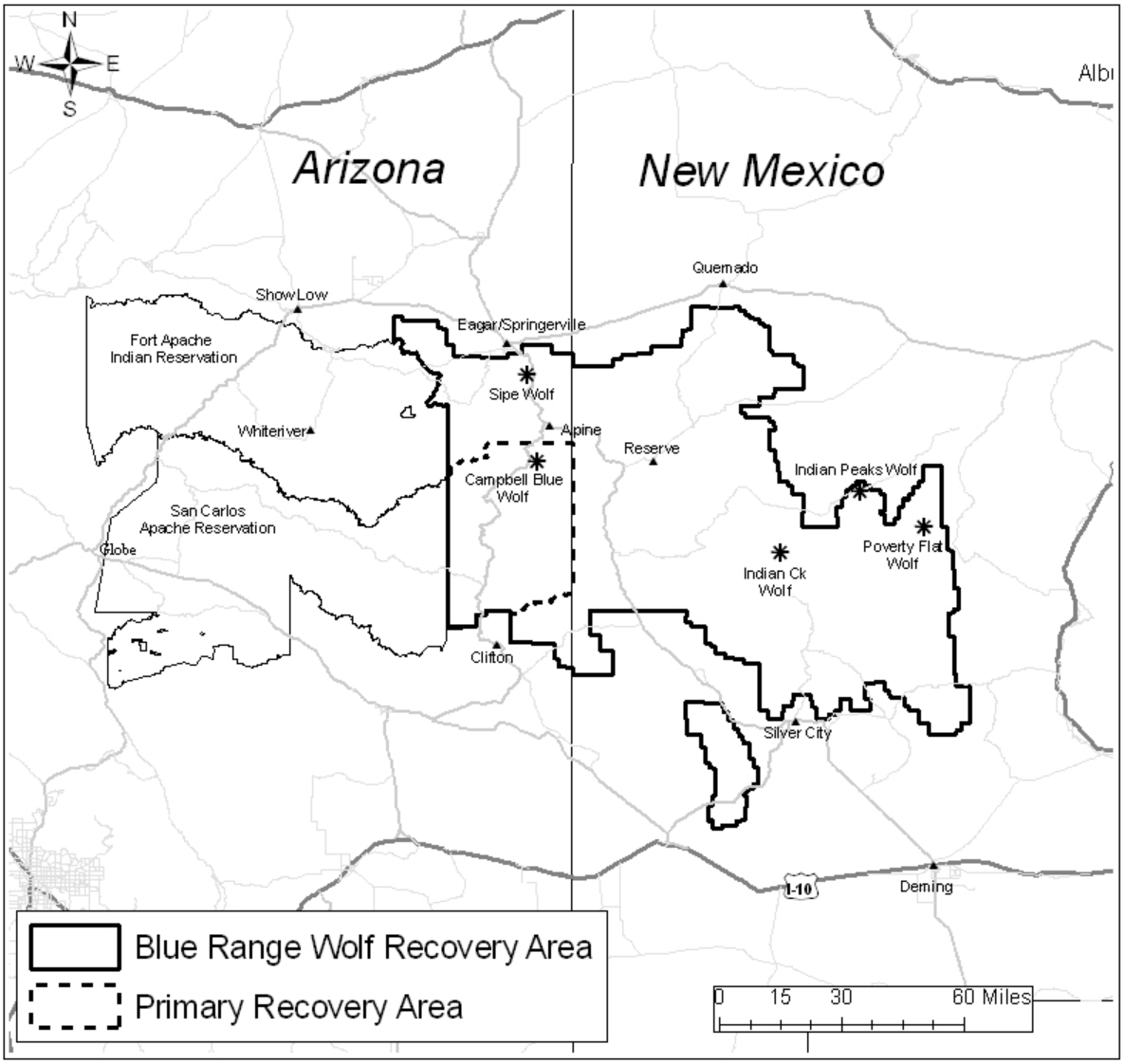

Figure 7. Uncollared wolves documented and counted in the 2011 wolf population in Arizona and New Mexico.

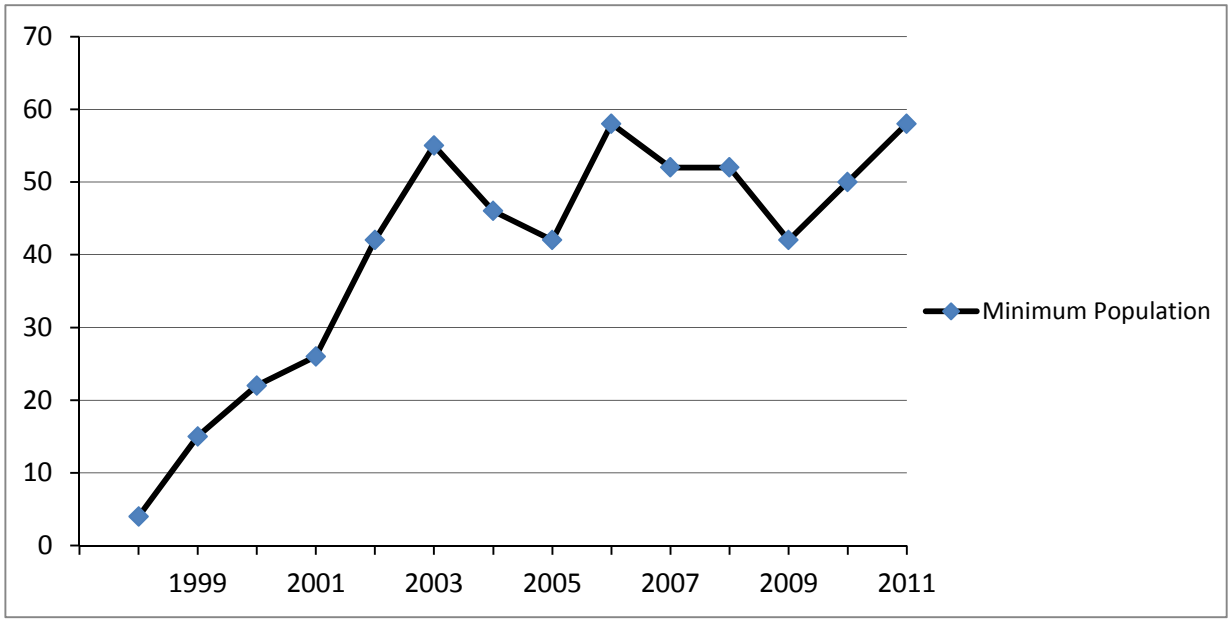

Figure 8. Mexican wolf minimum population estimates from 1998 through 2011 in Arizona and New Mexico.

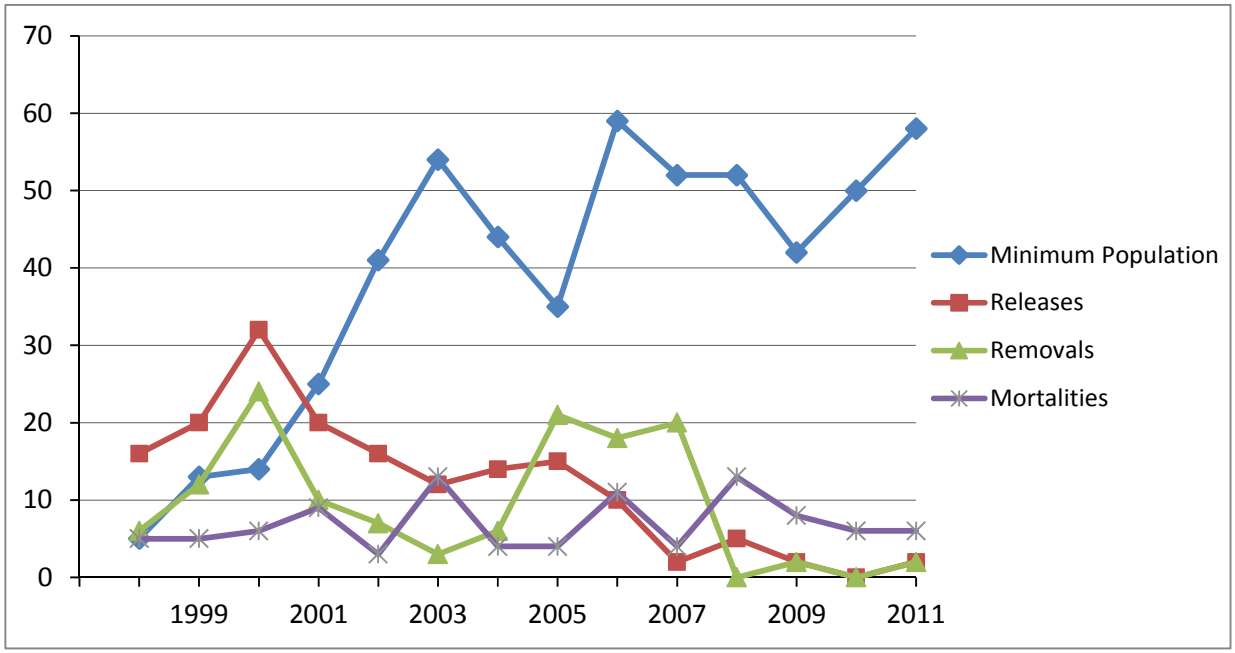

Figure 9. Mexican wolf population estimates and associated population parameters. Wolves released included: translocations (wolves re-released from captivity back into the wild) and initial releases (wolves released with no wild experience). Lethal control of wolves was counted within the wolves removed figures because they are associated with management actions (1998-2011).

Appendix A. 2011 Pack and Single Wolf Summaries

7. Pack Summaries

Bluestem pack (AM806, AF1042, mp1240, mp1242)

Throughout the year the Bluestem pack utilized their traditional territory in the central portion of the ASNF and the FAIR. In January, the Bluestem pack consisted of two wolves with functioning radio collars (AM806, and AF1042). In late April, the IFT documented denning behavior in the Bluestem pack. On May 19, the IFT documented the production of at least 3 pups. The denning area for this pack was directly impacted by the Wallow Fire. In June, the IFT set up a food cache to help insure the survival of the Bluestem pack during the Wallow Fire. The food cache was maintained into August. By the end of July 2 pups were documented as having survived. On August 13, a pup was trapped, collared, and assigned stud book number mp1240. On August 21, a pup was trapped, collared, and assigned stud book number mp1242. On November 24, an injured wolf, which the IFT confirmed as mp1242, was reported South of Big Lake. On November 24, the IFT determined that mp1242 had sustained an injury to its rear leg. On November 26, the IFT initiated efforts to capture mp1242 for needed medical attention. During capture attempts for mp1242 the IFT observed an uncollared wolf with the Bluestem pack, believed to be a pup of the year. On December 23, mp1242 was captured, however, it died en route to a veterinarian for medical attention. As of January 2012, the Bluestem pack consisted of four animals (AM806, AF1042, mp1240 and one uncollared pup); therefore, this pack was considered a "Breeding Pair" per the definition in the Final Rule (USFWS 1998). There were no depredations, removals, or translocations involving the Bluestem pack in 2011.

Dark Canyon pack (AM992, AF923, fp1250, fp1251)

In January, the Dark Canyon pack consisted of AF923 and AM992. Throughout the year, the IFT located the Dark Canyon pack within its traditional territory in the west-central portion of the GNF. In May, the IFT documented denning behavior in the Dark Canyon pack. On July 12, a colt suffered injuries to its legs and had to be euthanized as a result of the injuries. The depredation incident was assigned to the Dark Canyon pack. Although adult behavior indicated that pups survived, the IFT was not able to document the production of pups through the summer. On October 2, the IFT observed AF923 with two uncollared wolves. In early October, following the observation of the three wolves, the IFT initiated trapping efforts. On October10, two pups were trapped, collared, and assigned stud book numbers fp1250 and fp1251. As of December 31, the Dark Canyon pack consisted of AM992, AF923, fp1250, and fp1251; therefore, this pack was considered a "Breeding Pair" in 2011, per the definition in the final rule. No confirmed removals, translocations, or mortalities involving the Dark Canyon pack occurred in 2011.

Fox Mountain pack (F1188 and M1158)

Throughout January, the IFT documented M1158 traveling with Hawks Nest pack f1188 in the northeast-central portion of the ASNF in Arizona. In February, M1158 and f1188 (now considered part of the Fox Mountain pack) began traveling in the northwestern portion of the GNF in New Mexico. In April, the IFT documented denning behavior in the Fox Mountain pack. Throughout the summer, pack behavior suggested that pups were produced and survived, however, the IFT was unable to document neither pup production nor survival through July. On

June 17, an injured calf was investigated north of Luna on the GNF. The calf died three days later. The depredation incident was assigned to the Fox Mountain pack. On July 6, a dead calf was investigated near Romero Creek on the GNF. The depredation incident was assigned to the Fox Mountain pack. Throughout the remainder of 2011, the Fox Mountain pack was regularly located in the northwestern portion of the GNF. The IFT never confirmed the production nor survival of pups with this pack, thus, the Fox Mountain pack was not considered a ”Breeding Pair” in 2011 per the definition in the final rule. No confirmed removals, translocations, or mortalities involving the Fox Mountain pack occurred in 2011.

Hawks Nest pack (AF1110, AM1038, f1208, m1248, mp1209, mp1210, mp1244, fp1247)

In January 2011, the Hawks Nest pack consisted of AF1110, fp1208, mp1209, mp1210 and three uncollared wolves. In January, mp1209 began displaying movements away from the pack. On February 27, mp1209 was found dead after being hit by a car on highway 191 north of Springerville. In March, mp1210 began displaying dispersal movements to the northeast and into New Mexico. On April 1, mp1210 was found dead from a gunshot wound outside the BRWRA. In late April, the IFT documented denning behavior in the Hawks Nest pack. On May 27, the IFT documented the production of at least five pups. The denning area for this pack was directly impacted by the Wallow Fire. On June 12, a dead elk was placed in the vicinity of the den site in an effort to enhance pup survival during the Wallow Fire. On June 16, the IFT investigated the den site and did not document any dead wolves, and another supplementary food cache was set up in the vicinity of the previous den location. In July the IFT documented the presence of six pups with the pack. On August 23, the IFT found AF1110 dead due to a lightning strike. During September and October, the IFT observed f1208 displaying dominant and maternal behaviors, suggesting that f1208 may assume the alpha role within the pack in the subsequent year. On September 19, the IFT observed three pups and three adults/subadults north of the rendezvous site. One of the adults observed had a non-functioning rear leg and white radio collar. This wolf was later confirmed to be AM1038, formerly of the Fox Mountain pack. The results of genetic testing confirmed that AM1038 was the breeding male in 2011. On September 21, a pup was trapped, collared, and assigned stud book number mp1244. On September 27, a pup was trapped collard, and assigned stud book number fp1247. On October 2, subadult was trapped, collared, and assigned stud book number m1248. Wolf m1248 showed dispersal movements shortly after being trapped and remained apart from the pack throughout the remainder of the year. On October 6, fp1247 was caught again and given a second vaccination series. As of January 2012, the Hawks Nest pack consisted of five animals (AM1038, f1208, mp1244, fp1247, and one uncollared pup); therefore, the Hawks Nest pack was considered an “Operational Breeding Pair”, a modification of the “Breeding Pair” definition adopted by USFWS in 2008. No confirmed depredations or removals involving the Hawks Nest pack occurred in 2011.

Luna pack (AF1115, f1246, mp1241)

In January, the Luna pack consisted of AM1156 and AF1115. Throughout the year, the IFT located the Luna Pack within its traditional territory in the north-central portion of the GNF. In late April, the IFT documented denning behavior in the Luna pack. In June, the IFT was unable to locate AM1156. In June, AM1156 was considered “fate unknown”; the last location for AM1156 was obtained in mid-April via telemetry. In July, the IFT documented the production of six pups with the Luna pack. On August 17, a pup was trapped, collared, and assigned stud-book number mp1241. In September, a subadult was caught, collared, and assigned stud-book number

f1246 by WS personnel while trapping for coyotes. During the same trapping effort, mp1241 was recaptured, revaccinated and released. In mid-November, remote camera photos documented nine wolves in the Luna pack; AF115, mp1241, f1246, and six uncollared wolves. In late November, F1246 began displaying dispersal behavior, but was relocated with the Luna pack prior to December 31, 2011. On December 27, Morgart's pack M1155 was located in proximity to the Luna pack and between the two collared females (AF1115 and f1246) and mp1241. In January 2012, during the annual population count, AF1115 was located with M1155, f1246 was located with m1248 of the Hawks Nest pack, and mp1241 was located alone. During this time, remote cameras revealed that one uncollared pup was traveling with AF1115 and M1155. No other uncollared wolves were documented during the January population count. Although M1155 was located with AF1115 during the population count, they were not pair-bonded as of December 31, therefore: the Luna pack was not considered a "Breeding Pair" per the definition in the final rule. No confirmed removals, translocations, or mortalities involving the Luna pack occurred in 2011.

Middle Fork pack (AM871 and AF861)

In January, the Middle Fork pack consisted of AM871, AF861, and f1211. Throughout the year, the pack remained within their traditional territory in the central portion of the GNF and Gila Wilderness. On several occasions during April, the IFT located f1211 traveling away from the pack; however, it was relocated with the pack at the end of the month. In May, the IFT documented denning behavior in the Middle Fork pack. In June, the IFT again located f1211 traveling away from AF861 and AM871. In June, two dead calves were investigated and confirmed as wolf depredations. Because the calves died greater than 24 hours apart, f1211 who was traveling away from the pack and in the vicinity of the dead livestock was assigned two depredation incidents. In July, the IFT documented the production of at least six pups. In July, dispersing wolf f1211 had not been located with the pack since May and was considered a single wolf. On July 9, two dead yearling cows were investigated near Cooney Point. The depredation incidents were assigned to M871. In August, the IFT documented the survival of seven pups. During the January 2012 annual population count, the Middle Fork pack consisted of the two alpha animals and two uncollared pups, therefore; the Middle Fork pack was considered a "Breeding Pair" per the definition in the final rule. No confirmed removals, translocations, or mortalities involving the Middle Fork pack occurred in 2011.

Morgart's pack (M1155)

In January, the Morgart's pack consisted of M1155. On January 25, M1155 was captured outside the BRWRA and translocated to facilitate pair-bonding with F1105. On January 26, M1155 self-released form the holding pen prior to the arrival of F1105 from captivity; M1155 did not pair-bond with F1105 and returned to its traditional territory in the northeastern portion of the GNF. In May, the IFT documented M1155 traveling in central portions of the GNF. In late May, the IFT received information that this wolf may be traveling with another smaller-sized wolf. In June, the IFT confirmed that M1155 was traveling with another wolf. On November 21, a dead calf was investigated near O Bar O Canyon on the GNF. The depredation incident was assigned to M1155. Throughout December, the IFT documented M1155 traveling in the north-central portion of the GNF, largely within the Luna Pack territory. On December 27, M1155 was located in proximity to the Luna pack and between the two collared females (AF1115 and f1246) and mp1241. Per the final rule, Morgart's pack was not considered a "Breeding Pair" in 2011.

No confirmed removals, translocations, or mortalities involving the Morgart's pack occurred in 2011.

Paradise pack (AM795, AF1056, mp1243, mp1245)

At the beginning of 2011, the Paradise pack consisted of AF1056 and one other adult wolf. On January 20, AF1056 was captured and fitted with a new radio collar during the helicopter count and capture operation. On January 27, the IFT observed a large wolf with AF1056. On April 3, the IFT initiated effort to trap the animal traveling with AF1056. On April 4, AF1056 was trapped and fitted with a new radio collar. Blood collected during the capture event indicated that AF1056 was pregnant, suggesting that the animal traveling with AF1056 was a mature male. In early May, the IFT documented denning behavior in the Paradise pack. On June 3, the IFT documented the production of at least five pups. On June 20, AM795 was trapped and fitted with a new radio collar; confirming that the previous radio collar had failed in April 2010. Later in June the IFT determined that AF1056 had slipped her collar. On July 3, the Paradise pack was assigned a depredation involving one sheep. The sheep had escaped from an electric enclosure and was stuck in the mud near a pond during the night. On September 14, a pup was trapped, collared, and assigned stud book number mp1243. On September 16, AM795 was trapped again and given a second vaccination series. On September 25, a pup was trapped, collared, and assigned stud book number mp1245. On October 1, AF1056 was trapped again, and fitted with a new radio collar. On December 19, the IFT observed three pups, two of which were collared, with AM795. As of December 31, 2011 the Paradise pack consisted of five animals (AM795, AF1056, mp1243, mp1245, and an uncollared pup); therefore, the Paradise pack was considered a "Breeding Pair" per the definition in the Final Rule (USFWS 1998). There were no confirmed mortalities, removals, or translocations involving the Paradise pack in 2011.

Rim pack (AF858, AM1107, F1187, F1213)

Throughout the year, the Rim pack was located within its traditional home range in the central portion of the ASNF. In January 2011, the Rim pack consisted of four wolves (AF858, AM1107, F1187, and one uncollared wolf). On March 8, an adult wolf was caught, collared, and assigned stud book number F1213. This wolf was translocated from the SCAR to the Blue Vista area on the ASNF. On April 12, F1213 was located back with the Rim pack. On April 22, two separate depredation incidents were investigated on the SCAR, one incident was a confirmed wolf depredation and the other was a probable wolf depredation. Both incidents were assigned to the Rim pack. In late April, the IFT documented denning behavior in the Rim pack. The denning area for this pack was directly impacted by the Wallow Fire. In late July, the IFT located a potential den site and an elk carcass with potential pup sized tracks, however the IFT was unable to confirm the production or recruitment of pups from this pack during 2011. On July 19, AF858 and AM1107 were involved in a second confirmed depredation on the SCAR. On September 22, F1187 was found dead following a vehicle strike. On November 16, F1213 was confirmed dead. Necropsy results indicated that F1213 died from complications associated with a wound most likely caused by an elk antler. In January 2012, only AF858 and AM1107 were documented during the annual population count; therefore, the Rim pack was not considered a "breeding pair" in 2011 per the definition in the Final Rule (USFWS 1998). There were two confirmed mortalities, two confirmed depredations, and one translocation involving the Rim pack in 2011. No removals involving the Rim pack occurred in 2011.

San Mateo pack (AF903, AM1157, M1252, f1212, mp1249)

During January and February, the IFT located M1157 of the Fox Mountain pack traveling with AF903 in the traditional San Mateo territory. In February, following consistent documentation of AF903 and M1157 traveling together, the IFT considered M1157 part of the Sam Mateo pack. In late April, the IFT documented denning behavior in the San Mateo pack. On April 28, the IFT located the den and documented the production of five pups. On May 24, WS personnel investigated a dead cow and calf in the vicinity of Sand Flat on the GNF in New Mexico. It was determined that the cow was killed by a wolf; the calf was determined a probable wolf kill. The incident was assigned to AM1157 and f1212 from the San Mateo pack. During August, the IFT documented at least one pup and one adult-sized, uncollared wolf with the San Mateo pack. In October, a pup and subadult were captured, collared, and assigned stud-book numbers mp1249 and m1252. In November, the IFT documented f1212 traveling away from the pack on the edges of the pack territory. The IFT also documented m1252 displaying dispersal behavior, traveling widely through the BRWRA in Arizona and New Mexico, during November and December, respectively. During the January 2012 annual population count, the San Mateo pack consisted of three wolves (AF903, AM1157, mp1249); f1212 was located with an uncollared wolf to the south of San Mateo's traditional territory and M1252 was located alone in NM. San Mateo had only one surviving pup as of December 31 and therefore, was not considered a "Breeding Pair" per the definition in the final rule. No confirmed removals, translocations, or mortalities involving the San Mateo pack occurred in 2011.

Willow Springs pack (M1185)

In January, M1185, originally from the Middle Fork pack, traveled widely through northern portions of the BRWRA in both Arizona and New Mexico. Throughout February, the IFT located this wolf traveling widely through the north-central portions of the GNF. In March, M1185 began to localize in the north-central portion of the GNF. Spring locations of M1185 indicated the potential for denning behavior, however, the IFT had no evidence of M1185 traveling with another animal. In September, the IFT confirmed that M1185 was traveling with an uncollared wolf; evidence suggested that the uncollared wolf was a female. In October, M1185 and the associated uncollared wolf were named the Willow Springs pack. During the annual population count in January 2012, Willow Springs consisted of M1185 and an uncollared female wolf, therefore; the Willow Springs pack was not considered a "Breeding Pair" in 2011 per the final rule definition. No confirmed depredations, removals, translocations, or mortalities involving the Willow Springs pack occurred in 2011.

8. Individual Wolf Summaries

M1049

On January 28, the IFT translocated M1049 into the Hawks Nest Pack territory in efforts to facilitate pair-bonding with AF110. Unfortunately, this wolf did not pair-bond with AF1110 and instead became localized next to private residences in Nutrioso, Arizona. After multiple hazing attempts failed to deter this wolf from multiple nuisance incidents at residences, the IFT captured M1049 on February 2 and moved it to captivity. This wolf remains eligible for translocation back into the BRWRA.

F1105

In January 2011, F1105 was translocated from captivity into the wild in an attempt to facilitate pair-bonding with M1155. On February 7, F1105 was involved in the depredation of cow and a calf on private property near Cow Springs draw outside the BRWRA in NM. In April, the IFT documented this wolf traveling alone through northern portions of the GNF, repeatedly located near and on property and interacting with domestic dogs. The IFT initiated trapping efforts to capture F1105 and perform an inspection regarding its breeding status. During these efforts, F1105 localized in late April and the IFT documented the production of five pups. The IFT collected blood samples to determine the genetic makeup of the pups. Results indicated that the pups were not pure Mexican wolves, but the offspring of F1105 and a domestic dog. The IFT relocated the den, removed and humanely euthanized 4 pups; the fifth pup was not located at the den site. In June, the IFT confirmed that the wolf was traveling with a pup-sized canid, and initiated efforts to capture F1105 and the pup. On July 20, F1105 was captured, fitted with a new radio collar, and temporarily held in a pen to facilitate locating and capturing the remaining pup. The pup was not caught, however, by the end August, no evidence of the pup was collected by the IFT and F1105 began to travel more widely through the BRWRA in New Mexico, suggesting that the remaining pup may not have survived. At the end of August, the IFT located F1105 in the central portion of the GNF, where it remained through the fall. Despite continued efforts to document the presence of the hybrid pup, the IFT found no evidence of its survival. On September 1, F1105 was involved in the depredation of a calf near Cooney Prairie on the GNF. At the end of November, F1105 was documented associating with a domestic dog at a hunter's camp, and IFT personnel implemented capture efforts. In December, the IFT received several reports of F1105 interacting with domestic dogs and in proximity to private residences within the BRWRA in the central portion of the GNF. Due to these continued nuisance issues, a lethal removal order was issued by USFWS for F1105. On December 14, F1105 was lethally removed from the wild by Wildlife Services.

f1211

From May to July 2011, f1211 of the Middle Fork pack displayed dispersal behavior and was not located with its natal pack, therefore; f1211 was considered a single wolf in July. While dispersing from its natal territory, f1211 was assigned two depredation incidents. From August through November, f1211 was located in the north-central portion of the GNF. On November 18 and 19, the IFT documented f1211 traveling with another larger wolf. On November 22, f1211 was found dead. Necropsy results indicated that f1211 died of illegal gunshot.

Appendix B. Summary of sighting reports received from the public from January 1 through December 31, 2011.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
# AZ Reports	**0**	**4**	**6**	**5**	**3**	**2**	**2**	**5**	**4**	**2**	**6**	**3**	**42**
Known Wolf Reports	0	1	2	2	0	0	0	1	2	0	2	0	**10**
Unknown/Uncollared Reports	0	1	0	0	1	0	0	0	0	0	1	0	**3**
Non-wolf Reports	0	1	3	2	1	1	0	4	0	2	1	3	**18**
Probable Wolf Reports	0	0	0	0	0	0	1	0	1	0	1	0	**3**
Not Enough Information	0	1	1	1	1	1	1	0	1	0	1	0	**8**
# NM Reports	**0**	**0**	**2**	**3**	**2**	**1**	**2**	**0**	**1**	**2**	**3**	**9**	**25**
Known Wolf Reports	0	0	0	0	0	0	0	0	0	0	1	2	**3**
Unknown/Uncollared Reports	0	0	2	0	0	0	0	0	1	1	0	1	**5**
Non-wolf Reports	0	0	0	1	1	1	0	0	0	0	0	2	**5**
Probable Wolf Reports	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Not Enough Information	0	0	0	2	1	0	2	0	0	1	2	4	**12**
Total Sightings per Month	**0**	**4**	**8**	**8**	**5**	**3**	**4**	**5**	**5**	**4**	**9**	**12**	**67**

9. Personnel

Arizona Game and Fish Department
Chris Bagnoli, Field Team Leader
Jeff Dolphin, Wolf Biologist
Beth Wojcik, Wolf Technician
Quinn Harrison, Wolf Technician
Allison Greenleaf, Wolf Technician
Mike Godwin, Wildlife Manager Supervisor
Joel Weiss, Wildlife Manager
Aaron Hartzell, Wildlife Manager
Dave Cagle, Wildlife Program Manager
John Hervert, Wildlife Program Manager
Bill David, Chief Pilot
Basil Coffman, Pilot
Pete Applegate, Pilot
Steve Sunde, Pilot
Steve Dubois, Pilot

New Mexico Department of Game and Fish, *Agency cooperation ceased July 1, 2011.*
Ellen Heilhecker, Wolf Biologist
Mischa Larisch, Wolf Biologist
K.C. Gehrt, District Officer
Bobby Griego, District Supervisor
Ty Jackson, District Officer
Mike Matthews, District Supervisor
Andrew Teaschner, District Officer
Derek Theobald, District Officer
Storm Usrey, District Officer

USDA-APHIS Wildlife Services
Sterling Simpson, Field Team Leader/Wolf Management Specialist
Bill Nelson, Wolf Depredation Specialist
Armando Orona, Wolf Management Specialist
Chris Carrillo, District Supervisor
Keel Price, District Supervisor
Mike Kelly, Wildlife Biological Science Technician
Jedediah Murphy, Wildlife Biological Science Technician

U.S. Forest Service
Cathy Taylor – Forest Service Liaison to the Wolf Project

U.S. Fish and Wildlife Service
Sherry Barrett, Mexican Wolf Recovery Coordinator
Maggie Dwire, Assistant Mexican Wolf Recovery Coordinator
Elizabeth Jozwiak, Interagency Field Projects Coordinator

John Oakleaf, Fish and Wildlife Biologist
Melissa Kreutzian, Fish and Wildlife Biologist
Colby Gardner, Fish and Wildlife Biologist
Susan Dicks, Fish and Wildlife Biologist
Janess Vartanian, Wildlife Biologist
Dewey Wesley, Biological Technician
Tracy Pinter, Biological Technician
Peter Fitzpatrick, Biological Technician
Bonnie McDonald, Biological Technician (60 day hire)
Jim Ashburner, Lead Special Agent

USFWS Interns
Ryan Wilbur
Melissa Ruszczyk
Jacob Humm
Bonnie McDonald
Kyle Crowson
Adair McNear
Rob Wise
Sara Eno
Aaron Koehlinger
Trevor Smith

White Mountain Apache Tribe
Krista Beazley, Field Team Leader
Deon Hinton, Wolf Technician
Ivan Kasey, Wolf Technician
Bobby Tobin, Wolf Technician

Project Veterinarians
Dr. Ole Alcumbrac
Dr. Susan Dicks