

**RESULTS OF THE 1996  
BLACK-FOOTED FERRET RELEASE EFFORT  
IN AUBREY VALLEY, ARIZONA**

William E. Van Pelt, Nongame Mammals Program Manager  
Nongame Branch, Wildlife Management Division

Mark E. Brennan, Nongame Specialist  
Region III, Field Operations Division



Technical Report 120  
Nongame and Endangered Wildlife Program  
Program Chief: Terry B. Johnson  
Arizona Game and Fish Department  
2221 West Greenway Road  
Phoenix, Arizona 85023-4399

June 1997

## RECOMMENDED CITATION

Van Pelt, W.E. and M.E. Brennan. 1997. Results of the 1996 black-footed ferret release effort in Aubrey Valley, Arizona. Nongame and Endangered Wildlife Program Technical Report 120. Arizona Game and Fish Department, Phoenix, Arizona.

## ACKNOWLEDGMENTS

We acknowledge the efforts of the following people, whose assistance is greatly appreciated: Kim Kime, Tim Snow, Shawn Castner, Melissa Kreighbaum, Jim Witham, Rob Simonson, Dexter Oliver, Joey Sneva, Angela McIntire, Ben Gonzales, Larry Riley, Lisa Anderson, Richard Rico, Gerald Hammett, Buzzy Ayers, Tom Christensen, Nick Freeman, John Harvey, Tom Puckett, Paul Puckett, Bill Sturgeon, Tom Selby, Mike Kuhns, Bob Broschied, Arlen Flax, Don Mathis, Dave Hunt, Basil Coffman, Frosty Taylor, Bruce Sitko, Richard Wilde, Ron Tinseth, Tim Pender, Mike Senn, Bill Ough, Tim Baumgarten, Don Buckley, Darren Tucker, John Wangnild, Steve Ferrell, Rod Lucas, and Terry Johnson, Arizona Game and Fish Department; Craig Levy and Mike Fink, Arizona Department of Health Services; Debra Yazzie and Larry Benallie Sr., The Navajo Nation; Joe Christman and Jeff Williamson, The Phoenix Zoo; Dr. Carlos Reggiardo, University of Arizona; Gino Fornara, Animal Damage Control; Bill Austin, Pete Gober, Mike Lockhart, and Bruce Palmer, U.S. Fish and Wildlife Service; Aaron Clack, Black-footed Ferret Recovery Foundation; Tom Thorne, Wyoming Game and Fish Department; Dean Biggins and Jerry Godbey, Biological Resources Division of the U.S. Geological Survey; and volunteers from Northern Arizona University, Grand Canyon College, The Hualapai Nation, Biological Resources Division (formerly the National Biological Service) of the U.S. Geological Survey, and The Phoenix Zoo, who built pens and spotlighted in hopes of seeing the fabled green eye-shine.

## AMERICANS WITH DISABILITIES ACT COMPLIANCE

The Arizona Game and Fish Department complies with all provisions of the Americans with Disabilities Act. This document is available in alternative format by contacting Mary Turner, Nongame Branch, Arizona Game and Fish Department, 2221 West Greenway Road, Phoenix, Arizona 85023-4399 -- (602) 789-3501.

## PROJECT FUNDING

Funding for this project was provided by: voluntary contributions to Arizona's Nongame Wildlife Checkoff; the Arizona Game and Fish Department's Heritage Fund; Project W-95-M (Jobs 2 and 5), under the Federal Aid in Wildlife Restoration Act (Pittman-Robertson Act); and Title VI of the Endangered Species Act (Project E-5, Job 29).

## Table of Contents

|  |    |
|--|----|
| Introduction .....                       | 1  |
| Background.....                          | 1  |
| Methods.....                             | 2  |
| Results .....                            | 3  |
| Pen design.....                          | 3  |
| Pen integrity .....                      | 3  |
| Prairie dog monitoring.....              | 4  |
| Prairie dog trapping and quarantine..... | 4  |
| Disease Monitoring.....                  | 8  |
| Ferret Allocation.....                   | 8  |
| Pre-conditioning .....                   | 8  |
| On-site reproduction .....               | 14 |
| Ferret releases and monitoring.....      | 14 |
| Discussion .....                         | 14 |
| Recommendations.....                     | 15 |
| Literature Cited.....                    | 16 |

## Tables

|  |    |
|--|----|
| Table 1. Transects completed in Audley prairie dog town, Aubrey Valley, Arizona.....                       | 5  |
| Table 2. Transects completed in Pica Camp prairie dog town, Aubrey Valley, Arizona.....                    | 6  |
| Table 3. Transects completed in satellite prairie dog towns found within Aubrey Valley, Arizona .....      | 7  |
| Table 4. Results from the 1996 canine distemper and plague sampling effort in Aubrey Valley, Arizona ..... | 9  |
| Table 5. Description, history, and status of black-footed ferrets allocated to Arizona in 1996.....        | 11 |

**RESULTS OF THE 1996  
BLACK-FOOTED FERRET RELEASE  
EFFORT IN AUBREY VALLEY, ARIZONA**

William E. Van Pelt and Mark E. Brennan

INTRODUCTION

This report describes Arizona Game and Fish Department (AGFD) activities directed toward reintroducing the black-footed ferret (*Mustela nigripes*) into Aubrey Valley, Arizona, during calendar year 1996. Field activities included prairie dog density surveys; monitoring of diseases, such as canine distemper and plague, which may have a detrimental effect on establishing a self-sustaining ferret population; the use of on-site, pre-conditioning pens as a practical tool for releasing ferrets back into the wild; and the monitoring of released black-footed ferrets.

This reintroduction project is a cooperative effort among AGFD, Arizona State Land Department, The Phoenix Zoo, U.S. Fish and Wildlife Service (USFWS), The Navajo Nation, The Hualapai Nation, and private land managers. AGFD and USFWS are charged with project leadership, with AGFD assuming primary responsibility for initiating the field activities of this reintroduction project.

AGFD's ferret reintroduction activities are evaluated on an annual basis to help ensure that objectives outlined in the release protocol are being accomplished (Van Pelt 1996). Annual evaluations may determine that protocols or procedures need to be modified to allow for unforeseen circumstances or events.

BACKGROUND

Once occurring in 12 western states, the black-footed ferret was listed as endangered by the U.S. Fish and Wildlife Service (USFWS) on March 11, 1967. The ferret is also being considered for inclusion on AGFD's *Wildlife of Special Concern in Arizona* list (in prep.). It was included on AGFD's previous list *Threatened Native Wildlife in Arizona* (AGFD 1988), as endangered.

Since 1987, AGFD has been involved with black-footed ferret reintroduction activities (Yarchin 1988, Belitsky et. al. 1994). Beginning in 1990, matching funds have been made available to AGFD through Section 6 of the Endangered Species Act, and more recently, the AGFD Heritage Fund, to intensely evaluate existing habitat for possible reintroduction of black-footed ferrets in Arizona. After evaluating eight different prairie dog complexes, the Aubrey Valley was selected as Arizona's highest ranking site for potential ferret reintroduction (Van Pelt 1995).

Aubrey Valley is characterized by Brown (1982) as a Plains and Great Basin Grassland community, with annual precipitation averaging 25 to 30 cm. The valley floor is approximately

220 km<sup>2</sup> in area and ranges in elevation from 1600 to 1900 m. It is bounded on both sides by pinyon-juniper ridges along a 41 km northwest-southeast axis. The valley is 12 km wide near mile marker 124 of U.S. Highway 66.

While evaluating potential ferret habitat, a statewide scoping effort was initiated to determine and discuss with the public their attitude toward black-footed ferret reintroduction. Through the scoping process, it was determined that the designation of a nonessential experimental population (as prescribed in Section 10j of the Endangered Species Act of 1973, as amended) would be essential to development of a viable ferret reintroduction project in Arizona.

In October 1993, after recommending Aubrey Valley as the fourth reintroduction site to the Black-footed Ferret Interstate Coordinating Committee, AGFD and USFWS initiated the nonessential experimental population designation process. In November 1995, a proposed rule was published in the Federal Register (USFWS 1995). A hearing was held in Seligman, Arizona on December 12, 1995, to facilitate public comment. The public comment period closed on January 2, 1996. A final rule designating the Aubrey Valley Experimental Population Area (AVEPA) was published on March 20, 1996 (USFWS 1996).

The AVEPA is described as the Aubrey Valley west of the Aubrey Cliffs, starting from Chino Point and running along the crest of the cliffs north to Indian Route 18. The boundary then runs along Route 18 to the line bordering townships 27 and 26 north. It then runs east to the line bordering ranges 10 and 11 west at which point it turns south to the line bordering townships 24 and 25 north. From that point, the boundary runs east to the corner section marker and turns south to the Hualapai Indian Reservation boundary. The experimental boundary then follows the reservation boundary until it reaches U.S. Highway 66, where it turns east and runs along the highway approximately 6 km to a northern point of the Juniper mountains. It then follows the Juniper mountains back to Chino Point.

## METHODS

The Arizona reintroduction effort includes use and evaluation of a new release strategy that involves on-site, pre-conditioning pens. These pens allow animals an extended period in which to acclimate to their surroundings and condition themselves to the rigors of life prior to release. Because animals were pre-conditioned, it was assumed that they would disperse relatively short distances and establish home ranges in densely populated prairie dog towns, thus increasing their chances of survival (Biggins et al. 1993).

Acclimation pens were constructed from one-inch chicken wire, 17 gauge electric-fencing wire, solar-powered electric fencers, standard metal fence posts and connectors, and metal flashing. Each pen encompassed up to one acre of Gunnison's prairie dog (*Cynomys gunnisoni*) habitat and was divided into four equal sections. To augment existing holes, and encourage burrowing within the release pens by prairie dogs and ferrets, starter burrows measuring approximately 1.5 m in

length were dug using a 12.7 cm auger. Specific ferret husbandry protocols are outlined in other documents pertaining to this effort (Van Pelt 1996).

In addition to building pens and caring for ferrets, previously established monitoring programs were continued during this reporting period. These monitoring programs included techniques described by Biggins et al. (1993) for monitoring prairie dog densities, and procedures outlined by Clark et al. (1984) for nocturnal ferret surveys. With assistance from the Arizona Department of Health Services Vector and Zoonotic Diseases Division (VZD), the U.S. Department of Agriculture's Animal Damage Control (ADC), and the University of Arizona (UofA), a disease monitoring program similar to that described by Williams (1991) was also continued.

## RESULTS

### PEN DESIGN

Pen construction began in March 1996 and was completed by May. Initially, strong persistent winds in the AVEPA posed a problem in maintaining the aluminum flashing. Wind stress tended to tear flashing at points of attachment. To solve this problem, without compromising pen integrity, personnel secured the flashing at T-post with lengths of PVC tubing.

The outer-perimeter electrical fence was intended to be the first line of defense against livestock, and to a lesser extent terrestrial predators, damaging the integrity of the enclosure. At pens one, four, and eleven, cattle consistently breached the perimeter fence by knocking it over and rendering the electrical system inoperable. At these pens, the outer fencing was replaced by a low two-strand barbed wire fence with an electrical shock wire on the bottom.

Electrical wiring inside the pens required intensive maintenance. Vegetation had to be continuously removed and the strong winds would temporarily bend the fencing until it contacted the wire. After wind storms, electrical fencing had to be thoroughly checked for shorts. Placement of additional insulators was generally adequate to remedy shorts. Occasionally, fencing had to be adjusted to take up excessive slack that developed after wind storms.

### PEN INTEGRITY

Pre-conditioning pens were designed to keep ferrets and prairie dogs in and terrestrial predators and livestock out. The design has been effective at keeping coyotes, foxes and badgers out. Signs of various canids were noted around the pens, and on occasion, within the outer perimeter electrical wire. In addition, on two occasions near pens four and nine, badgers tried to dig into the pens. In both cases, no pens were breached by these potential predators.

Another concern for pen integrity was burrow systems extending to the outside. Pen sections were checked for burrow connectivity by forcing air into them with a leaf blower. Any burrows found leading to the outside were sealed with concrete. In pens 2, 4, 7, and 11, prairie dogs were

successful in breaching five different sections to the outside. In one incident, at pen four, a burrow was dug 9 m outside the pen before being detected. Unfortunately, six ferrets escaped from the section before we sealed the burrow entrance with concrete.

#### PRAIRIE DOG MONITORING

Based on studies of white-tailed (*C. leucurus*) and black-tailed prairie dog (*C. ludovicianus*) towns Biggins et al. (1993) proposed guidelines for analyzing prairie dog town densities. They defined good ferret habitat in white-tailed prairie dog towns as the proportion of transects in a hectare with at least 25 active burrows divided by the total number of transects.

Biggins et al. (1993) found burrow densities in Meeteetse, Wyoming, varied from 39 to 108 burrows per hectare for white-tailed prairie dogs (*C. leucurus*,) and studies in Arizona show similar ranges for the Gunnison's prairie dog (Van Pelt 1995). Pizzimenti (1975) discussed the relationship of Gunnison's prairie dogs to other species of prairie dogs. He considered Gunnison's prairie dog to be a member of the subgenus *Leucocrossuromys* or white-tailed prairie dogs. Therefore, Gunnison's prairie dog densities are assumed to compare closely to the white-tailed prairie dog when evaluating habitat.

Between May and July 1996, prairie dog activity and burrow density were sampled at 62 established transect blocks located throughout the AVEPA (Tables 1, 2, 3). Due to the arrival of summer rains, 29 blocks were resampled in August for a total of 457 transects. Thirty-six percent (range 10-91%) of the transects completed could be classified as good ferret habitat. Active burrow densities ranged from 0 to 69 per hectare, with an overall mean of 21.

Using burrow densities, prairie dog densities were estimated for the AVEPA. The AVEPA ranged from 3.94 to 7.76 prairie dogs per hectare with a mean of 5.32. The estimated prairie dog density was used to determine the black-footed ferret carrying capacity. Carrying capacity is reported in terms of black-footed ferret families. A ferret family is defined by Biggins et al. (1993) as 1 female, 3.3 young, and 0.5 male. The 1996 ferret family estimate for the AVEPA is 24 families. This is down five ferret families from 1995. Project biologists attributed the reduced carrying capacity to the decline in the prairie dog population, which was due to the prolonged winter drought that encompassed most of Arizona in 1995 and 1996.

#### PRAIRIE DOG TRAPPING AND QUARANTINE

We had mixed results in capturing prairie dogs for feeding ferrets. In the beginning, trapping occurred in the Seligman area, but, due to prolonged drought between April and July, trapping success was only around two percent. This capture rate was not high enough to keep ferrets on a strict prairie dog diet and they had to be supplemented with rabbit meat. In August, trapping was relocated to Flagstaff, Arizona and trapping success increased to 23 percent.

Table 1. Transects completed in Audley prairie dog town, Aubrey Valley, Arizona.

| Location | Active Burrows Per Hectare |      |      |      |      | Transects completed<br>92/93/94/95/96 | Site # |
|----------|----------------------------|------|------|------|------|---------------------------------------|--------|
|          | 1992                       | 1993 | 1994 | 1995 | 1996 |                                       |        |
|          |                            |      |      |      |      |                                       |        |

Table 2. Transects completed in Pica Camp prairie dog town, Aubrey Valley, Arizona.

| Location | Active Burrows Per Hectare |      |      |      |      | Transects completed<br>92/93/94/95/96 | Site # |
|----------|----------------------------|------|------|------|------|---------------------------------------|--------|
|          | 1992                       | 1993 | 1994 | 1995 | 1996 |                                       |        |
|          |                            |      |      |      |      |                                       |        |

Table 3. Transects completed in satellite prairie dog towns found within Aubrey Valley, Arizona.

| Location | Active Burrows Per Hectare |      |      |      |      | Transects completed<br>92/93/94/95/96 | Site # |
|----------|----------------------------|------|------|------|------|---------------------------------------|--------|
|          | 1992                       | 1993 | 1994 | 1995 | 1996 |                                       |        |
|          |                            |      |      |      |      |                                       |        |

Prairie dogs trapped outside Aubrey Valley were quarantined for 14 days, as required by USFWS. Quarantine facilities consisted of a bank of cages in rows of three, stacked on top of each other. Each row consisted of eight cages measuring 76 cm x 30 cm x 46 cm.

We had a capacity of quarantining 96 animals at one time (one per cage). Eight prairie dogs died during quarantine. All were tested by the VZD. One from near Seligman tested positive for plague. However, no other prairie dogs in the quarantine bank contracted the disease, even after an additional 14 days of quarantine, and all were fed out ferrets. We fed a total of 1138 prairie dogs (502 live and 636 dead) to ferrets.

#### DISEASE MONITORING

The VZD has monitored plague activity in Arizona since 1974. Outbreaks are monitored by documenting human cases, testing carnivore blood samples for titers, and testing flea pools collected from prairie dog burrows. To date, fleas collected from the Aubrey Valley have tested negative for plague, but titer samples from carnivores collected within and adjacent to the AVEPA have tested positive. In 1996, 30 carnivore blood samples were tested for plague and 14 tested positive (Table 4).

Canine distemper has been monitored in the Aubrey Valley area by AGFD since 1993. Samples have been collected 22 miles east and as far as 48 miles north of Seligman, Arizona. Blood samples and coyote specimens were sent to the UofA for analysis and histological interpretation. In 1996, 31 coyotes were submitted for analysis (Table 4). Seven had titer counts that indicated past exposure to distemper, but the disease was probably not active that year.

#### FERRET ALLOCATION

In 1996, a total of 65 ferrets were allocated to Arizona for release. All 65 were released directly into pre-conditioning pens at the release site. Females accompanied by kits were placed in pens with the highest burrow densities. To reduce stress to the individual animal or family unit, nest boxes were left in the pens until the animals abandoned them. It took about six days for a ferret or a family unit to leave the nest box. Females with kits tended to occupy burrows sooner than individual animals. Two animals were forced to leave their boxes at days 32 and 45.

Seven separate shipments of ferrets were made between March 27 and September 27, 1996. Age classes and sex ratios included 20 adult males, 30 adult females, and 15 kits over the age of 60 days (9 male and 6 female). In addition to the 65 ferrets designated for release, 6 male and 12 female ferrets with high breeding potential were shipped from the National Black-footed Ferret Conservation Center on December 7. These animals were held over-winter to evaluate the use of pre-conditioning pens for on-site breeding.

#### PRE-CONDITIONING

In 1996, 40 of the 65 ferrets placed in pens were released or escaped into AVEPA. Of the 25 not released, 10 died within the pens. Pen mortalities included four raptor predations, two possible snakebites, one asphyxiation, and three unknown causes. Twelve ferrets are considered missing-in-action (MIA). It could not be determined if these animals escaped, died, or were preyed upon. Two ferrets were retained for the spring breeding experiment. One animal unfit for release was sent to Phoenix for rehabilitation, but it died there (Table 5).

| Table 4. Results from the 1996 canine distemper and plague sampling effort in Aubrey Valley, Arizona. |                  |                        |                  |
|---|------------------|------------------------|------------------|
| Collection Date   | Distemper titers | Plague titers          | Estimated age    |
| February 14, 1996   | 1:4              | Negative               | Adult male       |
| February 17, 1996   | No sample        | Negative               | Adult male       |
| February 18, 1996   | 1:16             | 1:1024                 | Adult male       |
|   | < 1:4            | Negative               | Adult male       |
| February 19, 1996   | 1:128            | 1:128                  | Juvenile? male   |
|   | 1:1024           | 1:1024                 | Adult male       |
| February 21, 1996   | < 1:4            | Negative               | Adult male       |
| February 22, 1996   | 1:64             | 1:512                  | Adult female     |
| February 23, 1996   | 1:128            | 1:128                  | Adult male       |
|   | 1:32             | Negative               | Adult male       |
|   | 1:32             | Negative               | Adult male       |
|   | < 1:4            | Negative               | Adult male       |
|   | 1:64             | Negative               | Adult male       |
| March 16, 1996  | 1:32             | 1:64                   | Adult female     |
|   | 1:64             | 1:256                  | Adult female     |
|   | 1:64             | 1:512                  | Adult male       |
|   | < 1:64           | 1:64                   | Adult female     |
|   | < 1:32           | 1:1024                 | Adult male       |
|   | 1:32             | 1:4096                 | Adult male       |
|   | < 1:64           | 1:1024                 | Adult male       |
|   | 1:32             | 1:128                  | Adult female     |
|   | No sample        | Negative               | Adult male       |
|   | < 1:128          | 1:64                   | Adult male       |
|   | 1:128            | 1:32                   | Adult female     |
|   | 1:32             | 1:32                   | Adult female     |
|   | No sample        | 1:32                   | Adult male       |
| August 21, 1996   | 1:4              | No sample <sup>1</sup> | Juvenile male    |
| August 22, 1996   | < 1:128          | No sample <sup>1</sup> | Adult female     |
| August 23, 1996   | 1:8              | No sample <sup>1</sup> | Adult female fox |

No sample<sup>1</sup>-Nuboto strips were not available for plague sampling

| Table 4. Cont. Results from the 1996 canine distemper and plague sampling effort in Aubrey Valley, Arizona. |                  |                        |                            |
|---|------------------|------------------------|----------------------------|
| Collection Date   | Distemper titers | Plague titers          | Estimated age              |
| August 23, 1996   | 1:8              | No sample <sup>1</sup> | Adult male                 |
| September 3, 1996   | 1:4              | 1:128                  | Juvenile male              |
| September 10, 1996  | 1:16             | 1:256                  | Juvenile female            |
| September 20, 1996  | Negative         | Negative               | Juvenile                   |
| September 21, 1996  | 1:8              | 1:1024                 | Adult female fox           |
| Negative-1:64   | 24               | 16                     | NA                         |
| 1:128-1:4096  | 7                | 14                     | NA                         |
| No results  | 3                | 4                      | NA                         |
| <b>Grand Totals</b>   | <b>34</b>        | <b>34</b>              | <b>Juvenile/Total-5/34</b> |

---

No sample<sup>1</sup>-Nuboto strips were not available for plague sampling

| Table 5. Description, history, and status of black-footed ferrets allocated to Arizona in 1996. |     |     |         |           |  |
|---|-----|-----|---------|-----------|--|
| Studbook  | Age | Sex | Arrival | Days held | Status   |
| 469   | 4   | F   | 9/27    | 33        | Escaped 10/29: Unknown                                     |
| 1869  | Kit | M   | 9/27    | 54        | Released 11/19: Collared-last signal heard 11/20, unknown  |
| 1870  | Kit | F   | 9/27    | 33        | Escaped 10/29: Unknown                                     |
| 1871  | Kit | F   | 9/27    | 33        | Escaped 10/29: Unknown                                     |
| 1873  | Kit | M   | 9/27    | 33        | Escaped 10/29: Unknown                                     |
| 1874  | Kit | F   | 9/27    | 33        | Escaped 10/29: Unknown                                     |
| 726   | 3   | M   | 9/27    | 54        | Released 11/19: Collared-last signal heard 11/21, unknown  |
| 725   | 4   | M   | 9/27    | 217       | Retained for breeding                                      |
| 588   | 4   | F   | 9/27    | 28        | MIA: last observed 10/24                                   |
| 772   | 3   | F   | 9/27    | 0         | MIA: Not seen since placement                              |
| 818   | 3   | M   | 9/27    | 51        | Mortality 11/16: Necropsied-unknown cause                  |
| 795   | 3   | M   | 9/27    | 54        | Released 11/19: Collared, no signal since released-unknown |
| 887   | 3   | F   | 9/27    | 54        | Released 11/19: Collared, active around pen-unknown        |
| 1329  | 1   | M   | 3/27    | 215       | Released 10/15: Collared, slipped, recovered-unknown       |
| 1335  | 1   | M   | 3/27    | 163       | Released 9/5: Unknown                                      |
| 709   | 4   | M   | 3/27    | 163       | MIA: last observed 9/5                                     |
| 708   | 4   | M   | 3/27    | 218       | MIA: last observed 10/30                                   |
| 1414  | 1   | F   | 5/18    | 82        | MIA: last observed 8/7                                     |
| 597   | 4   | F   | 5/18    | 187       | Released 10/15: Collared-badger kill 11/20                 |
| 569   | 4   | F   | 5/18    | 49        | MIA: last observed 7/5                                     |
| 623   | 4   | F   | 5/18    | 152       | MIA: last observed 10/16                                   |
| 480   | 4   | F   | 5/18    | 69        | MIA: last observed 7/25                                    |
| 491   | 4   | F   | 5/18    | 151       | Released 10/15: Collared-last signal heard 10/26, unknown  |
| 631   | 4   | F   | 5/18    | 186       | Released 11/19: Collared-active around pen, unknown        |

| Table 5. Cont. Description, history, and status of black-footed ferrets allocated to Arizona in 1996. |     |     |         |           |   |
|---|-----|-----|---------|-----------|---|
| Studbook  | Age | Sex | Arrival | Days held | Status  |
| 499   | 4   | F   | 5/18    | 151       | Released 10/15: Collared-last signal heard 10/18, unknown   |
| 1148  | 2   | F   | 5/24    | 217       | Retained for breeding                                       |
| 565   | 4   | M   | 5/24    | 18        | Mortality 6/10: Necropsied-unknown cause                    |
| 541   | 4   | M   | 5/24    | 82        | Mortality 8/13: Unknown-only bones found                    |
| 1448  | 1   | F   | 6/4     | 3         | MIA: last observed 6/7                                      |
| 662   | 4   | M   | 6/4     | 24        | MIA: last observed 8/29                                     |
| 643   | 4   | F   | 7/31    | 8         | Mortality 10/7: Necropsied-eviscerated by raptor?           |
| 4NE96M1   | Kit | M   | 7/31    | 10        | MIA: last observed 8/10                                     |
| 655   | 4   | F   | 7/31    | 9         | Mortality 9/6: Necropsied-asphyxiation                      |
| 6NW96M1   | Kit | M   | 7/31    | 6         | Mortality 8/27: Necropsied-snakebite?                       |
| 481   | 4   | M   | 5/24    | 87        | Mortality 8/18: Necropsied-raptor predation                 |
| 495   | 4   | F   | 5/24    | 180       | Released 11/19: Collared-coyote kill 11/23                  |
| 596   | 4   | F   | 6/4     | 168       | Not released: Unhealthy-died later at Phx Zoo               |
| 471   | 4   | M   | 6/4     | 94        | Released 9/5: Unknown                                       |
| 489   | 4   | F   | 5/24    | 105       | Released 9/5: observed 10/21-unknown                        |
| 674   | 4   | F   | 7/31    | 77        | Released 10/15: Unknown                                     |
| 11NW96F1  | Kit | F   | 7/31    | 77        | Released 10/15: Collared, strange signal-probable mortality |
| 11NW96M1  | Kit | M   | 7/31    | 28        | Mortality 8/27: Necropsied-possible raptor predation        |
| 11NW96M2  | Kit | M   | 7/31    | 77        | Released 10/15: Collared, slipped, recovered-unknown        |
| 666   | 4   | F   | 7/31    | 77        | Released 10/15: Unknown                                     |
| 11NE96F1  | Kit | F   | 7/31    | 77        | Released 10/15: Collared-last signal heard 10/20, unknown   |

| Table 5. Cont. Description, history, and status of black-footed ferrets allocated to Arizona in 1996. |     |     |         |           |   |
|---|-----|-----|---------|-----------|---|
| Studbook  | Age | Sex | Arrival | Days held | Status  |
| 470   | 4   | F   | 8/6     | 71        | Released 10/15: Unknown                                     |
| 1589  | Kit | M   | 8/6     | 71        | Released 10/15: Collared-last signal heard 10/22, unknown   |
| 1590  | Kit | M   | 8/6     | 71        | Released 10/15: Collared, active outside pen-unknown        |
| 1592  | Kit | F   | 8/6     | 71        | Released 10/15: last observed 11/10-unknown                 |
| 437   | 5   | F   | 8/6     | 71        | Released 10/15: unknown                                     |
| 1616  | Kit | M   | 8/6     | 71        | Released 10/15: Collared, slipped, recovered-unknown        |
| 500   | 4   | F   | 6/4     | 77        | Released 11/19: Collared, active outside pen-unknown        |
| 501   | 4   | M   | 6/4     | 134       | Released 10/15: Collared-last signal heard 10/19, unknown   |
| 504   | 4   | M   | 6/4     | 134       | Released 10/15: Collared-last signal heard 10/19, unknown   |
| 483   | 4   | F   | 6/4     | 134       | Released 10/15: Unknown                                     |
| 484   | 4   | F   | 6/4     | 134       | Released 10/15: Unknown                                     |
| 472   | 4   | M   | 6/4     | 94        | Released 9/5: Unknown                                       |
| 1009  | 2   | M   | 6/4     | 94        | Released 9/5: Collared, slipped, observed 10/10-unknown     |
| 624   | 4   | F   | 6/4     | 2         | Mortality 6/6: Necropsied-raptor predation                  |
| 496   | 4   | M   | 6/4     | 134       | Released 10/15: Collared-coyote kill 11/12                  |
| 660   | 4   | M   | 6/4     | 1         | Mortality 6/5: Necropsied-dehydration, possible snake bite? |
| 661   | 4   | M   | 6/4     | 134       | Released 10/15: Collared-Mortality 10/18, cause unknown     |
| 539   | 4   | F   | 6/4     | 134       | Released 10/15: Collared-Mortality 10/18, cause unknown     |
| 728   | 3   | F   | 8/6     | 106       | Released 11/19: Collared, active around pen-unknown         |
| 589   | 4   | F   | 8/6     | 3         | MIA: last observed 8/9                                      |

Released ferrets spent 33 to 215 days ( $x = 98$  days) in pre-conditioning pens. While in pre-conditioning pens, a ferret had access to an average of nine live and ten dead prairie dogs. Because of limited quarantine space for prairie dogs, pre-conditioning priority was given to females with kits. On occasion, when no prairie dogs were available for feeding, rabbit and zoo predator diet was provided to ferrets. Nearly 66 kg of zoo diet and 34 kg of rabbit were fed to ferrets while in pre-conditioning pens.

Field personnel made eight observations of ferrets killing or attempting to kill prairie dogs. On two separate occasions, a female with kits watching was seen making kills. Personnel believed the females were teaching their young to kill. All other observed kills were by single adult animals.

#### ON-SITE REPRODUCTION

We estimated that 10 pregnant females were shipped to Arizona. Prior to shipping, all had been palpated and determined to be carrying young. Two weeks after arrival, one female appeared to have swollen teats, but no young ever appeared above ground. No other signs of whelping were observed.

#### FERRET RELEASES AND MONITORING

Releases occurred on September 5, October 15, and November 19. Release cohorts were comprised of 5, 22, and 13 ferrets, respectively. Of the 40 animals released, 24 were fitted with radio collars and monitored by personnel from the Biological Resources Division. Tracking was conducted using three null peak, fixed antenna stations located throughout the valley. Nocturnal or spotlight surveys were conducted in October, November, and December approximately 30 days after each release. A total of 581 hours was spent on nocturnal surveys.

From the first release, two animals (studbook numbers 489 and 1009) were documented as surviving at least 30 days post release. From the second release, female 597 survived 33 days. However, after being re-collared on November 16, she was killed by a badger on November 20. Five other ferret sightings were documented but the animals were not identified to individual.

Six of the 24 radio-collared ferrets have been confirmed as mortalities. Five were from the cohort released on October 15 and one was from the November release. We determined two were killed by coyotes (495 and 496), and one by a badger (597) and three were unknown. The longest single-night movement for a ferret (1590) was 10 km.

#### DISCUSSION

Modifications to the acclimation pen design would probably reduce ferret mortalities and escapes. Modifications would include entrenching the fencing material to a depth of at least four to five feet, adding doors for easier pen access, and affixing raptor protection.

By placing fencing deeper, there is a greater probability of bisecting additional prairie dog burrows and closing them off as a potential escape routes for ferrets. In addition to deeper fencing, personnel must initiate and maintain a prairie dog trapping campaign that extends as far as 14 m from the pens. This will prevent any prairie dogs from opening plugged burrows and allowing ferrets to escape prematurely. The preservation of a burrow system adjacent to the pens is a desired condition of this reintroduction effort. One of the objectives of this release is to encourage short, underground movements. By filling burrows after removing prairie dogs, dispersal distances for ferrets leaving pens may be lengthened and thus contribute to

The addition of pen doors would allow field personnel faster access for feeding and maintenance. Doors were originally omitted from the pen design because of concerns about unauthorized persons entering the unattended pens. However, since we have virtually continual presence of field personnel, unwanted pen entrance is unlikely to occur.

By adding raptor protection, ferret mortalities in the pens should be reduced. Raptor protection was omitted from the original design because we assumed raptor predation would be low. This was based on experiences from prairie dog releases in New Mexico and releases of ferrets in other states. However, we now know raptors can inflict heavy losses on recently released ferrets.

In August, ropes were strung diagonally across acclimation pens but proved inadequate for deterring raptors. After stringing pens, a golden eagle was observed swooping into a pen pursuing a prairie dog. Gill-netting and closely strung monofilament will be strung at a later date to deter access by raptors.

Due to the low trapping success for prairie dogs, we did not have any extra animals available for pen enhancement. A surplus of live prairie dogs would have enabled us to put these animals in pens and give them an opportunity to dig more burrows. Multiple burrow entrances in acclimation pens would have benefitted the preconditioning experience for ferrets.

#### RECOMMENDATIONS

1. Modify acclimation pens to reduce maintenance and enhance ferret survivability and retention. This would include adding raptor protection, entrenching fencing at least four feet underground, and adding doors.
2. If prairie dog trapping is below 20 percent, move trapping efforts to an alternate area. Trap enough prairie dogs to meet site objectives, such as pen enhancement. In addition, supply prairie dogs to captive breeding facilities for ferret imprinting.
3. White-tailed prairie dog species hibernate in the winter so ferrets should be released before the prairie dogs go underground. This would allow the ferrets to react to the behavioral change of the prairie dog population.
4. Investigate the use of underground fiber optics. This would assist in detecting the presence of kits.

LITERATURE CITED

- Arizona Game and Fish Department. 1988. Threatened native wildlife in Arizona. Arizona Game and Fish Department, Phoenix, Arizona.
- Arizona Game and Fish Department. In prep. Wildlife of special concern in Arizona. Arizona Game and Fish Department, Phoenix, Arizona.
- Belitsky D.W., K.A. Kime, and W.E. Van Pelt. 1994. Evaluation of a potential black-footed ferret reintroduction site in the Aubrey Valley, Coconino County, Arizona. Unpublished AGFD report to the U.S. Fish and Wildlife Service. Phoenix, Arizona. 21 pp.
- Biggins, D., B. Miller, L. Hanebury, B. Oakleaf, A. Farmer, R. Crete, and A. Dood. 1993. In Proceedings of the symposium on the management of prairie dog complexes for the reintroduction of the black-footed ferret. U.S. Fish and Wildlife Service, Washington D.C.
- Brown, D.E. (ed.). 1982. Biotic communities of the American Southwest-United States and Mexico. Desert Plants 4 (1-4): 1-342. University of Arizona Press, Tucson.
- Clark, T.W., T.M. Campbell III, M.H. Schroeder, and L. Richardson. 1984. Handbook of methods for locating black-footed ferrets. Wyoming BLM Wildlife Technical Bulletin No. 1. 55 pp.
- Pizzimenti, J.J. 1975. Evolution of the prairie dog genus *Cynomys*. Museum of Natural History papers. No. 39. 60 pp.
- U.S. Fish and Wildlife Service. 1995. Endangered and threatened wildlife and plants: Proposed establishment of a nonessential experimental population of black-footed ferrets in Aubrey Valley, Arizona. Federal Register Vol. 60 No. 220, Wed. November 15. pp. 57387-57396.
- U.S. Fish and Wildlife Service. 1996. Endangered and threatened wildlife and plants: Establishment of a nonessential experimental population of black-footed ferrets in Aubrey Valley, Arizona. Federal Register Vol. 61 No. 55, Wed. March 20. pp. 11320-11335.
- Van Pelt, W.E. 1995. Assessment of potential black-footed ferret habitat in northern Arizona. Nongame and Endangered Wildlife Program Technical Report 79. Arizona Game and Fish Department, Phoenix, Arizona.
- Van Pelt, W.E. 1996. The 1996 black-footed ferret release protocol for Aubrey Valley,

Arizona. Nongame and Endangered Wildlife Program Technical Report 99. Arizona Game and Fish Department, Phoenix, Arizona.

Williams, E.S. 1991. Survey for diseases of carnivores in the Conata Basin Badlands, South Dakota. Report to South Dakota Game and Fish and Parks.

Yarchin, J.C., G.C. Dickens, R.L. Glinski, and R.B. Spicer. 1988. An investigation of prairie dog populations and associated sensitive predators in the Little Colorado River Basin: Black-footed ferret, ferruginous hawk, and Swainson's hawk. Unpublished AGFD report to U.S. Bureau of Land Management, Phoenix District Office, Phoenix, Arizona.