

RESULTS OF THE 1997 BLACK-FOOTED FERRET RELEASE EFFORT IN AUBREY VALLEY, ARIZONA

William E. Van Pelt¹, Nongame Mammals Program Manager
Robert J. Simonson², Wildlife Specialist
Angela L. McIntire², Wildlife Assistant
Joey L. Sneva², Wildlife Assistant
Jill L. Bright², Wildlife Assistant

¹Nongame Branch, Wildlife Management Division
²Region III, Field Operations Division



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Program Chief: Terry B. Johnson
Arizona Game and Fish Department
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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 1997. 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; use of on-site, pre-conditioning pens as a practical tool for releasing ferrets into the wild and for breeding animals on-site; and monitoring of released 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 field activities.

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 by USFWS as endangered on March 11, 1967. The ferret also is 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 et. al. 1988, Belitsky et. al. 1994). Beginning in 1990, matching funds were 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 km² 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.

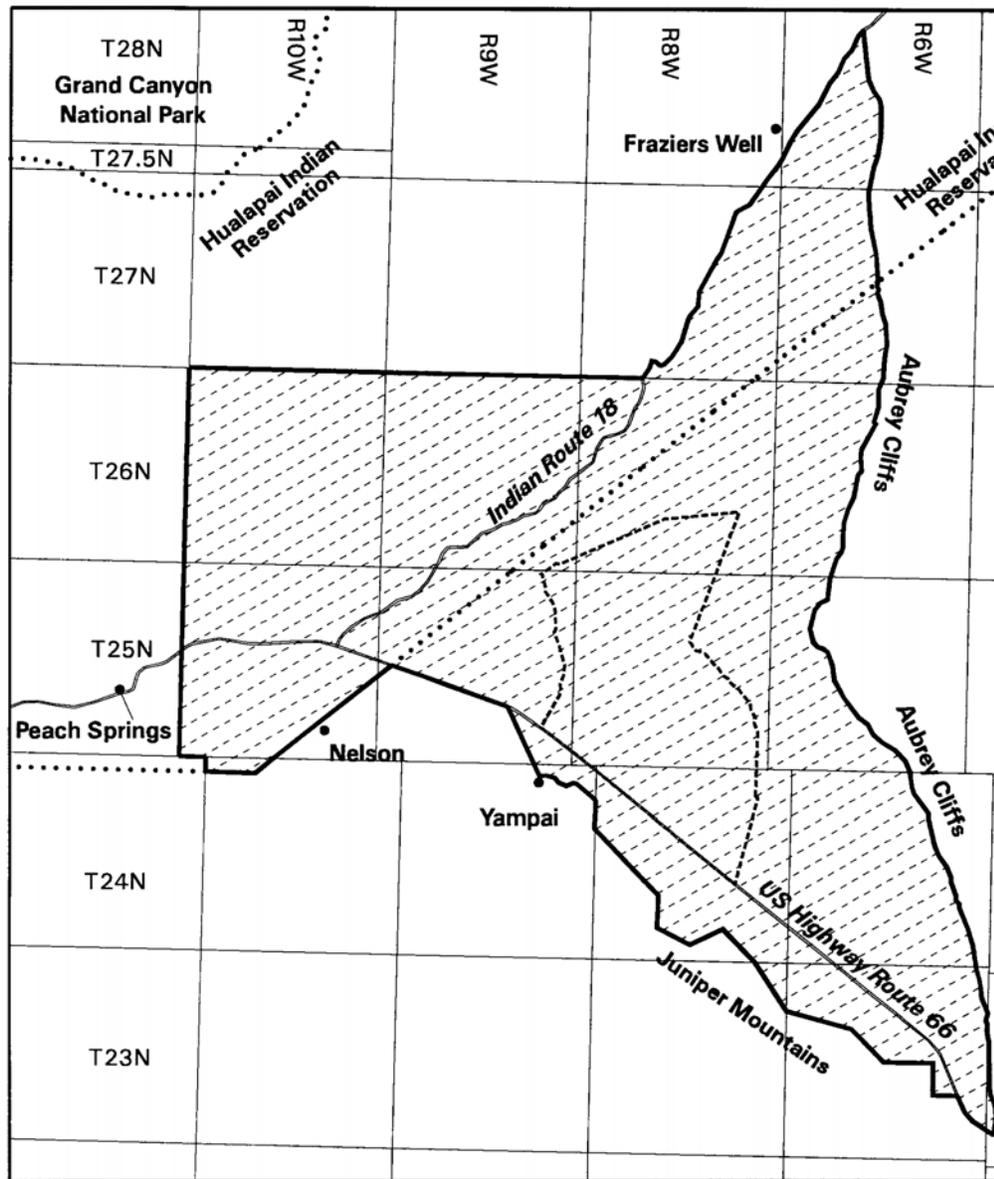
In October 1993, after recommending Aubrey Valley as the fourth reintroduction site to the Black-footed Ferret Interstate Coordinating Committee, AGFD and USFWS initiated the nonessential experimental population designation process. In November 1995, a proposed rule was published in the Federal Register (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. It 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 (Fig. 1).

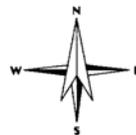
METHODS

The Arizona reintroduction effort includes use and evaluation of a release strategy that involves on-site, pre-conditioning pens (Van Pelt 1996, Van Pelt and Brennan 1997). In 1997, reintroduction efforts concentrated on experimental breeding trials within acclimation pens; no ferrets were released into the wild. Field activities focused on developing on-site protocols for breeding ferrets in large enclosures.

To establish on-site breeding protocols, personnel involved with black-footed ferrets in Arizona received training for black-footed ferret husbandry and breeding techniques at the National Black-footed Ferret Conservation Center and The Phoenix Zoo. Information obtained during these training exercises was used to develop protocols applicable for large, on-site pens.



Shaded area shows location of inset map in Arizona



 Black-footed ferre Reintroduction Ar

 Aubrey Valley Exl Population Area

Figure 1. Delineation of the Aubrey Valley Experimental Population Area.

The breeding technique used by Arizona started with the placement of ferrets into acclimation pens. A single male was placed in one section of each pen adjacent to two compatible females. If possible, females were placed opposite each other in these pens to reduce potential territorial strife. Placement occurred at least three months prior to the onset of estrus. Biologists trapped and monitored the reproductive condition of each ferret at least once per week.

When ferrets displayed physical and behavioral signs of breeding, males were allowed access to adjacent females through passive introduction. This was accomplished by placing plastic tubing through a hole cut in the fencing between pens for the ferrets to access each other. Males could only access one female at a time. Biologists monitored their movement between pens and watched for signs of compatibility. Incompatible ferrets were immediately separated and returned to their respective pens. If a pairing was incompatible, or there were no males in a pen, a male ferret was trapped and transferred to a pen of a receptive female. This procedure was repeated until all healthy females were bred.

Successful breeding was inferred through observation of physical and behavioral signs displayed by the ferret. Physical signs used for determining possible breeding included: orange saliva signs on the back of the neck, decrease in vulval swelling shortly after pairing, and a distended abdomen near potential whelping date. Behavioral characteristics used for determining possible success for breeding included an increase in secretiveness during the gestation period followed by a decrease in activity around the estimated whelping date.

Dates of anticipated whelping were calculated for each female based on the dates they were successfully paired with a male. The females that were thought to be pregnant were given an increased diet three days before their due date. They were fed twice the normal amount of food, or 200 grams per day. Interestingly, most of them eagerly took all food and exhibited little if any weight gain as a result of the food increase. Females were checked regularly after the estimated whelping date for behavioral or physical signs that their dietary needs were not being met. Biologists watched for signs such as weight loss and excessive begging behavior indicative of special needs.

In addition to breeding efforts, previously established monitoring programs were continued in 1997. 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 Wildlife Services program, and the University of Arizona (UofA), a disease monitoring program similar to that described by Williams (1991) was also continued.

RESULTS

PEN DESIGN

Acclimation pens continue to need constant maintenance. Exposure to the elements has stretched fencing material and resulted in electrical shorts that need to be located and remedied on a daily basis. Adding insulators and adjusting for slacks were adequate to remedy shorts. In addition, the monofilament line strung to deter raptors occasionally snapped and had to be replaced.

By installing vertical PVC tubing to stabilize flashing in 1996, ripping and maintenance of flashing was greatly reduced in 1997.

In 1997, all pens were fitted with sliding metal doors. This allowed easier access for personnel taking care of ferrets. Each pen had four doors. Two were on the outside of the pens and allowed personnel to enter the pens. The other two doors were on the inside and led to the other two sections not reachable from the outside. The doors are constructed of tubular aluminum and ½-inch hardware cloth. The frames were made from welded channel iron and rebar. Each outside door was secured with a padlock.

PEN INTEGRITY

The pens have continued to be successful at keeping terrestrial predators out; However, prairie dogs digging under the fencing continues to be a challenge. Pen breaches are located using a leaf blower and blowing non-toxic smoke into burrows. Burrows that compromise the pen's integrity are sealed with chicken wire and concrete. To prevent further digging into pens, all prairie dogs within approximately 10 m of the pens are trapped and removed.

Pens that had the outer electrical fencing replaced with barbed wire have been very successful at keeping livestock away. This remedy will be used on other pens that warrant it, if livestock continue to damage perimeter fences.

The original intent of the pre-conditioning pens was to hold animals for three months pending release. We have been quite successful at holding animals for this period of time, and six of the 34 animals have been held for more than a year. By incorporating minor pen modifications, such as monofilament line for raptor protection, the pen design was improved to allow for holding animals longer and to attempt on-site breeding. Other actions implemented to increase holding times included intense spotlighting after the arrival of new animals to guard against escapes, prairie dog trapping in the immediate area surrounding pens, filling and marking possible problematic burrows, and creating new solutions to prevent burrow escapes. These actions were necessary to make the transition from short term holding to a more long-term holding capacity. The past misfortunes and current successes of our pen design have been of value to other sites that use pre-conditioning pens.

PRAIRIE DOG MONITORING

In 1997, personnel mapped the Aubrey Valley prairie dog complex (AVC) using Global Positioning System (GPS) units. The AVC is comprised of 16 towns with a total acreage estimate of 12,001 ha (29,656 ac) (Fig. 2). This is up from 7838 ha (19,368 ac) estimated in 1996 for 21 towns identified. Reduction of the number of towns in the AVC was due to expansion of bigger towns in the complex. For example, three towns -- Last Chance, Lone Tree, and Crossroads -- were incorporated into Pica Camp, Chicken Leg was incorporated into Cliff, and Burrow Pit was included in South Audley. We believe the observed expansion of AVC is due to a combination of more accurate mapping and better habitat conditions.

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 a measure of good ferret habitat in white-tailed prairie dog towns to be 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*). Surveys 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 1997, prairie dog activity and burrow density were sampled at 64 established transect blocks located throughout the AVEPA (Tables 1, 2, 3). We ran 295 transects, with 37% of the transects completed being classified as good ferret habitat. Active burrow densities ranged from 0 to 62 per hectare, with an overall mean of 22.

Using burrow densities, prairie dog density estimates for AVEPA ranged from 3.94 to 11.15 prairie dogs per hectare ($x = 6.52$). Estimated prairie dog density was used to determine 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 1997 ferret family estimate for AVEPA is 40 families. This is up 16 ferret families in 1996. Project biologists attribute the increased carrying capacity to recovery of the prairie dog population from the winter drought of 1995-1996.

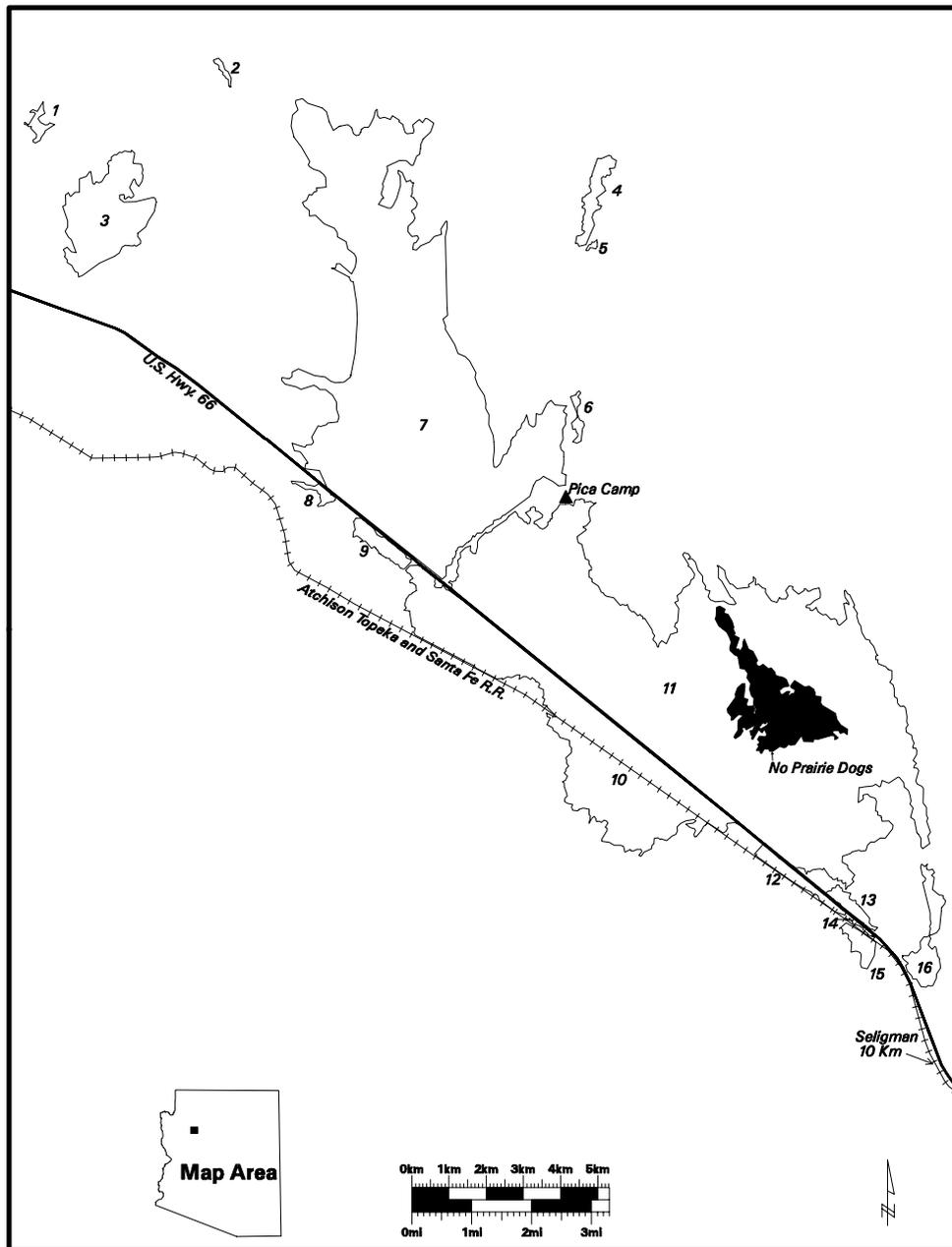


Figure 2. Prairie dog towns within the Aubrey Valley Complex.

- | | | | |
|------------------|---------------|------------------|-----------------------|
| 1. Reservation | 5. Owl Track | 9. Mission | 13. North Caterpillar |
| 2. Prairie Hills | 6. Valley | 10. South Audley | 14. Streamline |
| 3. Grand Canyon | 7. Pica Camp | 11. North Audley | 15. Railroad Corner |
| 4. Cliff | 8. Devil Horn | 12. Tin Shack | 16. South Caterpillar |

Table 4. Status of prairie dogs quarantined and processed at Seligman, Arizona.	
Status of prairie dogs brought to Seligman	Number
Processed and frozen for over-winter feeding	563
Used for live-feeding to ferrets	55
Known to have escaped	25
Found dead	3
Killed by other prairie dogs	7
euthanized due to suffering	1
Assumed to have escaped	7
Total	661

We also trapped prairie dogs in Aubrey Valley, primarily near acclimation pens. These animals were fed live to ferrets without being quarantined. Live trapping near pens did not provide adequate numbers of prairie dogs for daily feeding. To supplement live-feeding, additional prairie dogs were shot, cleaned, and immediately fed to ferrets. Three prairie dogs died during quarantine and were necropsied by the University of Arizona. Cause of death was not attributed to plague.

In 1997, 974 prairie dogs were collected for the Arizona reintroduction effort. We sent 200 to Wyoming for distribution to the captive breeding program, fed 364 live to ferrets, and froze 410 to feed ferrets being held for breeding trials.

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 1997, 44 coyote blood samples were tested for plague and seven (16%) tested positive (Table 5). Two of the seven positives were juvenile coyotes, but both were collected outside and east of Aubrey Valley. As observed in past surveys, plague is active in the Seligman area, but no recent activity has been observed within Aubrey Valley.

Table 5. Results from the 1997 canine distemper and plague sampling effort in Aubrey Valley, Arizona.			
Collection Date	Distemper titers	Plague titers	Estimated age
January 24, 1997	No sample	1:32	Adult female
February 26, 1997	<1:4	1:32	Juvenile female
March 8, 1997	<1:4	Negative	Juvenile female
	No sample	1:4096	Adult male
	No sample	Negative	Juvenile female
	No sample	1:256	Juvenile male
	1:32	Negative	Adult male
	No sample	Negative	Adult male
	No sample	1:64	Adult female
	No sample	Negative	Adult male
	No sample	Negative	Adult female
	No sample	Negative	Adult male
	1:128	1:32	Adult female
March 9, 1997	1:4	Negative	Adult female
	1:64	Negative	Adult female
	<1:4	Negative	Adult male
	No sample	1:256	Juvenile female
	1:4	1:64	Juvenile female
	No sample	1:256	Adult male
	1:32	1:128	Adult male
	<1:4	Negative	Adult male
June 6, 1997	No sample	Negative	Adult female
July 3, 1997	<1:4	Negative	Adult female
July 9, 1997	1:64	Negative	Adult female
	<1:4	Negative	Adult female
July 10, 1997	<1:4	Negative	Adult female
July 11, 1997	1:4	Negative	Adult female

July 12, 1997	<1:4	1:128	Adult male
	<1:4	Negative	Adult male

Table 5. Cont. Results from the 1997 canine distemper and plague sampling effort in Aubrey Valley, Arizona.			
Collection Date	Distemper titers	Plague titers	Estimated age
July 13, 1997	1:8	Negative	Adult male
	1:256	Negative	Adult female
July 14, 1997	1:4	No sample	Adult male
	1:4	No sample	Adult male
October 7, 1997	Negative	1:32	Juvenile male
	Negative	1:32	Adult male
	Negative	1:128	Adult male
October 8, 1997	Negative	Negative	Adult male
	Negative	1:64	Adult female
	Negative	Negative	Juvenile male
October 9, 1997	1:4	1:64	Adult male
October 10, 1997	1:8	Negative	Juvenile female
October 12, 1997	1:32	Negative	Juvenile female
October 14, 1997	1:16	1:32	Juvenile male
	1:128	Negative	Adult male
	1:128	1:64	Adult male
	1:16	Negative	Adult female
Negative-1:64	30	37	
1:128-1:4096	4	7	
No samples	12	2	
Grand Totals	46	46	Juvenile/Total-11/46

Canine distemper has been monitored in the Aubrey Valley area by AGFD since 1993. Blood samples and coyote specimens were sent to the University of Arizona for analysis and histological interpretation. In 1997, 34 coyotes were submitted for analysis (Table 5). Four had titer counts indicating past exposure to distemper. Canine distemper was probably not active in 1997, because all the juvenile coyotes collected during the sampling period tested negative.

FERRET ALLOCATION

In 1997, 53 ferrets were involved in the Arizona recovery effort (Table 6). Thirty-three were

newly allocated and 20 were held over from 1996. Shipments of ferrets received in 1997 occurred on August 15 (11 animals), October 21 (8 animals), November 14 (9 animals), and December 7 (5 animals). Of the 33 animals received, 24 were adults and 9 were kits.

Table 6. Description, history, and status of black-footed ferrets used in Arizona reintroduction effort in 1997.							
Studbook	Age	Sex	Arrival	Days held	Dead Prairie dogs fed ¹	Live Prairie dog fed ¹	Status
1148	2	F	5/24/96	316	28	21	Escaped 4/12/97; last observed 1/17/98
725	4	M	9/27/96	126	14	4	Mortality 1/30/97; possible raptor
664	4	F	12/7/96	78	4	0	MIA: Last observed 2/1/97
737	3	F	12/7/96	254	19	14	Mortality 8/17/97; possible anemia
738	3	F	12/7/96	178	14	0	MIA: last observed 5/21/97-coccidia exposure
780	3	M	12/7/96	62	4	0	Mortality 2/6/97; possible raptor
782	3	F	12/7/96	296	29	19	MIA: last observed 9/21/97-tooth problems
785	4	F	12/7/96	378	40	19	In pen
796	3	F	12/7/96	127	7	0	Mortality 4/12/97: Unknown
797	3	F	12/7/96	118	8	0	MIA: last observed 4/1/97-after breeding
817	4	M	12/7/96	399	35	12	Mortality 1/10/98; possible raptor
832	4	F	12/7/96	378	47	20	In pen
836	3	F	12/7/96	105	4	0	MIA: last observed 3/16/97
867	4	F	12/7/96	378	41	17	In pen
884	3	F	12/7/96	235	24	15	MIA: last observed 7/29/97
902	4	M	12/7/96	214	17	14	MIA: last observed 7/7/97
1011	3	M	12/7/96	139	10	0	MIA: last observed 4/24/97
1028	3	F	12/7/96	378	47	25	In pen
1285	2	M	12/7/96	378	32	22	In pen
1350	1	M	12/7/96	140	14	0	MIA: last observed 4/26/97-moved this day
1039	3	F	8/15/97	138	16	3	MIA: last observed 1/2/98
1135	3	F	8/15/97	190	18	1	Mortality: 2/24/98; possible raptor
1904	Kit	M	8/15/97	0	0	0	MIA: Not seen since placement
1905	Kit	F	8/15/97	141	18	1	In pen
1906	Kit	F	8/15/97	24	5	0	MIA: last observed 9/7/97-coccidia exposure
1911	Kit	M	8/15/97	9	2	0	MIA: last observed 8/24/97
1912	Kit	M	8/15/97	141	16	2	In pen

¹as of December 19, 1997

Table 6 cont. Description, history, and status of black-footed ferrets used in Arizona reintroduction effort in 1997.							
Studbook	Age	Sex	Arrival	Days held	Dead Prairie dogs fed ¹	Live Prairie dog fed ¹	Status
1915	Kit	M	8/15/97	12	3	0	MIA: last observed 8/27/97-escaped before
1917	Kit	F	8/15/97	10	2	0	MIA: last observed 8/25/97
1922	Kit	M	8/15/97	141	16	3	In pen
1923	Kit	M	8/15/97	141	17	3	In pen
1027	3	F	10/21/97	75	5	0	In pen
1047	3	M	10/21/97	75	6	0	In pen
1089	3	F	10/21/97	75	6	0	In pen
1136	3	F	10/21/97	75	6	0	In pen
1143	3	F	10/21/97	75	6	0	In pen
1179	3	F	10/21/97	75	5	0	In pen
1244	3	F	10/21/97	75	3	0	In pen
1499	2	M	10/21/97	75	6	0	In pen
1056	3	F	11/14/97	48	2	0	In pen
1061	3	M	11/14/97	48	2	0	In pen
1110	3	F	11/14/97	47	2	0	MIA: last observed 12/31/97
1113	3	F	11/14/97	48	2	0	In pen
1200	3	F	11/14/97	48	1	0	In pen
1301	2	M	11/14/97	48	2	0	In pen
1351	2	F	11/14/97	48	2	0	In pen
1437	2	F	11/14/97	48	2	0	In pen
1614	1	M	11/14/97	48	2	0	In pen
1137	3	F	12/7/97	24	1	0	In pen
1079	2	F	12/7/97	24	1	0	In pen
1001	3	M	12/7/97	24	1	0	In pen
1134	3	F	12/7/97	24	1	0	In pen

¹as of December 19, 1997

1090	3	F	12/7/97	24	1	0	In pen
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¹as of December 19, 1997

In 1997, six mortalities were documented. Four were probably caused by raptor attacks; the other two ferrets died of unknown causes. In one of the unknown mortalities, anemia may have attributed to the death of the animal. The raptor attacks occurred prior to the final installation of the raptor protection.

Sixteen animals are considered missing-in-action. Missing-in-action is defined as not being able to ascertain if ferrets died underground, were killed, or escaped.

One adult female escaped in April 1997. She was located near pens 2 and 3 in early 1998. She had survived over 270 days and was last observed south of pen 7 on January 17, 1998.

The remaining 34 animals are being maintained in the acclimation pens at the release site. Of the 20 animals allocated in 1996, six are still being held in the pens. Of the 33 ferrets allocated in 1997, five are considered missing-in-action and the remaining 28 are in the pens.

PRE-CONDITIONING

All ferrets on-site in 1997 were maintained in acclimation pens for breeding trials; none were released. As in 1996, ferrets were received in nest boxes from the breeding facilities. The nest boxes were placed in pens to reduce stress while the ferrets explored their new surroundings. The nest boxes were removed after the ferrets occupied a burrow. All surviving ferrets placed in December 1996 have had the opportunity to kill up to 25 live prairie dogs. Those received since October 21 have had little or no opportunity to kill prairie dogs in the pens, since most of the prairie dogs in Aubrey Valley had already entered hibernation. These ferrets will be fed live prairie dogs this summer to pre-condition them and any kits with the intention of releasing the best adult candidates with their kits.

ON-SITE REPRODUCTION

Nine females and 5 males were available at the beginning of the breeding season when field biologists began monitoring animals for reproductive condition (Table 7). One female was never paired because of health reasons. Eight pairings were accomplished in 1997. However, one female was presumed killed while with the male underground. The male was observed the day after the pairing with blood on his snout and the female was never seen again. The first pairing occurred on March 31 and the last pairing occurred on May 24.

Of the seven successful pairings, two females disappeared prior to their whelping date. At least two of the females paired exhibited orange salivary stains on the nape of their necks indicative of mating activity. One of the females was observed sharing a burrow with the paired male for three days.

Table 7. Female ferrets available for breeding in 1997.	
Studbook number	Breeding status
738	In estrus 5/4; paired with 817-MIA before whelping date
782	In estrus 5/22; paired with 902-positive signs of breeding
884	In estrus 5/14; paired with 1285-MIA before whelping date
737	Not paired due to health
1028	In estrus 4/1. paired with 1350, 1285-no signs of breeding
867	In estrus 5/11; paired with 1285-positive signs of breeding
797	In estrus 3/31; paired with 902-presumed killed by male
832	In estrus 4/19; paired with 1011-positive signs for breeding
785	In estrus 5/24; paired with 902-positive signs for breeding

After observing signs of breeding, we separated the ferrets, returned them to their respective pens, and observed the females for signs of possible whelping. At least one female was unable to stand, or had difficulty standing, upright, possibly due to pregnancy. Another female appeared to have lost weight and was fed three times the normal amount of prairie dog (300 grams per day). This female continued to come out eagerly for food but did not exhibit any obvious weight gain. She began sleeping just on the inside of the entrance to her burrow rather than down in a chamber and was observed doing so for several nights. The behavior, which seemed to indicate a need for an increase in food, looked very promising as it also coincided with a time when young would be eating solid foods. Another female appeared to be lactating about 40 days past the expected due date. Despite these positive signs for whelping, no female brought a litter aboveground in 1997.

FERRET MONITORING

In 1997, no ferrets were released from the pre-conditioning pens. Spotlight surveys were conducted for 18 nights in blocks of six consecutive nights during July, August, and October. These surveys totaled 930 person-hours, including 67 hours of backpack surveying. Personnel included Department employees and volunteers from The Phoenix Zoo, The Navajo Nation, and students from state universities.

Spotlight surveys were used to determine the long-term survival of ferrets released in 1996 and if there were any wild-born progeny. Ferrets that may have escaped from the pens in 1997 were

also targeted. Only one probable and five possible sightings of ferrets were recorded. A probable sighting is defined as a sighting in which the body of the ferret was observed but the PIT tag did not scan. A possible sighting is defined as green eyeshine close to the ground and displaying ferret movements. No ferrets were positively identified during our spotlight surveys.

DISCUSSION

Raptor protection measures taken in 1997 have proven very successful. No apparent raptor mortalities have occurred for more than a year. However, the lines are subject to breaking after exposure to sun and wind for several months. We will investigate whether a UV-resistant brand of monofilament line is manufactured and, if so, begin replacing the older lines.

We demonstrated that ferrets can be held for extended periods of time for pre-conditioning and breeding. With few modifications to the original pen design, only six of 53 (11%) ferrets used in the 1997 Arizona recovery effort were probable escapes. The probable escape mechanism is burrows. Prairie dogs try to dig both into and out of the acclimation pens. Increased monitoring by field personnel and better burrow management have greatly reduced the number of escapes. The last MIA in Arizona was recorded in September.

In 1997, more prairie dogs were available for pre-conditioning ferrets and enhancing pen environments. However, no ferrets were designated for release this year. This increased the problem of prairie dogs breaching the pens. Entrenching the fencing deeper would probably stop most of the breaches, but would be expensive, time consuming, and disruptive. With nearly 90% of the ferrets being retained, we determined that deeper trenching is not needed at this time.

We do not know what caused the lack of reproductive success in 1997. Four females were successfully mated and exhibited behavior indicative of pregnancy. Kits may have been whelped but soon died for unknown reasons. Cannibalization by the dams in times of stress has been seen in other captive breeding sites. Tick infestations have been noted in some burrows and may have been a factor. As a precaution, pest management strategies will be implemented prior to breeding this year.

In 1998, on-site breeding in the pre-conditioning pens will be attempted again. Proposed procedural changes include placing female ferrets in nest boxes set in the ground with an artificial tunnel to a cage on the surface. The nest boxes would have visual access to the females and kits. We anticipated that biologists will be able to confirm whelping and monitor the status of kits by this process. The female and her kits would then be released into the acclimation pen for pre-conditioning.

RECOMMENDATIONS

1. Investigate UV-resistant materials for raptor protection to decrease maintenance costs in time and materials.
2. Continue replacing outer pen fencing with posts and barbed wire as needed.
3. Investigate other means to prevent prairie dogs from digging under entrenched fencing.
4. Stabilize fencing to prevent continuous electrical shorts and weakening of structure.
5. Investigate new breeding strategies and revise procedures for 1998. This should include experimenting with placing female ferrets in cages within the acclimation pen prior to whelping.
6. Explore the possibility of using internal radio transmitters and underground optics as monitoring tools for released ferrets.

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

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.

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.