RESTORING SWIFT FOXES (*VULPES VELOX*) TO THE BAD RIVER RANCHES AND ENVIRONS IN WESTERN SOUTH DAKOTA

Final Report (2005 – 2007)

For the

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SWIFT FOX RESTORATION IN WEST CENTRAL SOUTH DAKOTA

Summary

In 1999, the Turner Endangered Species Fund (TESF), in collaboration with private landowners, state, federal and tribal agencies, and other private organizations embarked on an effort to restore a self-sustaining population of swift foxes (*Vulpes velox*) to the environs of western South Dakota (Figure 1). Since then we trapped 274 foxes (126 males, 148 females) in 4,416 trap nights (6.2 captures/100 trap nights) from wild source populations in Colorado and Wyoming. We translocated and released 180 of these foxes (82 males, 98 females) onto private lands in South Dakota, along with an additional 46 pups (28 males, 18 females) born in captive soft-release pens. We documented 90 pups (32 males, 29 females, 29 unknown) born to 25 wild litters (3.6 pups/litter). We documented 160 mortalities (82 females, 77 males) attributed to coyotes (*Canis latrans*; 0.43), vehicles (0.14), human (0.08), bobcats (*Lynx rufus;* 0.04), raptors (0.04), swift fox (0.01), miscellaneous (0.01), and unknown (0.25) causes. We stimulated at least four similar restorative efforts within the state and have documented movement and reproduction between three of the restoration areas. As a result of a trap related injury, we rehabilitated and donated a male to the American Zoological and Aquarium Association's captive breeding program. Finally, we documented the longest known post-release (411 km) and natal dispersal (367 km) movement events known for the species.

This report outlines our activities during the period of January 1, 2005 to December 31, 2007. Annual activities during the reporting period fell into ten categories: (1) post-release monitoring; (2) captive husbandry of soft-release/breeding pairs; (3) predator control; (4) trapping and translocation of wild foxes; (5) fall hard-releases; (6) management relocations of free-ranging foxes; (7) veterinarian services; (8) prey and predator surveys; (9) education and outreach; and (10) administration. Please refer to previous reports (Kunkel et al. 1999; Kunkel et al. 2001a, b; Kunkel et al. 2003; Kunkel et al. 2004) for all methods.

We conducted this reintroduction with a rigorous experimental design to gain the most knowledge possible without compromising our ultimate objective of restoring a swift fox population that persists in the presence of minimal management. We strove to establish a self-sustaining population of swift fox on and around the Bad River Ranches (BRR), which serves as a source for swift fox recovery and expansion in South Dakota while assisting in the removal of foxes from South Dakota's threatened species list. Private landowners working in conjunction with agency and non-governmental organizations have made a significant contribution toward the conservation of swift foxes, while simultaneously maintaining their agricultural activities. Since over 75% of swift fox habitat is on private property (Swift Fox Conservation Team 1997), innovative plans that actively engage private landowners in the restoration process will be needed to fully recover populations. In South Dakota we enlisted the cooperation of over 100 neighboring and local landowners who allowed us access to their lands for the purposes of monitoring, collection of mortalities, documenting reproduction, and beginning in fall 2004, providing release sites off the BRR. Such continued cooperative efforts will be vital for recovering fox populations in South Dakota and for creating a template for the long-term management of the species throughout its historical range.

Primary Objectives

Our primary objectives of this study were to:

1. Establish a self-sustaining population of swift foxes (hereafter "foxes") on the BRR and within TESF's Swift Fox Restoration Area (SFRA, Figure 1).
2. Establish a population that serves as a source for swift fox recovery and expansion in South Dakota and neighboring states and assists in removing foxes from threatened status in South Dakota.
3. Establish a population that enhances the long-term survival of the species, restores natural biodiversity to the area (as part of the restoration of a full array of native species), and promotes prairie conservation awareness.
4. Collect and disseminate information on reintroduction techniques and the ecological requirements for successful swift fox restoration.
5. Collect and disseminate information on the ecology of foxes.

Secondary Objectives

Our secondary objectives of this restoration project were to:

1. Estimate fox density annually for 6-10 years following first release.
2. Estimate fox reproductive parameters annually for 6-10 years following first release.
3. Estimate fox cause-specific mortality rates annually for 6-10 years following first release.
4. Determine primary factors limiting fox population.
    a. Monitor fox population trends.
    b. Monitor fox prey population trends.
    c. Monitor fox predator (coyote) population trends.
5. Determine fox diet annually for 6-10 years following first release.
6. Determine fox resource selection annually for 6-10 years following first release.

Post-Release Monitoring

Built around concepts and experience gleaned from other fox research, experts in the field, and other reintroduction efforts, we attempted to refine an aggressive post-release monitoring program aimed at determining the overall, long-term success of our restoration work. This program included, but was not limited to, a 60-day initial post-release monitoring period (October - December), a maintenance monitoring and re-collaring period (January - April), a daily den observation period (May - June), and a 60-day post-release monitoring period for soft-released foxes (July - September).

Monitoring was accomplished primarily through a combination of aerial- and ground-based telemetry augmented by visual observations at den sites in early summer. We found that monitoring for fox home-range, survival, and mortality was best accomplished during the late evening and early morning hours when foxes were most active and above ground, while den locations, pairing, and reproduction were best documented during the day. We also found aerial reconnaissance was most effective during the evening hours, especially when combined with

coordinated ground crews who were then able to pinpoint, via triangulation, dispersing or dead foxes.

All foxes trapped and translocated to South Dakota from Wyoming and Colorado in 2005, 2006, and 2007 were fitted with radio collars prior to release (Table 1). We also radio-marked as many wild-born and captive-born pups that were large enough to support either intraperitoneal transmitters or collars. We re-collared 44 free-ranging foxes, allowing us to maintain telemetric contact with them.

Monitoring Effort

During the 2005-2007 reporting period we logged 266 hours of aerial reconnaissance and 4,522 hours of ground monitoring. By air we documented 1,563 detections and 907 relocations and by ground we documented 11,091 detections and 8,575 relocations (Table 2).

Dispersal

One aspect of our work that may prove most illuminative is the relatively long range dispersal and post-release movements we have observed. These events are important since understanding the processes and components of animal movements has increasingly become a central tenant in determining the long-term viability of threatened and endangered native species, which often occur in small, geographically isolated populations. This is thought to be true for swift foxes whose range is increasingly experiencing habitat fragmentation and which are thought to exhibit limited dispersal abilities (Moerhenschlager and MacDonald 2003). Long-distance dispersal events, such as those we are documenting, have the potential to overcome difficulties posed by this trend, especially relating to reintroduced populations that are expected to expand from established populations within release areas or maintain connection to existing populations in the core of the species range (Trakhtenbrot et al. 2005).

2005

In March 2005, we conducted several wide-ranging flights that encompassed a large portion of central and western South Dakota. These flights were conducted to search for missing foxes and to determine if there were mortalities of radio-collared foxes outside our normal monitoring area. While we did not detect any mortalities we detected two missing foxes, including one that had been missing for over one year, and both foxes were on or near the Badlands National Park (BNP). We notified BNP project staff and they verified that two male foxes released on the BRR had paired with females from BNP releases. These were the first documented cases of foxes integrating from the two project areas.

2006

In March 2006, we received two reports of collared swift foxes that had been trapped in leg-hold traps. The first was a female (424F) hard released on the south unit of the BRR that established residency on non-Turner lands roughly 10 miles north of Murdo, SD (Jones County). Nearly one

year to the day after her last known location, she was trapped south of Belle Fourche, SD (Butte County), 263 km away.

The second report was of a collared fox trapped south of Prairie City, SD (Perkins County). This fox (456M) was a wild-born juvenile male from the BRR's north unit that had last been located 30 days earlier at his natal den site, 218 km from where he was trapped.

In May 2006, we received a third report of a collared fox that was shot while (supposedly) raiding a chicken coop 15 miles west of Winner, SD (Tripp County). Released the previous fall on the north unit of the BRR, 417M had been missing since his last location on 3/21/06, still within a mile of his release site and 120 km from where he was killed.

2007
We documented two movements that constituted the longest post-release movement and true dispersal events for the species. Both of these foxes were recovered as road kills in the same general area of central North Dakota, hailing from the same area in South Dakota. One fox was a wild-born female juvenile; the other was a translocated yearling male. While last known locations for each were documented within a week of one another, it would be speculation to assume that these foxes traveled together. A more plausible explanation may be that one followed the other using a scent trail, which is a dispersal technique well documented in larger canids (i.e., gray wolves). Regardless of the mechanism, such a scenario could also have a second important ramification: illustrating the potential for long-distance dispersal events to result in breeding pairs that ultimately contribute to the establishment of additional sub-populations, as opposed to lone, spatially isolated animals.

Reproduction

During the 2005-2007 reporting period we documented 18 wild-born litters with a total of 75 pups and eight captive-born litters with a total of 32 pups.

2005
We documented four wild litters of 18 pups (8 males, 6 females, 4 unknown) and placed intraperitoneal transmitter implants (ITI's) in 12 of the 18 at seven weeks of age. Six wild-born pups (3 males, 3 females) were fitted with radio-collars. One pair (out of four) in our captive, soft-release pens produced a litter of five pups. Four of the five captive-born pups were implanted and one was fitted with a radio-collar.

2006
We documented four wild litters of 21 pups (8 males, 10 females, 3 unknown) and placed ITI's in 13 of the 21 at seven weeks of age. Nine wild-born pups (3 males, 6 females) were fitted with radio-collars. Three pairs (out of five) in our captive, soft-release pens produced litters of four, four, and five pups, respectively. Parturition dates were known for all three litters to within two days: two litters were born in late May and the third was born on June 5, 2006. Due to the lateness of the litters, only six captive-born pups from two litters were large enough to fit with

ITI's before being released from soft-release pens. One captive-born pup was fitted with a radio-collar.

2007
We documented 10 wild litters of 36 pups (11 males, 6 females, 19 unknown) and estimated parturition dates to occur between April 14th and April 29th. Four of the litters produced second generation pups (those born to first generation South Dakota-born foxes). One of these litters was born to a missing captive-born female whose transmitter had been dead for over nine months, but who had remained within 12 km of her natal area. We placed ITI's in nine of the 36 wild-born pups at 7-9 weeks of age. Ten wild-born pups (4 females, 6 males) were fitted with radio-collars. Four pairs (out of five) in our long-term soft-release pens produced a total of 14 pups (10 males, 4 females), the highest number since we the project's inception. Parturition dates were known for all four captive-born litters to within two days: three litters were born in early May and the first was born in late April.

Survival and Mortality

Survival was calculated annually (365 days post-release) on a release cohort basis (Figure 2). Minimum survival estimates were calculated using a Kaplan-Meier staggered entry estimator (Pollock et al. 1989).

2005
Survival was tracked for foxes released in July (soft-release, n=5) and in October (hard-release, n=18) of 2004 until the 1-year anniversary of their release date. Overall survival for 2004 releases was 0.23 (95% CI = 0.03 – 0.42) with higher survival in hard-released foxes (0.56, 95% CI = 0.26 – 0.85) than soft-released foxes (0.0).

Survival of foxes released in 2005 was also tracked through the end of the year (December 2005). There was an overall survival rate of 0.60, (95% CI = 0.46 – 0.74), a hard-release survival rate of 0.70 (n=20, 95% CI = 0.53 – 0.87), and a soft-release survival rate of 0.67 (n=18, 95% CI = 0.49 – 0.84). By the end of 2005, we had known locations for 30 surviving foxes (15 males, 15 females) and an additional 11 were missing (6 males, 5 females). Missing foxes were defined as not having been located by ground or aerial tracking efforts for >14 days.

We documented 33 mortalities (19 males, 14 females; 12 juveniles, 21 adults; 12 hard-released, 12 soft-released, 9 wild-born) caused by coyotes (18 [0.55]), vehicles (6 [0.18]), unknown (6 [0.18]), raptors (1 [0.03]), snake (1 [0.03]), and swift fox (1 [0.03]). One fox (1 female adult) drowned in her soft-release pen after heavy rains prior to release and was not included in the analysis.

2006
Survival was tracked for foxes released in July (soft-release, n=14) and in October (hard-release, n=20) of 2005 until the 1-year anniversary of their release date, ending years 3 (soft-release) and 4 (hard-release). Survival for all foxes was 0.57 (95% CI = 0.48 – 0.65). We saw higher survival in soft-released foxes (0.40, 95% CI = 0.09 – 0.70) than in hard-released foxes (0.38, 95% CI =

0.12 – 0.64) for the first time. Survival for wild-born pups born in 2005 (n=14) was 0.36 (95% CI = -0.04 – 0.75), which was slightly higher than pups born to the captive soft-released pairs (n=3; 0.25, 95% CI = -0.17 – 0.67).

Survival of all foxes released in previous years was also tracked through December 2006. There was an overall survival rate of 0.89, (95% CI = 0.82 – 0.95), a hard-release survival rate of 0.84 (n=25, 95% CI = 0.70 – 0.98), and a soft-release survival rate of 0.43 (n=6, 95% CI = 0.02 – 0.67). Wild-born pup survival for the 2006 cohort (n=21) was 0.53 (95% CI = 0.33 – 0.72), while captive-born pup survival (n=13) was 0.50 (95% CI = 0.22 – 0.78). By the end of 2006, we had known locations for 38 surviving foxes (18 males, 20 females) and an additional 40 were classified as missing (17 males, 23 females).

We documented 32 mortalities (15 males, 17 females; 15 pups, 3 juveniles, 14 adults) caused by coyotes (13 [0.40]), bobcats (2 [0.06]), raptors (2 [0.06]), unknown (11 [0.34]), injury/starvation (2 [0.06]), and human-caused (1 [0.03]). Two captive-born pups (males) who had not yet been released, succumbed to possible heat exhaustion during extreme summer temperatures in mid-July. Pierre, SD reported a high of 47.2 ºC on the same day they were found dead. Tarps secured over the pens provided enough shade to lower temps in the pens by nearly14º C.

2007

Survival was tracked for foxes released in July (soft release-long, n=10) and in October (soft release-short, n=25) of 2006 until the 1-year anniversary of their release date. Survival for all translocated foxes was 0.48 ± 0.02 SE (n = 35) and 0.27 ± 0.01 SE (n = 22) for wild-born foxes. We saw higher survival in the soft-released/short cohort (n = 25; 0.72 ± 0.003 SE) than soft-released/long foxes (n = 10; 0.40 ± 0.01 SE). Survival for wild-born pups was 0.50 ± 0.003 SE (n = 12), which was slightly higher than pups born to the captive soft-release pairs (0.40 ± 0.01 SE (n = 10).

Survival of all foxes released in previous years was also tracked through December 2007. There was an overall survival rate of 0.54 ± 0.01 SE (n = 36), a soft/long survival rate of 0.70 ± 0.01 SE (n = 10), and a soft/short survival rate of 0.69 ± 0.001 SE (n = 26). Wild-born pup survival for the 2007 cohort was 0.77 ± 0.003 SE (n = 17) while captive-born pup survival was 0.31 ± 0.006 SE (n = 14). By the end of 2007, we had known locations for 78 surviving foxes and an additional 81 were classified as missing.

We documented 24 mortalities (17 females, 7 males; 13 sub-adults, 11 adults; Figure 3) caused by coyotes (7 [0.29]), bobcats (2 [0.08]), raptors (1 [0.04]), vehicle-collisions (8 [0.33]) and unknown causes (6 [0.25]).

Population Trend

The year 2005 was characterized by slightly lower survival of released foxes and slightly higher reproduction than in previous years (Table 3). This yielded a positive population growth since releases were first conducted in 2002. We began the year with a minimum of 26 foxes surviving from the previous two years of releases and reproduction. As of December 31, 2005, there were an additional 18 wild-born pups, 18 soft-released foxes (14 adults, 4 pups), and 20 hard-released

foxes (5 males, 15 females). With 33 mortalities, this yielded a net population growth of 23 foxes (lambda = 1.88).

The year 2006 was characterized by slightly higher survival of released foxes and slightly higher reproduction than in previous years (Table 3). This yielded a positive population growth for a fourth consecutive year. We began the year with a minimum of 28 foxes surviving from the previous three years of releases and reproduction. As of December 31, 2006, there were an additional 21 wild-born pups, 19 soft-released foxes (6 adults, 13 pups), and 29 hard-released foxes (14 males, 15 females). With 32 mortalities and 27 missing foxes, this yielded a net population growth of 12 foxes (lambda = 1.36).

The year 2007 was characterized by slightly higher survival of released foxes, greater numbers of documented breeding pairs, and significantly higher reproduction than in previous years. This yielded a positive population growth for a fifth consecutive year and the greatest increase we have seen to date. We began the year with a minimum of 38 foxes surviving from the previous four years of releases and reproduction. As of December 31, 2007, there were an additional 36 wild-born pups, 14 captive-born pups, 10 summer-released adults, and 26 fall-released foxes. With 24 mortalities and 22 missing foxes, this yielded a net population growth of 40 foxes (lambda = 2.05). The Badlands National Park Swift Fox Restoration Project also reported a significant population growth for the same period, nearly doubling the numbers of breeding pairs and more than doubling reproduction from the previous year (Greg Schroeder, personal communication).

Captive Husbandry / Soft-Releases

2005

We successfully maintained 14 foxes in seven soft-release/breeding pens built on the BRR in areas we felt would be suitable habitat for foxes once they were released. During this husbandry period one male fox (422M) escaped from his enclosure and was killed by coyotes seven days later 46 km from his release site. A second fox (420F) drowned in her soft-release pen after heavy rains prior to being released. We fed foxes once or twice per week (depending on the time of year) a diet of road-killed deer, rabbits, and birds. We trapped prairie dogs on neighboring lands as part of a “good neighbor” policy and fed them to foxes as whole carcasses. Dry dog kibble, provided ad libitum, supplemented this wild game diet. We provided fresh water (6 gallons) at every feeding. During their time in captivity, all foxes gained weight. Also during this period one captive-born litter of five pups (4 males, 1 female) was born to an adult pair being maintained. We surgically fitted the four male pups with abdominal implants at age 54 days.

On July 13, 2005 we released all soft-release foxes (n=18; Figure 4) and supplemented the pens with food (i.e., road-killed rabbits, prairie dogs) for another four weeks, if foxes were nearby.

2006

We successfully maintained 10 foxes in five soft-release/breeding pens on the BRR. Three captive-born litters of four, four, and five pups (6 males, 5 females, 2 unknown) were born. We surgically fitted six pups (3 male, 3 female) with abdominal implants at age 68 days.

On August 7, 2006 we released all soft-release foxes (n=19; Figure 5) and supplemented the pens with food (i.e., road-killed rabbits, and prairie dogs) for another four weeks, if any foxes were nearby. One of the foxes released (515M) had badly injured his shoulder the previous fall after being released. After undergoing surgery performed by Dr. Carpenter, DVM, in Sturgis, SD, 515M was returned to the BRR and placed in a soft-release pen to recover. He was observed on a number of feeding visits above ground and running around in the pen. There did not seem to be any pronounced, even noticeable limp to his gait and in July the decision was made to release him along with his pen mate and pups. Two days after his release he was observed digging at a prairie dog burrow near his release pen. Three of his four pups were with him at the den.

2007

For the fifth and final year, we successfully maintained 10 foxes in five soft-release/breeding pens on the BRR. Four captive-born litters of three, three, four, and four pups were born. We surgically fitted four pups (1 male, 3 female) with ITI's at an average age of 66 days. Five of these pups (2 female, 3 male) were fitted with radio collars prior to release.

Due to losing several pups in the extreme summer heat of 2006, we decided to release the soft-release pens approximately a month earlier than in past years. On June 16th we locked open the gates to the pens and released four of the five pens (n=18; Figure 6). A female in the fifth pen was found to be injured as a result of a loose collar, and required veterinary care, thus was not released until later in the summer when she had completely healed.

Due to the young age of the pups, we continued to provide both water and food at the pens, hoping this would encourage the adults to remain in the area as caretakers. Two of the males left the area soon after being released; one joined several other wild-born juveniles in the eastern part of the ranch. Two females and one male were killed within weeks of their release and one female was not accounted for, likely the result of a malfunctioning collar. Surviving adults from separate pens have paired and continued to use a soft-release pen and the immediate area surrounding it. It is not known whether there are still pups with these adults.

Predator Control

We attempted to achieve our primary objective by temporarily reducing the abundance of coyotes in the SFRA. This coyote reduction program had several objectives:

1. Reduce and maintain coyote densities at <50% of pre-control abundance (approximately 0.20 – 0.40 coyotes/km^2).
2. Maintain coyote-caused mortality rates on foxes at <25%.
3. Reduce coyote predation rates on foxes annually.
4. Stop coyote control if it appears ineffective at reducing coyote predation rates on foxes (see criteria above).
5. Stop coyote control when it appears that fox density has reached a level to maintain a viable fox population capable of withstanding coyote predation (fox density >0.10/km^2), or if we have not maintained a viable fox population in 10 years.

Kamler (2003) suggests a survival rate >0.60, such as that found only in Wyoming and Colorado, is needed to create a source population of swift foxes. While coyotes appeared to be the single greatest source of mortality for our reintroduced foxes, research has shown that survival, especially of juveniles, can be increased by efforts aimed at reducing coyote populations (Karki 2003). The results of this may have implications for our reintroduced foxes, which like dispersing juvenile foxes in Karki's study area, were unfamiliar with the area and did not have a known network of escape dens available. Thus the behavior of translocated foxes is likely similar to juvenile foxes in established populations (Kunkel et al. 2004). For this reason we designed and implemented a coordinated coyote control program aimed at short-term reductions timed to coincide with early summer and fall releases. Our primary method of control was aerial shooting from a fixed-winged aircraft (Piper Super Cub) combined with targeted use of recreational coyote callers and opportunistic shooting. We made an effort to collect a representative number of downed animals for necropsy to determine coyote population demographics and potentially transferable diseases.

2005

We contracted a pilot prior to our fall hard releases and removed 27 coyotes in 13 hours of hunting (Table 4). Six coyotes (4 males, 2 females) were collected for necropsy. The average age and mass for collected coyotes was 2.75 years and 13.7 kg for males, respectively, and 0.75 and 8.9 kg for females. Results from the disease testing were unavailable at the time of this report. We also employed the use of several recreational coyote callers who have continued the removal work in areas of known foxes. These callers are known to have harvested over 100 coyotes from the BRR during 2005. This combination of methods may have been partially responsible for the high survival of the hard-released foxes. Due to pilot availability during good to excellent conditions (i.e., significant snow cover) we did not conduct any aerial control work prior to our soft releases in 2005.

2006

We conducted control operations twice during the year. The first removal effort was in March and the second was in August shortly before the release of soft-release pens. We removed 47 coyotes in 16.5 hours of aerial hunting. We continued to employ several recreational predator callers who concentrated their efforts in areas of known fox locations. Between the two hunting methods we collected 29 coyote carcasses (15 male, 14 female) for analyses. The average age and mass for collected coyotes was 2.5 years and 12.74 kg for males, respectively, and 2.2 and 10.56 kg for females. Results from the disease testing are provided in Table 5. In 2006, we had greater hunting success (i.e., the number killed per hours hunting; 2.85 coyotes/hour) than in 2005 (2.36 (coyotes/hour), which may have indicated an increasing population, as this trend was also evident in our coyote surveys. Analysis of blood samples showed no coyotes with antibodies to plague (Table 5).

2007

We did not conduct any aerial predator control during 2007. Recreational coyote callers opportunistically removed coyotes in areas of know fox locations, but no blood samples were collected.

Trapping and Translocation

Wyoming Population Surveys

We assisted the Wyoming of Game and Fish Department (WGFD) with their annual swift fox surveys in order to assess translocation impacts on the Wyoming source population. We conducted a presence /absence survey using track plates coated with chalk and baited with canned mackerel. The survey was conducted prior to trapping activities so as not to affect the detection probabilities. Plates were placed along 16, two-mile long transects selected by WGFD biologists for Region 2 (Laramie and Goshen Counties) and lasted for six weather-free nights or until a fox was detected. Foxes were detected on four of nine transects in Laramie County and on zero of seven transects in Goshen County (Table 6).

2005

We trapped and processed 60 wild foxes (21 males, 39 females; 35 adults, 25 sub-adults; Table 7) from a 1,119-km2 area around Cheyenne, WY (12 Townships; T12 –T18N, R63 – R67W) in 810 trap nights (7.41foxes/100 trap nights). We trapped 59 foxes on private land with permission from five landowners and one at a den on a county road right-a-way. Traps were set in the evening, checked again at dawn, and closed during the day. We used a handling bag to remove foxes from traps. Foxes were physically restrained and handled by two technicians. Body condition was assessed, parasites were counted and collected, blood was drawn, and measurements were taken on the neck, canines, shoulder, tail, and body length. We also weighed, ear-tagged and radio-collared each fox. Juvenile female mass averaged 1.94 kg, adult females averaged 2.17 kg, juvenile males averaged 2.14 kg, and adult males averaged 2.33 kg.

We translocated 30 foxes (10 male, 20 female; 18 adults, 12 sub-adults) to South Dakota that tested negative or that showed no increasing titer levels for exposure to the sylvatic plague bacterium (*Yersinia pestis*). We vaccinated foxes for rabies, distemper, infectious hepatitis, adenovirus (Type 2), para influenza, and parvovirus. We treated foxes, shipping kennels, and transport vehicles with Sevin dust (carbaryl powder) prior to shipment to South Dakota. We secured all necessary documents prior to shipping, including health certificates and SD Animal Industry Board shipping permits, #'s SP-1223-DO, SP-1226-DO, SP-1229-DO. We released the other 30 foxes to the wild at their exact capture sites. All 30 translocated foxes were free of any overt signs of disease and were quarantined the Van Metre Field Station in Jones County, South Dakota for a minimum of 21 days prior to release.

2006

In an effort to increase the genetic diversity and spread out any potential local impacts, we secured permits to translocate foxes from both Colorado and Wyoming for the 2006 trapping season. We trapped and processed 37 wild foxes (17 males, 20 females; 20 adults, 17 sub-adults; Table 8) from the area around Karval, CO in 291 trap nights (12.7 foxes/100 trap nights). With assistance from the Colorado Division of Wildlife (CDOW) Regional biologist Bob Davies, staff biologists Casey Cooley and Brian Dreher, Conservation Officer Warren Cummings, and other CDOW personnel, we trapped foxes on private land with permission from at least five landowners. We followed the same handling and data collection protocol as described above.

Juvenile female mass averaged 2.02 kg, adult females averaged 2.21 kg, juvenile males averaged 2.24 kg, and adult males averaged 2.42 kg.

We translocated 35 foxes (17 male, 18 female; 19 adults, 16 sub-adults) to South Dakota. All foxes tested negative for exposure to the sylvatic plague bacterium. Again, we vaccinated foxes for rabies, distemper, infectious hepatitis, adenovirus (type 2), Para influenza, and parvovirus. We treated foxes, shipping kennels, and transport vehicles with Sevin dust (carbaryl powder) prior to shipment to South Dakota. We secured all necessary documents prior to shipping, including health certificates from CDOW veterinarian Dr. Lisa Wolfe and SD Animal Industry Board import permit # 090106. We released the two non-translocated foxes to the wild at or near their capture sites. All 35 translocated foxes were free of any overt signs of disease and were quarantined at the Van Metre Field Station for a minimum of 21 days prior to release.

Trapping under TESF's Chapter 33 Scientific Collection Permit (ID # 325) issued by the WGFD was also conducted by BNP personnel, with the permission of Scott Talbott, Assistant Chief of the Wildlife Division. BNP personnel successfully trapped a total of 65 foxes (26 males, 39 females; 32 pups, 27 sub-adults, 6 adults), and translocated 26 (10 males, 16 females; 20 pups, 6 sub-adults) to South Dakota after testing results were determined to be negative for plague antibodies. Foxes testing positive for antibodies (n=39; 16 males, 23 females; 12 pups, 21 sub-adults, and 6 adults) were returned to their capture locations.

2007

We trapped and processed 27 wild foxes (13 males, 14 females; 19 adults, 8 sub-adults: Table 9) from an area around Lamar, CO in 199 trap nights (13.6 foxes/100 trap nights). We trapped the foxes on private land with permission from two landowners by CDOW biologists. We followed the same handling and data collection protocol as described above.

We translocated 26 (13 males, 13 females; 18 adults, 8 sub-adults) to South Dakota. Again, we vaccinated foxes for rabies, distemper, infectious hepatitis, adenovirus (type 2), Para influenza, and parvovirus. We treated foxes, shipping kennels, and transport vehicles with Sevin dust (carbaryl powder) prior to shipment to South Dakota. We secured all necessary documents prior to shipping, including health certificates and SD Animal Industry Board shipping permit #SP-2409TC. We released the 27th fox to the wild at her exact capture site.

Based on serologic titers, nine of the 26 translocated foxes initially tested positive for exposure to the sylvatic plague bacterium, and were held in a quarantine facility located at the TESF Van Metre Field Station for a minimum of 21 days before release. Samples from the nine foxes were shipped to the Center for Disease Control (CDC), Fort Collins, CO for follow-up testing to determine baseline titer levels. Blood was re-drawn 14 days after their initial capture and sent to CDC for analysis. Titer levels were compared between the initial and subsequent rounds of testing and results indicated that no foxes suffered from active infections of the bacterium as evidenced by a significant rise in titer levels.

Fall Hard Releases

2005
On October 9, 2005 we conducted the fourth consecutive year of swift fox releases. We released 20 foxes (5 males, 15 females; 10 adults, 10 sub-adults; Table 10). We conducted releases in two areas of the BRR we hoped to establish breeding populations in (Figure 4). We also received authority from the SDGFP to conduct eight releases on other private lands, given we secured landowner permission. These cooperating landowners were Mr. David Stirling and Mrs. Lois Hall. These releases were conducted to take advantage of favorable habitat used by previous foxes or to supplement lone, unmated foxes. Twelve foxes (2 males, 10 females; 5 adults, 7 sub-adults) were released onto BRR property and eight foxes (3 males, 5 females; 5 adults, 3 sub-adults) were released onto other private lands.

2006
In an effort to maximize the survival potential of foxes during the fifth year of scheduled releases, we secured the permission of landowner Jack Hansen to conduct the bulk of the 2006 releases on lands centered in Haakon County (Figure 5). In previous years several foxes were observed traveling through and a litter of pups was born (in 2003) within 5 km of this land, we felt this area would be well suited to direct releases. Additionally, Hansen's land (then owned by his father, Bud Hansen) was also one of the two original release sites for the first swift fox reintroduction effort conducted by the South Dakota Game, Fish and Parks (SDGFP) in 1980 (Sharps and Whitcher 1984).

On October 1, 2006 we conducted the fifth consecutive year of swift fox releases. We released 29 foxes (14 males, 15 female; 13 adults, 16 sub-adults; Table 11); 20 of them (10 males, 10 females; 11 adults, 9 sub-adults) were released on the Hansen ranch. Two male-female pairs that did not breed in soft-release pens were held through the summer and released in the Haakon County cohort. All foxes in Haakon County were released using mush pens. Nine foxes (4 males, 5 females; 2 adults, 7 sub-adults) were released onto BRR property in the Ash Creek area of the northeast unit. These releases were used to supplement breeding opportunities for wild-born pups born in the area and to take advantage of one fox family's experience of living on and around a large prairie dog colony in Colorado. All releases were conducted within the parameters of our permit from the SDGFP and with the permission of cooperating landowners.

2007
In an effort to build on the success of the previous year, we conducted the bulk of our 2007 releases on Jack Hansen's lands in Haakon County (Figure 6). On October 8, 2007 we conducted the sixth and final year of swift fox releases. We released 26 foxes (13 males, 13 females; 15 adults, 11 sub-adults; Table 12); 21 of them (10 males, 11 females; 12 adults, 9 sub-adults) were released on the Hansen ranch. All foxes were released using short-term soft-release pens. Four foxes (2 males, 2 females; 2 adults, 2 sub-adults) were released onto BRR property in the Ash Creek area of the northeast unit. These releases were used to supplement breeding opportunities for wild-born pups born in the area. One fox self released prior to being moved to his acclimation pen, but after the quarantine period was complete. As in previous years, all releases were conducted within the parameters of our permit from the SDGFP and with the permission of the cooperating landowners.

Management Relocations

2005
We did not trap and move any free-ranging South Dakota foxes in 2005.

2006
Due to the initial success of this year's releases we had little need to attempt management relocations, with one exception. Fox 619M, released in the Ash Creek area of the BRR, moved east toward Fort Pierre and established a territory along the Bad River, just outside of town limits. He was caught in a box trap set for raccoons by Tom Maupin, a local youth living along Bad River road (the landowner, Darby Nutter called to inform us of the capture). The decision was made to relocate this fox to the BRR and pair him with an adult female who had lost her mate in August. They were confined to a mush pen for seven days and then released.

2007
No management relocations were necessary during 2007.

Veterinarian Services

We worked primarily with a local veterinarian, Dr. Virginia Trexler-Myren, DVM, to conduct the surgical procedure necessary to place intraperitoneal transmitters in a sample of wild-born and captive-born pups in order to better assess neonate survival. We also relied on her expertise to treat what may have been several life-threatening injuries to foxes incurred either in the wild or while being held in captivity.

<u>Implants</u>

We developed a protocol (Appendix 1) to use ITI's in swift fox pups to determine survival, causes of mortality, and dispersal habits during the critical pup rearing stage (Kitchen et al. 1999). Pups in this stage (three to 20 weeks) are vulnerable to disease and predators and are typically too small to be fitted with radio collars. While observations carried out at den sites can provide data relating to reproductive success, the recovery of carcasses and determination of cause of mortality is often limited. Survival, reproductive success, and dispersal are considered to be critical components that contribute to the success or failure of reintroduction efforts (Bar David et al. 2005). Having the means to assess these components may assist in developing strategies to mitigate losses and increase juvenile recruitment. We attempted to capture and implant a representative sample from each of our known litters, given annual funding parameters.

2005
In July, when pups ranged in age from 54 to 66 days old, we placed ITI's in four captive-born and 12 wild-born fox pups. Pups were captured in the early morning by hand (captive-born) or using baited box traps (wild-born) and transported to the All Creatures Animal Hospital, Pierre, SD in Vari Kennel shipping crates. Dr. Virginia Trexler-Myren, DVM conducted the surgery. Pups were monitored closely post-operation and all pups were returned to their natal sites by late

afternoon. No pups died as a result of the surgery, although one wild female pup died shortly after administering the gas anesthesia. This pup appeared anemic and unhealthy. The body was shipped to the WY State Vet Lab in Laramie for necropsy and disease testing. Lab results indicated that she was severely dehydrated, underweight, and suffering from severe anemia, which was likely caused by a blood-born parasite. A littermate was also dehydrated and underweight but responded well to IV fluids, thus was implanted and released.

2006
During June and July we placed ITI's in six captive-born and 13 wild-born fox pups. Pups were between 52 to 76 days old and weighed between 0.73-1.34 kg (females) and 0.76 – 1.5 kg (males) at the time of the surgery. As in 2005, pups were captured in the early morning by hand (captive-born) or using baited box traps (wild-born) and transported to the All Creatures Animal Hospital, where Dr. Trexler-Myren, DVM, conducted the surgeries. Pups were monitored closely post-operation and all pups were returned to their natal sites by late afternoon. Pups were observed for several hours to determine their acceptance by the parents and their post-operative condition. Implanted pups were observed eating and running around briskly with their litter mates. No pups appeared to have died as a direct result of the surgery.

Implants have yielded a great amount of data relating to neonate survival and their causes of mortality that would not otherwise have been possible to determine. Of the 19 pups implanted in 2006, we have known fates for 17 with just two classified as missing. Of the 17 known fates, 12 were mortalities (five coyote, two vehicle, one starvation, and four unknown causes) and five survived. Five of the mortalities were documented before pups were large enough for radio-collars which would not have been possible without the ITI's. Before ITI's, these animals would have likely been classified as missing from the population. Ten of the implanted pups were located and collared in late August, a process greatly facilitated by the ability to track a signal to a particular hole, as opposed to blindly setting traps in an area known to be used by pups.

2007
During July we placed ITI's in four captive-born and 9 wild-born fox pups. Pups were between 52 to 76 days old and weighed between 0.76-1.37 kg (females) and 0.97 – 1.7 kg (males) at the time of the surgery. All capture, surgery, post-surgery, and release events followed previous year's protocols. No pups appear to have died as a direct result of the surgery. Several pups have been re-trapped post-surgery and no complications (i.e., infections, tears) were documented.

<u>Injuries</u>

2005
Shortly after being trapped and translocated from Wyoming, a male fox (515M) escaped from his quarantine pen and was free-ranging for four days until we located and trapped him. He was suffering from an injury to the head and right shoulder. We transported him to All Creatures Animal Hospital for treatment. The head injury appeared to be an abscess while the shoulder appeared to be a gunshot wound that was affecting the shoulder joint. Dr. Trexler-Myren successfully treated the head injury, but due to the nature of the shoulder recommended another surgeon, Dr. Larry Carpenter, DVM, MS repair the shoulder. This was successfully done on October 3, 2005. Dr. Carpenter's assessment of the injury was that it was probably caused by a

blunt trauma (i.e., getting kicked) rather than by a gunshot. Fox 515M was paired with a female in a soft-release pen and released in 2006.

2006
A wild-born male fox (456M) released on the BRR was trapped south of Prairie City, SD (Perkins County). He was alive but injured, so an aerial monitoring flight was rerouted to Faith, SD to pick him up and bring him to Pierre for medical attention. Though his paw had been damaged in the trap, Dr. Trexler-Myren was able to save enough of the lower leg to allow him to bear weight. Dan Miller, Director for the Bramble Park Zoo in Watertown, SD assisted by locating a zoo that was interested in taking him into their American Zoological Association sanctioned breeding program. In June, 456M was transferred from Pierre to the Riverside Zoo in Scottsbluff, NE, where he now resides and is passing on his genes through the captive breeding program.

Dr. Trexler-Myren also repaired an injury to a female fox (629F) that was obtained either before being trapped in Colorado or while in the trap. She was treated for an infection and after several weeks of consistent care and daily antibiotics, was placed in a soft-release pen on the BRR and released in 2007.

2007
Two injuries to long-term soft-release foxes required medical attention. The first was sustained by a female fox (629F) in the fall of 2006 prior to being translocated from Colorado to South Dakota. This injury required stitches and was held at All Creatures for approximately 16 days. She was placed in a long-term soft-release pen where she was held along with a male (609M) until their release in June 2007, along with their three pups. She showed no adverse effects from the injury or medical confinement.

A second female (604F) was found injured while we conducted the final handling and re-collaring prior to release of the long-term soft-release pens. Her collar had become much too loose, probably while nursing, which allowed her to get her right front leg through the collar strap. Once she began to put body weight on again, the collar began rubbing into her neck and ‘arm pit’ causing a large laceration, which required stitches. Due to the flexing that occured in that area of the leg, the healing time was substantial and required the fox to remain at the hospital for 107 days during which time the wound was cleaned every 3rd day. This was the longest medical confinement we experienced during the life of this project. She was released on October 8, 2007 along with her mate, 628M, and their three pups.

Prey and Predator Surveys

2005
We assessed both prey and predator trends. Preliminary analysis suggested the relative abundance of breeding birds (Table 13, Table 14) and density of lagomorphs (Table 23) were down slightly from 2004’s estimates, while estimated densities of arthropods (Table 20) were higher than the previous year. Most notable was the 2005 small mammal abundance (Table 17), which was dramatically lower than in 2004 but roughly equal to the estimate in 2003 (as

measured by capture success [captures / 100 trap nights]). Similar trends for both years (i.e., 2004 and 2005) were also observed on the Lower Brule Reservation (S. Grassel, personal communication). These estimates appeared to indicate large-scale fluctuations in densities and species diversity annually, a phenomena that has been well documented in the scientific literature. Because it is also documented that roughly 80% of the swift fox diet is comprised of small mammals (Hines 1980), these fluctuations may play an important role in both movements and survival of foxes. We monitored these prey populations annually to better understand the factors that may be most important to fox establishment.

Results from predator surveys and our aerial hunting effort indicated the coyote population on the BRR was at an all time low since the project's inception in 1999. During the spring and fall survey periods, we estimated coyote densities at 0.22/ km^2 and 0.10/km^2, respectively (Table 23). Estimated relative coyote densities are displayed in Table 26. Normally densities would increase over the course of the year as reproduction is added to the population. In 2005, however, we collected what was thought to be the first case of mange in a coyote since we began removing and collecting coyotes in 2001. Anecdotally, recreational coyote hunters and SDGFP staff also observed numerous cases of coyotes with mange in this area during summer and fall of 2005, which could partially explain why coyote densities have declined.

2006

Preliminary analysis suggested that relative abundance of breeding birds (Table 13, Table 15) and small mammals (Table 18) were down slightly from 2005's estimates, while estimated densities of arthropods (Table 21) and lagomorphs (Table 24), particularly jack rabbits (*Lepus tonwsendii*) were higher than the previous year's estimates. Most notable were arthropods and jackrabbit densities which showed an increase of 0.89 and 0.59, respectively over 2005 estimates. For jackrabbits, this increase represented an upward trend for each year surveys have been conducted, with the exception of 2005, which decreased slightly. While estimates of both breeding birds and small mammals were lower in 2006, neither were dramatically lower, and breeding bird densities were likely affected by the mowing of the Conservation Reserve Program (CRP) units for upland hay forage as a result of the drought relief assistance offered to west-river ranchers. Though abundance estimates for small mammals was slightly lower (as measured by capture success [captures / 100 trap nights]), species diversity was higher.

Results from predator surveys and aerial hunting effort indicated the coyote population on the BRR increased over 2005's estimates, while fox abundance decreased slightly (Table 26). These trends were consistent between both survey methods – fecal line transects and night spotlighting. Coyote indices were measured using nine, 1.6 km transects located along unimproved roads, moderately used two-tracks, and seldom used two-tracks within the BRR boundaries. Transects were first cleared of scats and then scats deposited during the sampling period were counted and collected if presumed to be from foxes. The index is the deposition rate of fresh scats (scats/km/day; Knowlton 1984). Indices were converted to estimates of coyote density (number/km2) using the regression equation: *density = (index – 2.66) x 0.054* (Stoddart et al. 2001). Density estimates in 2006 for coyotes and foxes were 8.5/ km^2 and 0.55/km^2 respectively. Estimated densities derived from 2006 nocturnal spotlighting transects were 0.16/ km^2 and 0.02/km^2 for coyotes and foxes, respectively, compared to 2005 estimates of 0.11/ km^2 and 0.05/

km^2. While estimates from the two methods differ greatly, the trend between years was consistent between methods and compared favorably to the aerial hunting effort data.

2007
Preliminary analysis suggests that relative abundance small mammals (Table 19) was experienced a two-fold increase from 2006's estimates, while estimated densities of arthropods (Table 22) and lagomorphs (Table 25) showed only slight increases. Estimated densities of breeding birds (Table 13, Table 16) were lower than in 2006; however, estimates did not include data from the spring survey period, which was not conducted due to weather, logistics, and scheduling difficulties. Since the spring period was typically the peak for breeding bird activity, estimates lacking these data will naturally be skewed downward.

Results from predator surveys indicate the coyote population on the BRR decreased slightly from the previous year's estimate, while fox abundance increased by a factor of three (Table 26). Again, these trends were consistent between both survey methods – fecal line transects and night spotlighting. Density estimates in 2007 for coyotes and foxes were 6.51/ km^2 and 3.79/km^2 respectively, compared with 2006 estimates of 8.5/ km^2 and 0.55/km^2. Estimated densities derived from 2007 nocturnal spotlighting transects were 0.14/ km^2 and 0.06/ km^2 for coyote and fox respectively, compared with 2006 estimates of 0.16/ km^2 and 0.02/ km^2. Both methods reflected the sizable increase observed in the overall population trend.

Education and Outreach

2005
According to IUCN guidelines for reintroductions (IUCN/SSC Re-introduction Specialist Group 1998) conservation education and public relations through mass media and in local communities are important elements in any reintroduction program. We created and distributed an annual newsletter, *Swift Fox Restoration News*, to local residents via mail and through a project website (www.tesf.org/projects/swiftfox). We also extended our outreach efforts by speaking to area civic and conservation groups, student groups, and professional societies. In April and May of 2005, TESF and BRR staff conducted a series of classroom education programs for the Jones County School District, grades 4 –12. These programs were followed up with a ranch field trip for the 11th grade science class where prairie ecology relating to bison management, prairie dog restoration, and swift fox reintroduction were discussed. With a theme of "Be a biologist for a day", activities were designed to give students an opportunity to participate in actual field research techniques such as burrowing owl (*Athene cunicularia*) nest surveys, black-tailed prairie dog (*Cynomys ludovicianus*) density estimates, and fox tracking using vehicle and hand-held telemetry equipment. The program was well received. We also presented a talk entitled "Ecological Restoration on the Bad River Ranches" to the SD Ornithological Union in Pierre, SD. This talk covered the broader vision of imperiled species restoration and how it relates to commodity (i.e., bison) production.

By far, the most important and effective method of promoting our work was from one-on-one contacts with area residents and adjoining landowners while conducting daily field activities. Because many foxes released on the BRR have migrated to other private lands outside the

boundaries of the ranch, we have been heavily dependent on the gracious cooperation of these landowners for collecting our data. As mentioned previously, we have received access from nearly 90 individual landowners to conduct monitoring, collect mortalities, determine reproductive success, and provide release sites for hard released foxes outside of the BRR. In several cases, we were permitted to trap and remove unwanted prairie dogs from neighboring lands to use as a high quality food source for captive foxes and their pups. These relations speak to the careful nature by which we conducted our work on lands adjacent to the BRR, but also to the charismatic nature of the swift fox itself and the non-controversial role it can play in promoting the continued conservation of native grasslands.

2006
For the second year, TESF and BRR staff conducted a series of classroom education programs for the Jones County School District, grades 4 –12. These programs were followed up with a ranch field trip for the 11th grade science class where students participated in our "Be a biologist for a day" event.

2007
We did not conduct any formal outreach programs during 2007. We continued our work with neighboring and willing landowners for securing access to mortalities, natal dens, and for providing release areas in higher quality habitat outside the BRR.

Administration

As with any long-term research effort conducted over a broad landscape, much work was necessary to administer the needed support to keep field activities running smoothly. Project coordination between agency, tribal and other non-governmental entities was vital in promoting a broad vision capable of recovering a species as opposed to a single, isolated population. We organized and forged a working group comprised of private, federal, and tribal entities to reintroduce and restore multiple populations of swift foxes throughout western South Dakota.

Beginning in 2003, the National Park Service at Badlands National Park conducted swift fox releases within the Park's administrative boundaries. After a review of their initial efforts, BNP decided to translocate additional foxes in 2006, beyond the three years proposed in the original plan. Because we trapped our full complement of foxes from Colorado, the WGFD allowed BNP to trap foxes under the 2006 permit granted to TESF. As a result, BNP trapped and translocated 26 foxes (10 males, 16 females) in 2006. It was our hope that these additional foxes provided breeding opportunities to foxes dispersing between the TESF and BNP release areas and would contribute to the existing population in South Dakota.

Two tribal governments in South Dakota, the Lower Brule Sioux Tribe (LBST) and the Ogallala Sioux Tribe, received federal funds in 2004 to assess the potential for reintroducing foxes and to conduct surveys for the presence of foxes on their respective tribal lands. In 2006, the LBST released 40 foxes in the first of three years of proposed releases. We actively cooperated with these projects by sharing sampling design and providing hands-on trapping and monitoring opportunities. We also cooperated with the LBST project by monitoring for missing foxes, and

locating and collecting mortalities. By enlisting the support of private landowners between these other project areas, we hoped that swift foxes would again occupy much of their historical range within the state.

Funding proposals

2005
In total, we secured $228,000 in grant monies that were added to TESF funding to administer the fox project in 2005, 2006, and 2007.

We received $118, 000 from the South Dakota State Wildlife Grants Program for the proposal:

K.M. Honness, and M.K. Phillips. 2005. Restoring Swift Foxes (*Vulpes velox*) to the Bad River Ranches and environs in western South Dakota.

We received $90,000 from the U. S. Fish and Wildlife Service Private Stewardship Grant Program (PSGP) for the 2005 proposal:

K.M. Honness, and M.K. Phillips. 2005. Restoration of Swift Fox to the Bad River Ranches and Environs in South Dakota. U.S. Fish and Wildlife Service Private Lands Stewardship Grant Program.

We received $20,000 from the National Fish and Wildlife Foundation (NFWF) for the 2005 proposal:

K. M. Honness, and M.K. Phillips. 2005. Restoration of the Swift Fox in the Northern Great Plains. National Fish and Wildlife Foundation Grant Program.

2006
In total, we secured $53,000 in grants that were added to TESF funding to administer the fox project in 2007 and 2008.

We received $53, 000 from the South Dakota State Wildlife Grants Program for the proposal:

K. M. Honness and J.A. Jenks. 2006. Assessing Swift Fox (*Vulpes velox*) habitat use and resource selection in the pup-rearing period in the mixed-grass prairie of west-central South Dakota.

2007
We did not submit proposals for any additional funding during 2007.

Papers produced

K. M. Honness, M. Phillips, and K.E. Kunkel. 2005. Swift Fox Restoration in west central South Dakota: 2004 Annual Progress Report. Turner Endangered Species Fund Conservation Report 01-05.

K. M. Honness, M. Phillips, and K.E. Kunkel. 2005. Swift Fox Restoration in west central South Dakota: 2004 Annual Progress Report. Turner Endangered Species Fund Conservation Report 01-06.

Professional Presentations

K. M. Honness. 2005. Ecological Restoration on the Bad River Ranches. South Dakota Ornithological Union, Pierre, South Dakota.

K. M. Honness. 2005. Swift Fox Restoration in West-central South Dakota: 2002 – 2004. Swift Fox Conservation Team, Kansas City, KS.

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Honness, K.M., J.A. Jenks, S.M. Grassel, and G.M. Schroeder. April 17, 2007. Dispersals and long-range, post-release movements of reintroduced swift fox in western South Dakota. Swift Fox Conservation Team annual meeting. Rapid City, South Dakota.

Honness, K.M., and J.A. Jenks. December 10, 2007. Movement parameters of reintroduced and native-born swift foxes (*Vulpes velox*) in a mixed-grass prairie. 68th Midwest Fish and Wildlife Conference. Madison, Wisconsin.

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Veterinarian and Animal Industry Board, Swift Fox Conservation Team (SFCT), National Fish and Wildlife Foundation (NFWF), Capital City Air Carrier, Eileen Dowd Stukel (SDGFP), Lu Carbyn (Canadian Wildlife Service), Marsha Sovada (U. S. Geological Survey), Shaun Grassel (Lower Brule Sioux Tribe), Brian Kenner, Todd Russell, Greg Schroeder (Badlands National Park), Hank Edwards (WSVL), Kyran Kunkel (Mountain Thinking Institute), and Jon Jenks (South Dakota State University).

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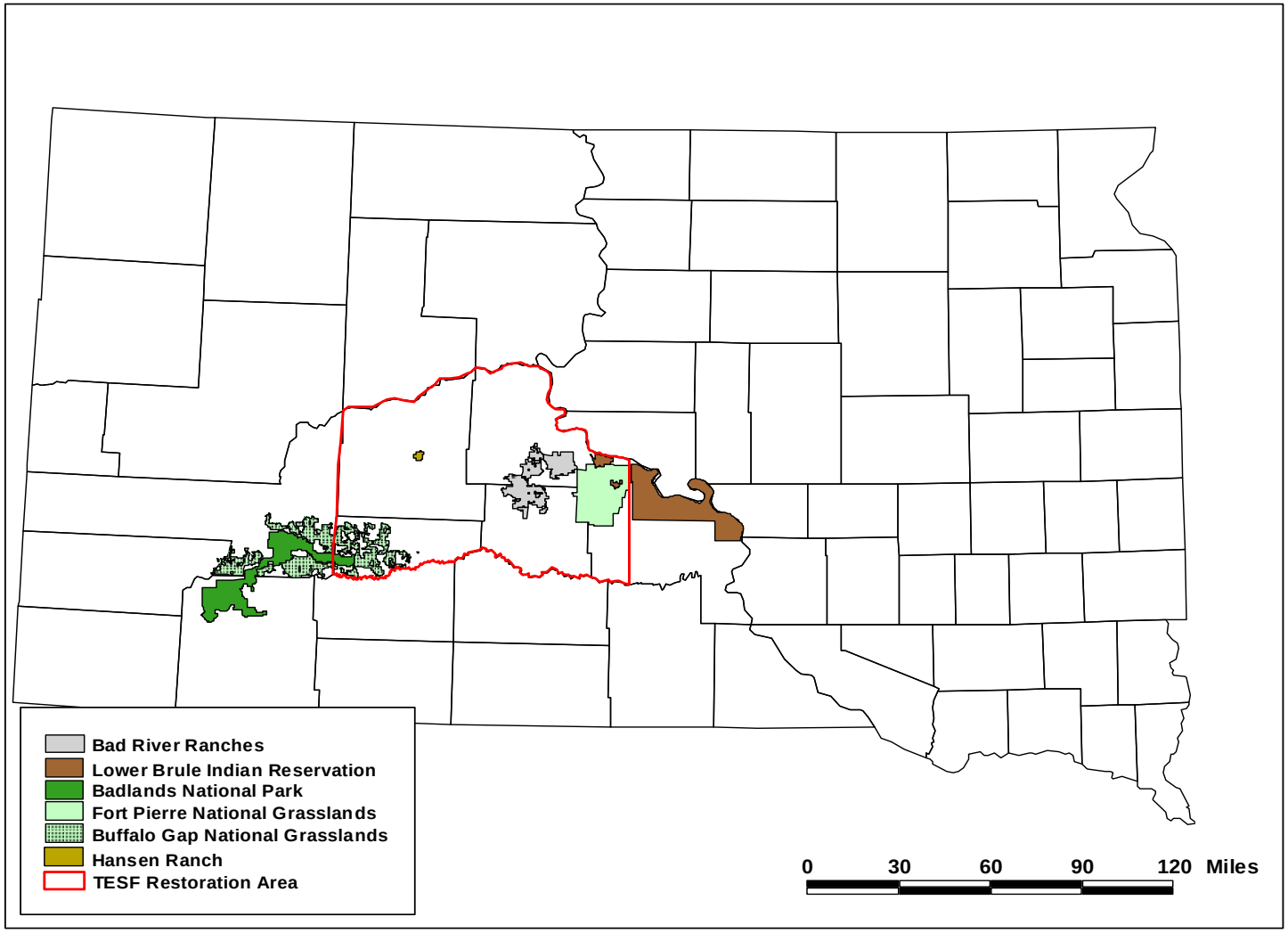

Figure 1. TESF Swift Fox Restoration Area (SFRA).

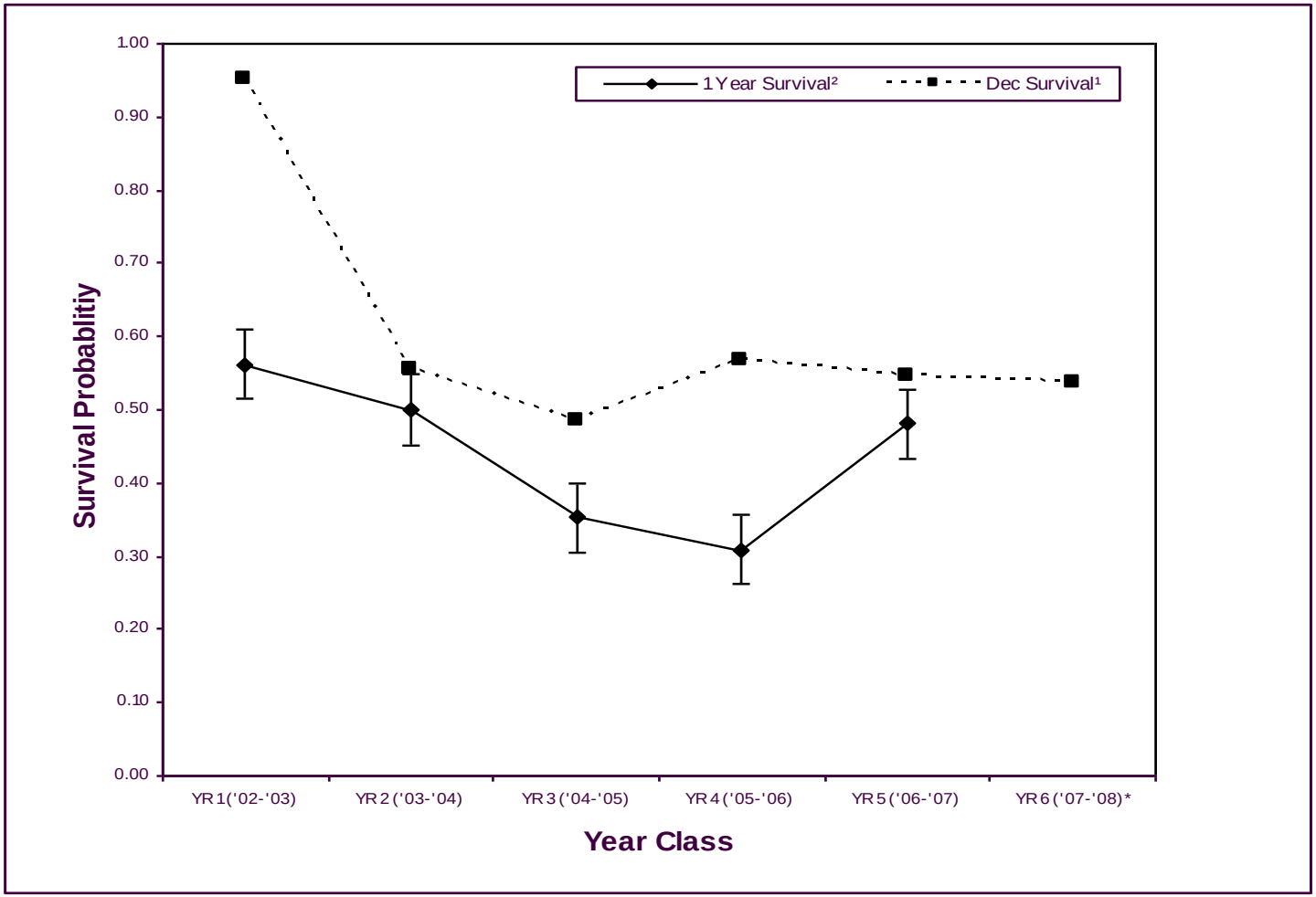

Figure 2. Graph showing overall survival by release year class for foxes translocated to TESF Swift Fox Restoration Area, 2002 – 2007. One-year survival was calculated for the first 365 days post-release for each class. December survival is shown to allow comparison across all years since Year 6 data were incomplete at the time of this report.

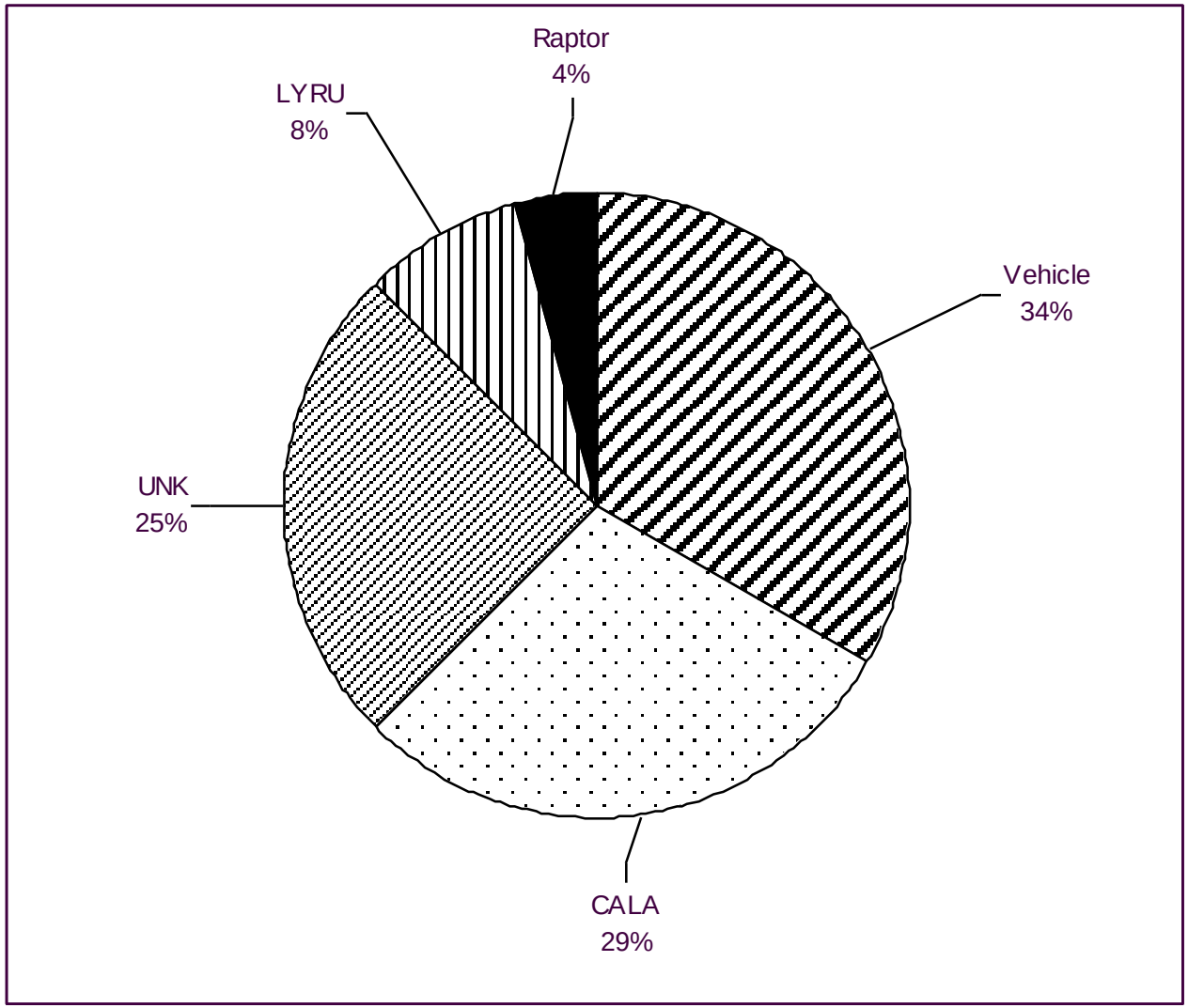

Figure 3. Cause-specific mortalities of foxes collected during 2007 (*n* = 24).

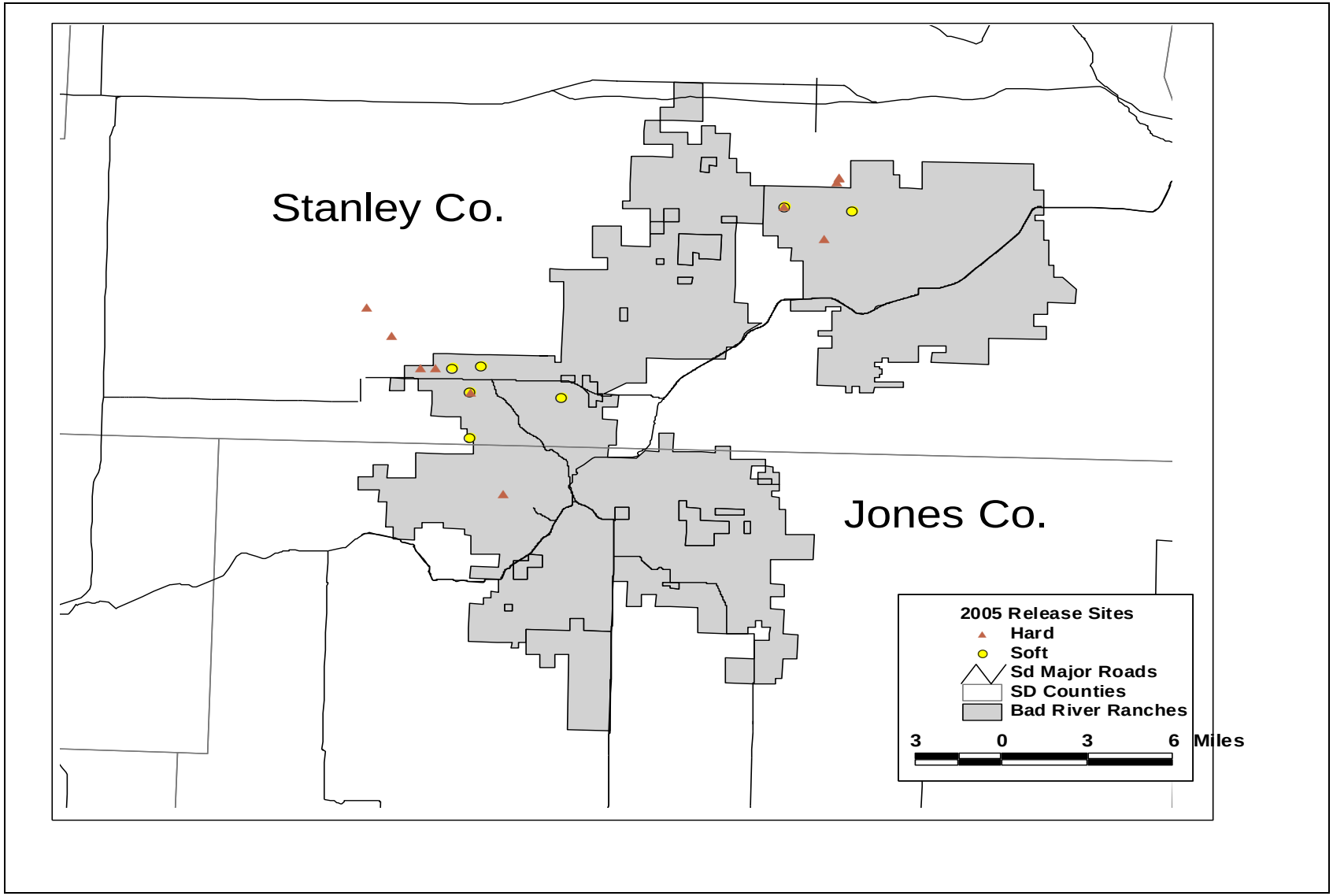

Figure 4. Release sites for foxes released in the TESF Swift Fox Restoration Area (SFRA) during 2005.

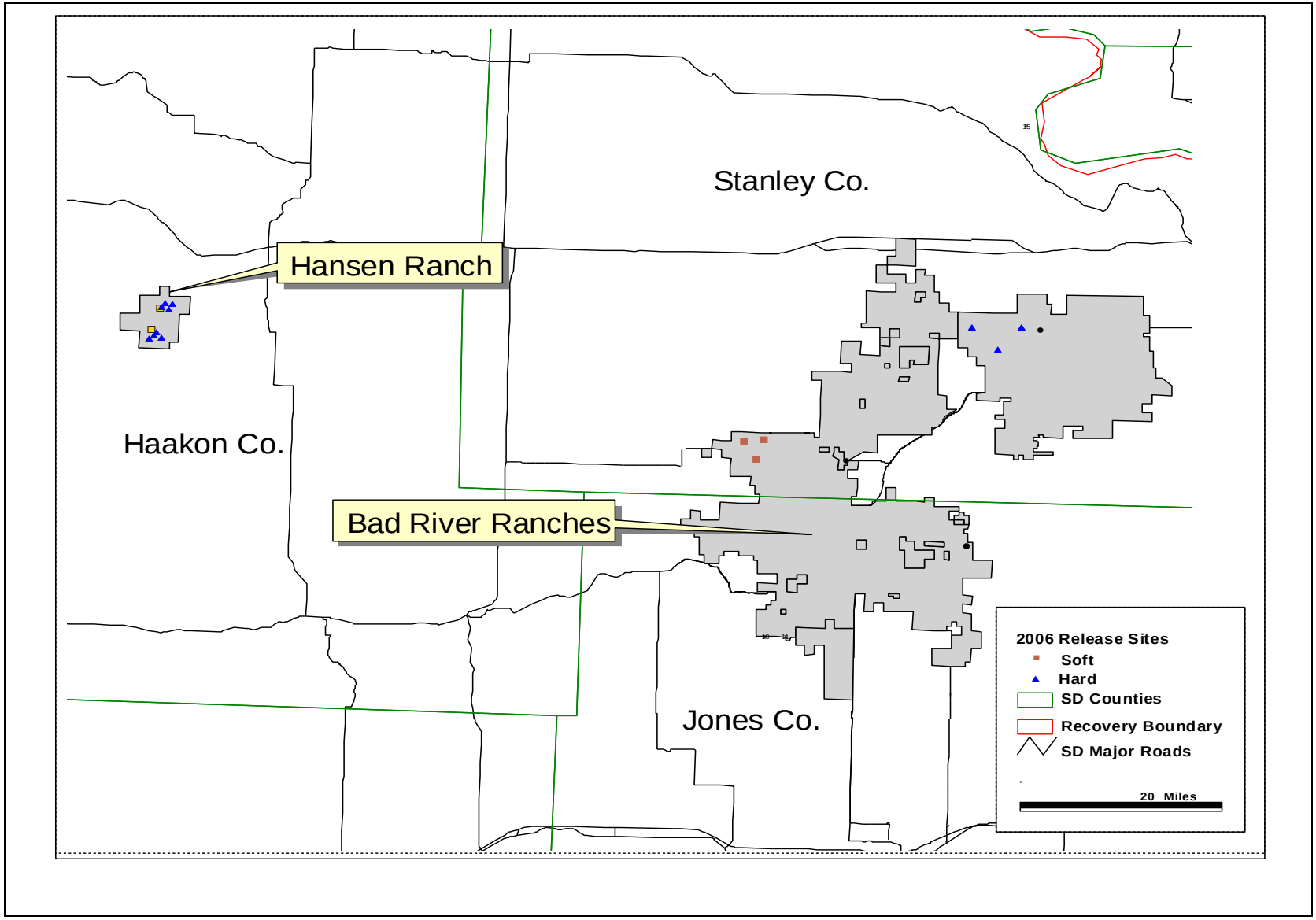

Figure 5. Release sites by release type for foxes released in the TESF Swift Fox Restoration Area (SFRA) during 2006.

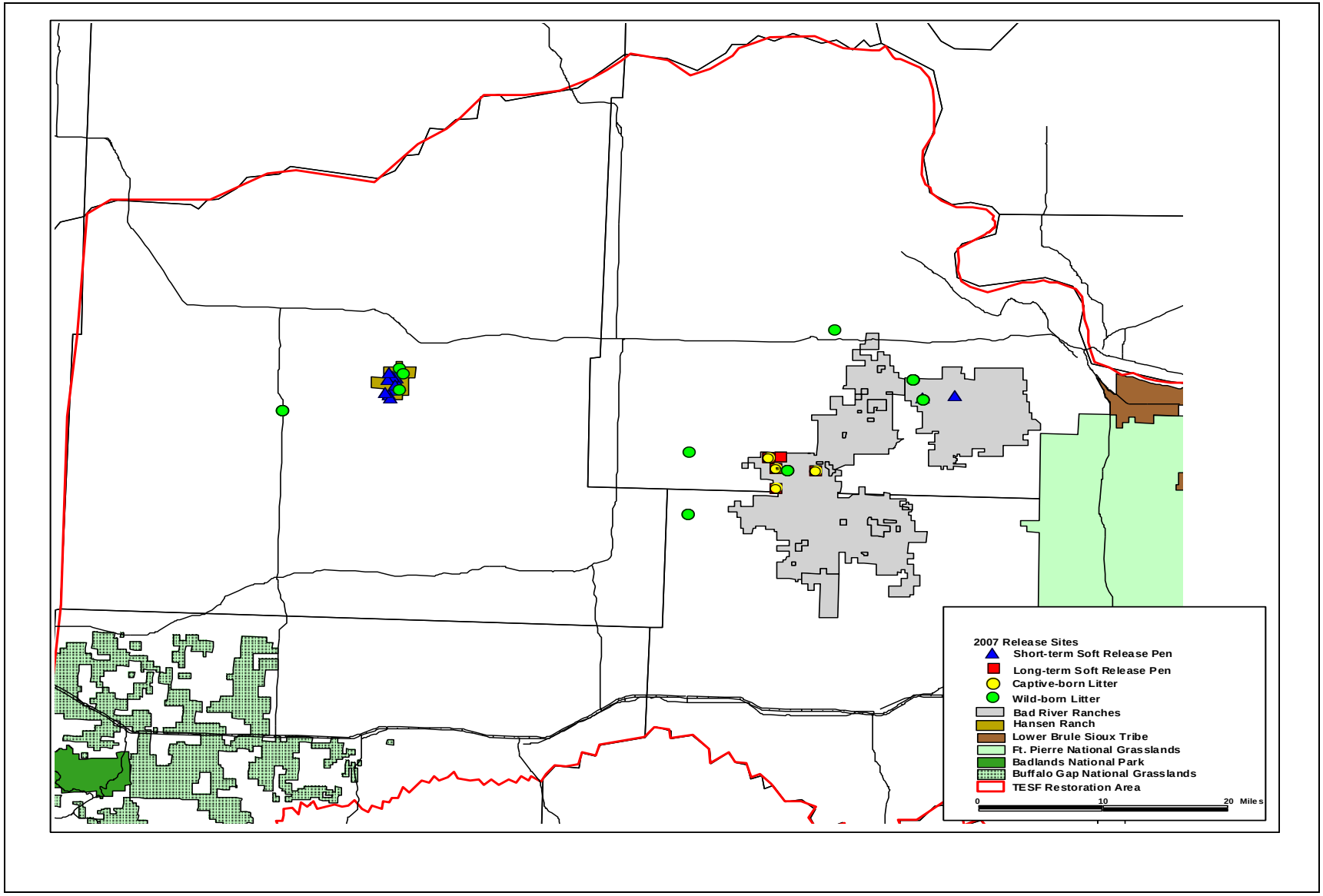

Figure 6. Release sites by release type for foxes released in the TESF Swift Fox Restoration Area (SFRA) during 2007.

Table 1. Summary of swift foxes trapped, translocated, and collared during the reporting period.

Year	Trapping Location	Number of Foxes Trapped, Translocated, and Collared	Number of Wild-Born Pups Marked	Number of Captive-Born Pups Marked	Number of Free-Ranging Foxes Collared
2005	Wyoming	30	12	0	9
2006	Colorado	35	13	3	9
2007	Colorado	26	11	5	26
Totals:		91	36	8	44

Table 2. Monitoring effort summary by type for monitoring conducted in TESF's Swift Fox Restoration Area in 2005, 2006, and 2007.

Year	Monitoring Type	Sessions	Hours	Locations*	Detections^	Locations/Hour	Detections/Hour	Locations/Detections
2005	Aerial	32	131	550	577	4.29	4.50	95/100
	Ground	341	1,157	2,895	3,947	2.50	3.41	73/100
2006	Aerial	19	70	337	482	4.85	6.90	70/100
	Ground	428	2,004	3,855	5,119	1.93	2.56	75/100
2007	Aerial	17	65	20	504	0.38	9.40	4/100
	Ground	318	1,361	1,825	2,475	1.34	1.78	75/100

* Locations are defined as a fixed spatial point with a corresponding UTM.
^ Detections are defined as hearing a signal without determining a precise spatial point.

Table 3. Population trend of swift foxes released and reproduced in west central South Dakota during 2002 – 2006. Includes missing foxes, censored from the population.

Period	2002 Hard Release	2003 Wild Born	2003 Soft Release	2003 Hard Release	2004 Wild Born	2004 Soft Release	2004 Hard Release	2005 Wild Born	2005 Soft Release	2005 Hard Release	2006 Wild Born	2006 Soft Release	2006 Hard Release	Total
2002 Hard Release	20													
31-Dec-02	16													16
Post Whelp, 31-May-03	11	16												
End Year 1 30-Sept-03	6	4												**10**
2003 Soft Release			22											
2003 Hard Release				18										
31-Dec-03	2	2	9	7										20
Post Whelp, 31-May-04	0	0	8	3	11									
2004 Soft Release						8								
End Year 2 30-Sept-04			6	3	4	4								**17**
2004 Hard Release							18							
31-Dec-04			5	3	3	3	14							28
Post Whelp, 31-May-05			1	0	1	1	10	14						
2005 Soft Release									18					
End Year 3 30-Sept-05			1	0	1	0	9	6	10					**27**
2005 Hard Release										20				
31-Dec-05			0		1		7	5	9	12				34
Post Whelp, 31-May-06					0		2	3	5	4	21			
2006 Soft Release												16		
End Year 4 30-Sept-06							1	2	4	3	16	9		**35**
2006 Hard Release													25	
31-Dec-06							1	1	4	3	5	3	21	38

Table 4. Predator management data collected from coyotes removed from the Bad River Ranches in 2005.

Animal ID	Date	Species	Age	Sex	Weight (kg)	Easting	Northing	Blood Sample Type	Plague*	Tularemia*	Titer	Distemper*	Titer	Mange*	Method	Hunter
228	8/28/05	CALA	U	F	0	3698106.3	4908294.8	tab							ground	Lewis
229	9/6/05	CALA	3-4	M	0	369918.98	4906523.0	tab							ground	Lewis
230	9/6/05	CALA	<1	M	0	381440.08	4906139.2	tab							ground	Lewis
231	9/6/05	CALA	<1	F	0	381441.55	4906171.9	tab							ground	Lewis
232	12/2/05	CALA	2-3	M	12.6			tab							ground	Lewis
233	12/2/05	CALA	<1	F	8.9	353575.78	4889506.7	no							ground	Lewis
234	12/8/05	CALA	5-6	M	14.9	355217.44	4886548.7	no							ground	Lewis

* Diagnostic results unavailable at time of press.

Table 5. Predator management data collected from coyotes removed from the Bad River Ranches in 2006 (n=29).

Carcass#	Date	Sex	Age	Weight	Easting	Northing	Type	Accession #	Plague	Tularemia	Titer	Distemper	Titer	Mange	Kill Method	Hunter
236	1/10/2006	F	2	12	355364	4889823	no		no test	no test		no test		Y	Ground	Lewis
240	2/22/2006	F	2		364830	4899816	no	6003886	Negative	Negative	1:32	no result			Ground	Lewis
241	2/22/2006	F	2		358314	4900066	no	6003886	Negative	Negative	<=1:32	no result			Ground	Lewis
243	3/22/2006	F	2	10.1	358314	4900066	no	6003886	Negative	Negative	<=1:32	no result			Ground	Lewis
246	4/27/2006	F	3	11.1	373306	4905891	TAB	601176	Negative	Negative	<1:4	Negative	<1:4		Ground	Lewis
248	4/27/2006	F	3	11	371157	4906963	TAB	601176	Negative	Negative	<1:4	Negative	<1:8		Ground	Lewis
249	5/2/2006	F	2	11	377923	4906043	TAB	601176	Negative	Negative	<1:4	Negative	<1:16	Y	Ground	Lewis
250	5/1/2006	F	3	11.1	364944	4898687	TAB	601176	Negative	Negative	<1:4	Negative	<1:16		Ground	Lewis
253	5/4/2006	F	2.5				TAB	601176	Negative	Negative	<1:4	Negative	<1:4		Ground	Lewis
256	5/5/2006	F	4		371157	4906963	TAB	601176	Negative	Negative	<1:4	Negative	<1:4		Ground	Lewis
257	5/2/2006	F	1		361724	4901625	TAB		*	*	*	*	*		Ground	Lewis
258	4/29/2006	F	3		354527	4886225	TAB	601176	Negative	Negative	<1:4	Negative			Ground	Lewis
259	8/2/2006	F	.5	8.7	368775	4906085	TAB		*	*	*	*	*		Aerial	Harmon
262	8/1/2006	F	1	9.5	357488	4898122	TAB		*	*	*	*	*		Ground	Rhode
235	1/10/2006	M	1.5	14.2	356523	4889944	no		no test	no test		no test			Ground	Lewis
237	3/16/2006	M	3	12.5			no		no test	no test		no test		Y	Ground	Lewis
238	3/16/2006	M	2	10.85			no		no test	no test		no test			Ground	Lewis
239	2/9/2006	M	3.5		367220	4908351	no	6003886	Negative	Negative	<=1:32	no result			Ground	Lewis
242	2/9/2006	M	1		367220	4908351	no	6003886	Negative	Negative	<=1:32	no result			Ground	Lewis
244	4/14/2004	M	4	16.8	390545	4909887	TUBE		no test	no test		no test			Road kill	
245	4/27/2006	M	3	12.1	371157	4906963	TAB	601176	Negative	Negative	<1:4	Negative	<1:16		Ground	Lewis
247	4/27/2006	M	3	13.2	368633	4908957	TAB	601176	Negative	Negative	<1:4	Negative	<1:16		Ground	Lewis
251	5/1/2006	M	3	12	361724	4901625	TAB	601176	Negative	Negative	<1:4	Negative	<1:16		Ground	Lewis
252	5/4/2006	M	4	13.5			no		no test	no test		no test			Ground	Lewis
254	5/18/2006	M	1	13			TAB	601176	Negative	Negative	<1:4	Negative	<1:128		Ground	Lewis
255	6/12/2006	M	2	13.7	370468	4908251	TUBE		*	*	*	*	*		Ground	Lewis
260	8/2/2006	M	.5	8.8	354170	4892901	TAB		*	*	*	*	*		Aerial	Harmon
263	8/3/2006	M	2	12	367800	4907274	TAB		*	*	*	*	*		Aerial	Harmon
261	8/1/2006		3.5	13	357341	4898015	TAB		*	*	*	*	*		Ground	Rhode

* Diagnostic results unavailable at time of press.

Table 6. Summary of swift fox track plate surveys conducted for WGFD, Region 2 (Laramie and Goshen Counties), 2001 - 2005.

Study Region	County	Total # Transects Run	Total # Track Plates	Ave # of Plates/ Transect	Total # Nights Run	Total # of Track Plate Nights	Total Miles of Transects	2005 Swift Fox Detections	Previous Swift Fox Locations	2001 Swift Fox Detections	2002 Swift Fox Detections	2003 Swift Fox Detections
2	Goshen	7	35	5	42	210	14	0	8	5	0	2
2	Laramie	9	45	5	35	175	18	4	9	9	5	9
Total		16	80	10	77	385	32	4	17	14	5	11

Table 7. Trapping data for swift foxes captured in Cheyenne, Wyoming, August – September, 2005.

Fox#	Capture Date	Capture Location	Easting	Northing	Sex	Age class	Status	Fox#	Accession No.	Plague Test #1	Test #1 Titer	Plague Test #2	Test #2 Titer	Tularemia	Titer	Distemper	Titer
500M	8/20/2005	Jerry Harding Ranch	544798	4591067	M	Pup	Released	500M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
501F	8/20/2005	Doran Lummis Ranch - S. camp	525057	4548475	F	Pup	Shipped	501F	5011433	Negative	n/a	n/a	n/a	Negative	1:32	Negative	<1:4
502F	8/20/2005	Doran Lummis Ranch - S. camp	526045	4548659	F	Adult	Released	502F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
503F	8/20/2005	Doran Lummis Ranch - S. camp	524038	4549262	F	Adult	Shipped	503F	5011433	Negative	n/a	n/a	n/a	Negative	1:32	Negative	<1:4
504F	8/20/2005	Doran Lummis Ranch - S. camp	527232	4549304	F	Pup	Released	504F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
505M	8/20/2005	Doran Lummis Ranch - S. camp	526819	4550434	M	Adult	Released	505M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
506F	8/20/2005	Doran Lummis Ranch - S. camp	527231	4549709	F	Pup	Released	506F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
507F	8/20/2005	Doran Lummis Ranch - S. camp	527232	4548904	F	Adult	Released	507F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
508M	8/21/2005	Doran Lummis Ranch - S. camp	525433	4548593	M	Adult	Shipped	508M	5011433	Negative	n/a	n/a	n/a	Negative	1:16	Negative	<1:4
509M	8/21/2005	Doran Lummis Ranch - S. camp	527228	4549303	M	Adult	Released	509M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
510M	8/21/2005	Jerry Harding Ranch	544798	4591067	M	Pup	Released	510M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
511F	8/21/2005	Jerry Harding Ranch	542706	4591345	F	Adult	Released	511F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
512F	8/21/2005	Jerry Harding Ranch	544798	4591067	F	Pup	Released	512F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
513M	8/22/2005	Jerry Harding Ranch	544798	4591067	M	Pup	Released	513M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
514F	8/22/2005	Jerry Harding Ranch	544807	4592017	F	Adult	Released	514F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
515M	8/22/2005	Warren Livestock Co. - Ghetto	518014	4569443	M	Adult	Shipped	515M	5011433	Negative	n/a	n/a	n/a	Negative	1:64	Negative	<1:4
516M	8/23/2005	Doran Lummis Ranch - Savory	528470	4549197	M	Adult	Released	516M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
517F	8/23/2005	Doran Lummis Ranch - Savory	527239	4547401	F	Adult	Released	517F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
518F	8/23/2005	Doran Lummis Ranch - Savory	528842	4548503	F	Adult	Released	518F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
519F	8/24/2005	Jerry Harding Ranch - Goshen Co	545533	4600076	F	Adult	Released	519F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
520F	8/25/2005	Jerry Harding Ranch - Clark	543813	4600956	F	Pup	Released	520F	5011633	Positive	n/a	n/a	n/a	No test	.	No test	.
521M	8/25/2005	Jerry Harding Ranch	542271	4600985	M	Adult	Released	521M	5011633	Positive	n/a	n/a	n/a	No test	.	No test	.
522F	8/25/2005	Jerry Harding Ranch	542706	4591345	F	Adult	Released	522F	5011633	Positive	n/a	n/a	n/a	No test	.	No test	.
523M	8/25/2005	Warren Livestock Co. - Jordan	525700	4568826	M	Adult	Shipped	523M	5011633	Negative	n/a	n/a	n/a	Positive	1:128	Positive	1:256
524M	8/25/2005	Don Berry Ranch	530539	4580630	M	Adult	Shipped	524M	5011633	Negative	n/a	n/a	n/a	Negative	1:8	Negative	<1:4
525F	8/25/2005	Don Berry Ranch	529002	4580348	F	Pup	Shipped	525F	5011633	Negative	n/a	n/a	n/a	Negative	1:16	Negative	<1:4
526F	8/26/2005	Warren Livestock Co.- Drake	512842	4582395	F	Pup	Released	526F	5011633	Positive	n/a	n/a	n/a	No test	.	No test	.
527M	8/26/2005	Warren Livestock Co.- Drake	515734	4582377	M	Pup	Released	527M	5011633	Positive	n/a	n/a	n/a	No test	.	No test	.
528F	8/27/2005	Don Berry Ranch	529541	4580641	F	Adult	Shipped	528F	5011631	Negative	n/a	n/a	n/a	Negative	1:4	Positive	1:64
529F	8/27/2005	Don Berry Ranch	529010	4580639	F	Adult	Shipped	529F	5011631	Negative	n/a	n/a	n/a	Negative	1:4	Positive	1:128
530F	8/27/2005	Warren Livestock Co.- Drake	513474	4581568	F	Adult	Released	530F	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
531M	8/27/2005	Warren Livestock Co.- Drake	513079	4581571	M	Adult	Released	531M	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
532M	8/27/2005	Warren Livestock Co.- Drake	512431	4582401	M	Adult	Released	532M	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
533M	8/27/2005	CR 203	540900	4545262	M	Adult	Shipped	533M	5011631	Negative	n/a	n/a	n/a	Negative	1:64	Positive	1:32

Table 7 (continued). Trapping data for swift foxes captured in Cheyenne, Wyoming, August – September, 2005.

Fox#	Capture Date	Capture Location	Easting	Northing	Sex	Age class	Status	Fox#	Accession No.	Plague Test #1	Test #1 Titer	Plague Test #2	Test #2 Titer	Tularemia	Titer	Distemper	Titer
534M	8/27/2005	Iron Mtn Bison Ranch- Porter draw	540037	4540670	M	Pup	Released	534M	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
535F	8/28/2005	Warren Livestock Co. - Whitaker	511197	4580761	F	Pup	Released	535F	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
536F	8/28/2005	Warren Livestock Co. - Whitaker	511218	4579956	F	Adult	Released	536F	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
537F	8/28/2005	Warren Livestock Co. - Whitaker	511218	4579554	F	Pup	Released	537F	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
538F	8/28/2005	Warren Livestock Co. - Whitaker	511469	4580473	F	Adult	Shipped	538F	5011631, 054867	Positive	1:32	Positive	1:32	No test	.	No test	.
539M	8/28/2005	Warren Livestock Co. - Whitaker	511177	4580709	M	Adult	Shipped	539M	5011631, 054868	Positive	1:64	Positive	1:32	No test	.	No test	.
540F	8/28/2005	Don Berry Ranch	530626	4580594	F	Adult	Shipped	540F	5011631	Negative	n/a	n/a	n/a	Negative	1:32	Positive	1:16
541F	8/28/2005	Don Berry Ranch	530993	4580610	F	Pup	Shipped	541F	5011631	Negative	n/a	n/a	n/a	Negative	1:4	Negative	<1:4
542M	8/29/2005	Don Berry Ranch	532897	4580422	M	Pup	Shipped	542M	5011704	Negative	n/a	n/a	n/a	Negative	1:64	Negative	<1:4
543F	8/29/2005	Don Berry Ranch	532533	4579007	F	Pup	Shipped	543F	5011704	Negative	n/a	n/a	n/a	Negative	<1:4	Negative	<1:4
544F	8/31/2005	Don Berry Ranch	530626	4580594	F	Adult	Released	544F	54869	Positive	1:32	No test		No test	.	No test	.
545F	8/31/2005	Don Berry Ranch	530643	4579897	F	Pup	Released	545F	54870	Negative	n/a	No test		No test	.	No test	.
546F	8/31/2005	Iron Mtn Bison Ranch	535438	4584715	F	Pup	Shipped	546F	54871	Negative	n/a	n/a	n/a	No test	.	No test	.
547F	8/31/2005	Iron Mtn Bison Ranch	538241	4585122	F	Adult	Shipped	547F	54872	Negative	n/a	n/a	n/a	No test	.	No test	.
548F	8/31/2005	Iron Mtn Bison Ranch	539105	4584676	F	Pup	Shipped	548F	54873	Negative	n/a	n/a	n/a	No test	.	No test	.
549F	8/31/2005	Iron Mtn Bison Ranch	539180	4584443	F	Pup	Shipped	549F	54874	Positive	1:64	Positive	1:64	No test	.	No test	.
550M	8/31/2005	Iron Mtn Bison Ranch	540957	4586889	M	Adult	Shipped	550M	54875	Negative	n/a	n/a	n/a	No test	.	No test	.
551F	9/1/2005	Warren Livestock Co. - Whitaker	515807	4571725	F	Adult	Shipped	551F	54876	Negative	n/a	n/a	n/a	No test	.	No test	.
552F	9/1/2005	Warren Livestock Co. - Whitaker	517680	4570748	F	Pup	Shipped	552F	54877	Negative	n/a	n/a	n/a	No test	.	No test	.
553F	9/1/2005	Warren Livestock Co. - Whitaker	517681	4570263	F	Adult	Shipped	553F	54878	Negative	n/a	n/a	n/a	No test	.	No test	.
554F	9/1/2005	Warren Livestock Co. - Whitaker	509601	4581345	F	Adult	Shipped	554F	54879	Positive	1:32	Positive	1:32	No test	.	No test	.
555F	9/1/2005	Iron Mtn Bison Ranch	535440	4584498	F	Pup	Shipped	555F	54880	Negative	n/a	n/a	n/a	No test	.	No test	.
556M	9/1/2005	Iron Mtn Bison Ranch	537102	4585398	M	Pup	Shipped	556M	54881	Negative	n/a	n/a	n/a	No test	.	No test	.
557M	9/1/2005	Iron Mtn Bison Ranch	538287	4584172	M	Pup	Shipped	557M	54882	Positive	1:16	Positive	1:32	No test	.	No test	.
558F	9/1/2005	Iron Mtn Bison Ranch	535431	4585052	F	Adult	Shipped	558F	54883	Positive	1:32	Positive	1:64	No test	.	No test	.
559F	9/1/2005	Iron Mtn Bison Ranch	540885	4587336	F	Adult	Shipped	559F	54884	Positive	1:16	Positive	1:32	No test	.	No test	.

Table 8. Trapping data for swift foxes captured near Karval, Colorado, August 2006.

Fox ID	Sex	Age Class	Capture Date	Capture Location	Easting	Northing	Status	Accession #	Plague	Tularemia	Titer	Distemper	Titer
600M	M	Adult	8/29/2006	STOGSDILL NE	0615826	4281997	Translocated	6013225	NEG	NEG	1:4	NEG	<1:4
601M	M	Pup	8/29/2006	STOGSDILL NE	0617918	4281133	Translocated	6013225	NEG	NEG	1:8	NEG	<1:4
602F	F	Adult	8/29/2006	STOGSDILL NE	0617985	4280662	Translocated	6013225	NEG	NEG	1:64	POS	1:512
603F	F	Adult	8/29/2006	STOGSDILL NE	0616905	4281988	Translocated	6013225	NEG	NEG	1:8	NEG	<1:4
604F	F	Adult	8/29/2006	STOGSDILL NE	0616714	4282130	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
605M	M	Adult	8/29/2006	STOGSDILL NE	0618592	4283116	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
606F	F	Pup	8/29/2006	STOGSDILL NE	0617414	4283115	Released	6013225	NEG	NEG	<1:4	NEG	<1:4
607F	F	Pup	8/29/2006	DAVIS SW	0613622	4278268	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
608F	F	Adult	8/29/2006	DAVIS SW	0613010	4277238	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
609M	M	Adult	8/29/2006	DAVIS SW	0613826	4275571	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
610F	F	Adult	8/29/2006	DAVIS SW	0613243	4275964	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
611M	M	Adult	8/29/2006	STOGSDILL HOUSE	0614787	4280569	Translocated	6013225	NEG	NEG	1:8	NEG	<1:4
612F	F	Pup	8/29/2006	STOGSDILL HOUSE	0614793	4279364	Translocated	6013225	NEG	NEG	1:8	POS	1:256
613M	M	Pup	8/29/2006	STOGSDILL HOUSE	0613718	4278953	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
614M	M	Adult	8/29/2006	STOGSDILL HOUSE	0612628	4279472	Translocated	6013225	NEG	NEG	1:32	NEG	1:16
615F	F	Adult	8/29/2006	DAVIS SE	0616097	4274636	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
616M	M	Pup	8/29/2006	DAVIS SE	0615854	4278403	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
617F	F	Pup	8/29/2006	DAVIS SE	0615997	4276103	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
618F	F	Pup	8/29/2006	DAVIS SE	0618722	4274830	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
619M	M	Pup	8/29/2006	DAVIS SE	0617464	4277879	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
620M	M	Adult	8/30/2006	S RD/CR 25	0621049	4285892	Translocated	6013225	NEG	POS	1:128	NEG	<1:4
621F	F	Pup	8/30/2006	CR 25-N	0621371	4291481	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
622M	M	Pup	8/30/2006	CR 25-N	0621702	4292637	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
623M	M	Adult	8/30/2006	CROWN RANCH	0588745	4309363	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
624F	F	Pup	8/30/2006	CROWN RANCH	0591682	4303737	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:8
625M	M	Pup	8/31/2006	STOGSDILL PDOG	0621409	4285892	Translocated	6013225	NEG	NEG	1:32	NEG	<1:4
626F	F	Pup	8/31/2006	STOGSDILL PDOG	0621049	4285892	Translocated	6013225	NEG	NEG	1:16	NEG	<1:4
627F	F	Adult	8/31/2006	STOGSDILL PDOG	0621049	4285892	Translocated	6013225	NEG	NEG	1:16	NEG	<1:4
628M	M	Adult	8/31/2006	SCHACK EAST	0609080	4289829	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
629F	F	Adult	8/31/2006	SCHACK WEST	0606511	4288964	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
630M	M	Pup	8/31/2006	SCHACK WEST	0605682	4289853	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
631F	F	Adult	8/31/2006	SCHACK WEST	0605990	4289832	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
632F	F	Adult	8/31/2006	STOGSDILL NE	0618478	4278834	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
633F	F	Adult	8/31/2006	STOGSDILL NE	0615884	4278779	Released	6013225	NEG	NEG	1:32	NEG	1:64
634M	M	Pup	8/31/2006	STOGSDILL NE	0616635	4279216	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
635M	M	Adult	8/31/2006	STOGSDILL NE	0615847	4281992	Translocated	6013225	NEG	NEG	1:32	NEG	<1:4
636F	F	Pup	8/31/2006	STOGSDILL NE	0616715	4282138	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4

Table 9. Trapping data for swift foxes captured near Lamar, Colorado, September 2007.

FOX ID	CAP DATE	SEX	AGE	CAP LOC	EASTING	NORTHING	Q-TINE#	PLAGUE	TITER #1	TITER #2	STATUS	PIT TAG
700F	9/3/2007	F	1-2	Walker- W	710787	4199696	VMC -C	NEG	--	--	Trans	103*785*041
701F	9/3/2007	F	1-2	Walker- W	710568	4200581	H5	POS	1:256	1:256	Trans	103*789*534
702F	9/3/2007	F	1-2	Walker- W	711828	4202666	VMC -E	NEG	--	--	Trans	103*777*352
703F	9/3/2007	F	1-2	Walker- W	711386	4202835	VMC -6	NEG	--	--	Trans	103*773*569
704F	9/3/2007	F	<1	Walker- W	711360	4203499	VMC -G	NEG	--	--	Trans	103*789*028
705M	9/3/2007	M	3-4	Walker- W	711227	4207399	H2	POS	1:64	1:128	Trans	103*794*261
706M	9/3/2007	M	1-2	Walker- W	711218	4207780	VMC -J	NEG	--	--	Trans	103*793*265
707M	9/3/2007	M	<1	Walker- W	711196	4208767	VMC -H	NEG	--	--	Trans	103*777*288
708M	9/3/2007	M	2-3	Walker- W	709536	4209927	VMC -1	NEG	--	--	Trans	103*798*293
709F	9/3/2007	F	2-3	Walker- W	709789	4201314	VMC -2	NEG	--	--	Trans	103*791*060
710F	9/3/2007	F	2-3	Walker- S	713880	4198768	H1	POS	1:16	1:16	Trans	103*795*020
711F	9/3/2007	F	<1	Walker- S	710019	4194688	H11	NEG	--	--	Trans	103*789*592
712F	9/3/2007	F	3-4	Airport	*	*	--	POS	1:256	--	Released	--
713M	9/3/2007	M	2-3	Gentz	709803	4238139	H8	POS	1:2048	1:2048	Trans	103*773*598
714M	9/3/2007	M	<1	Gentz	709987	4238024	H10	POS	NEG	NEG	Trans	103*786*077
715M	9/3/2007	M	1-2	Gentz	712496	4238081	H4	POS	1:64	1:128	Trans	103*786*317
716M	9/4/2007	M	<1	Walker - E	714493	4206028	VMC -5	NEG	--	--	Trans	103*797*888
717F	9/4/2007	F	<1	Walker- W2	710775	4198701	H9	NEG	--	--	Trans	103*773*821
718M	9/4/2007	M	<1	Walker- W2	710172	4199968	H12	POS	1:512	1:512	Trans	103*786*312
719M	9/4/2007	M	2-3	Walker- W2	709963	4200760	H6	POS	1:512	1:512	Trans	103*785*294
720F	9/4/2007	F	<1	Walker- W2	711018	4201429	VMC -3	NEG	--	--	Trans	103*794*011
721M	9/4/2007	M	<1	Walker- W2	711036	4208770	VMC -F	NEG	--	--	Trans	103*787*842
722M	9/4/2007	M	1-2	Walker- W2	711143	4210553	VMC -D	NEG	--	--	Trans	103*785*793
723F	9/4/2007	F	<1	Walker- W2	710816	4211379	VMC -I	NEG	--	--	Trans	103*786*051
724M	9/4/2007	M	<1	Gentz	712496	4238081	VMC -4	NEG	--	--	Trans	103*794*350
725F	9/4/2007	F	1-2	Gentz	712988	4238093	H3	NEG	--	--	Trans	103*787*635
726F	9/4/2007	F	1-2	Airport	*	*	H7	POS	1:128	1:256	Trans	103*786*544

Table 10. Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2005.

Fox ID	Sex	Age	Release Type	Release Unit	Release Date	Release Site Type	Site Description	Landowner	Site UTM Easting	Site UTM Northing	Total Days Acclimation
401	M	Adult	Soft	West	7/13/2005	Pen	Hoffman	Bad River Ranches	349632	4897820	340
404	M	Adult	Soft	West	7/13/2005	Pen	Twin Buttes - South	Bad River Ranches	350604	4893279	330
406	F	Adult	Soft	North	7/13/2005	Pen	Powell Crk	Bad River Ranches	380317	4910158	339
414	F	Adult	Soft	West	7/13/2005	Pen	Dandee Butte	Bad River Ranches	351215	4897951	269
419	F	Adult	Soft	North	7/13/2005	Pen	Twin Buttes - North	Bad River Ranches	350640	4896226	334
421	F	Adult	Soft	West	7/13/2005	Pen	Dandee Butte	Bad River Ranches	351215	4897951	266
422	M	Adult	Soft	West	3/25/2005	Pen	Twin Buttes - North	Bad River Ranches	350640	4896226	225
425	M	Adult	Soft	North	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	324
426	F	Adult	Soft	North	7/13/2005	Pen	Powell Crk	Bad River Ranches	380317	4910158	332
433	M	Adult	Soft	West	7/13/2005	Pen	Twin Buttes - South	Bad River Ranches	350604	4893279	323
435	F	Adult	Soft	North	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	320
437	M	Adult	Soft	South	11/26/2004	Pen	Golden	Bad River Ranches	357325	4879642	92
438	M	Adult	Soft	West	7/13/2005	Pen	Bullhead	Bad River Ranches	355766	4895918	319
442	M	Adult	Soft	West	7/13/2005	Pen	Bullhead	Bad River Ranches	355766	4895918	319
443	F	Adult	Soft	West	7/13/2005	Pen	Hoffman	Bad River Ranches	349632	4897820	318
458	M	Pup	Soft	West	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	60
459	M	Pup	Soft	West	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	60
460	M	Pup	Soft	West	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	60
461	M	Pup	Soft	West	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	60
501	F	Pup	Hard	West	9/8/2005	Pen	BRR / Van Metre	Bad River Ranches	352466	4889663	31
503	F	Adult	Hard	North	10/9/2005	Mush Pen	D. Stirling	David Stirling	371169	4909824	49
508	M	Adult	Hard	North	10/9/2005	Mush Pen	D. Stirling	David Stirling	371169	4909824	48
525	F	Pup	Hard	West	10/9/2005	Pen	BRR / Twin Buttes	Bad River Ranches	350604	4893279	44
528	F	Adult	Hard	West	10/9/2005	Mush Pen	L. Hall / North	Lois Hall	344822	4901693	42
529	F	Adult	Hard	West	10/9/2005	Pen	BRR / Twin Buttes	Bad River Ranches	350604	4893279	42
533	M	Pup	Hard	West	10/9/2005	Mush Pen	L. Hall / North	Lois Hall	344822	4901693	42
542	M	Pup	Hard	North	10/9/2005	Pen	BRR / Guardrail	Bad River Ranches	370443	4906159	40
546	F	Adult	Hard	North	10/9/2005	Pen	BRR / Guardrail	Bad River Ranches	370443	4906159	39
547	F	Pup	Hard	North	10/9/2005	Pen	BRR / White Dog	Bad River Ranches	368228	4908161	39
548	F	Pup	Hard	North	10/9/2005	Pen	BRR / White Dog	Bad River Ranches	368228	4908161	39

Table 10 (continued). Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2005.

Fox ID	Sex	Age	Release Type	Release Unit	Release Date	Release Site Type	Site Description		Site UTM Easting	Site UTM Northing	Total Days Acclimation
549	F	Adult	Hard	North	10/9/2005	Pen	BRR / Guardrail	Bad River Ranches	370443	4906159	39
551	F	Pup	Hard	West	10/9/2005	Mush Pen	L. Hall / South	Lois Hall	346224	4899897	38
552	F	Adult	Hard	North	10/9/2005	Mush Pen	D. Stirling	David Stirling	371309	4910105	35
553	F	Adult	Hard	North	10/9/2005	Mush Pen	D. Stirling	David Stirling	371309	4910105	35
554	F	Adult	Hard	West	10/9/2005	Mush Pen	BRR / Bad River Rd	Bad River Ranches	348564	4897744	38
555	F	Pup	Hard	North	10/9/2005	Pen	BRR / Guardrail Pen	Bad River Ranches	370443	4906159	38
556	M	Pup	Hard	West	10/9/2005	Mush Pen	L. Hall / South	Lois Hall	346224	4899897	38
557	M	Pup	Hard	West	10/9/2005	Mush Pen	BRR / Bad River Rd	Bad River Ranches	348564	4897744	38
558	F	Adult	Hard	West	10/9/2005	Mush Pen	BRR / Bad River Rd	Bad River Ranches	348445	4897806	38

Table 11. Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2006.

Fox ID	Sex	Age	Release Date	Release Type	Release Method	Site Description	Landowner	County	UTM Easting	UTM Northing	Total Days Acclimation
515M	M	Adult	8/7/2006	Soft	Pen	Hoffman	Turner	Stanley Co.	349632	4897820	334
524M		Adult	8/7/2006	Soft	Pen	Dandee Butte	Turner	Stanley Co.	351215	4897951	334
538F	F	Adult	8/7/2006	Soft	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	334
539M	M	Adult	8/7/2006	Soft	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	334
540F	F	Adult	8/7/2006	Soft	Pen	Dandee Butte	Turner	Stanley Co.	351215	4897951	334
541F	F	Adult	8/7/2006	Soft	Pen	Hoffman	Turner	Stanley Co.	349632	4897820	334
573M	M	Pup	8/7/2006	CB	Pen	Hoffman Pen (TB-S)	Turner	Stanley Co.	349632	4906160	72
574M	M	Pup	8/7/2006	CB	Pen	Hoffman Pen (TB-S)	Turner	Stanley Co.	349632	4906160	72
575F	F	Pup	8/7/2006	CB	Pen	Hoffman Pen (TB-S)	Turner	Stanley Co.	349632	4906160	72
581M	M	Pup	8/7/2006	CB	Pen	TB-N	Turner	Stanley Co.	350640	4896226	77
582F	F	Pup	8/7/2006	CB	Pen	TB-N	Turner	Stanley Co.	350640	4896226	77
583F	F	Pup	8/7/2006	CB	Pen	TB-N	Turner	Stanley Co.	350640	4896226	77
584M	M	Pup	8/7/2006	CB	Pen	Dandee Pen	Turner	Stanley Co.	351215	4897951	63
585F	F	Pup	8/7/2006	CB	Pen	Dandee Pen	Turner	Stanley Co.	351215	4897951	63
586M	M	Pup	8/7/2006	CB	Pen	Dandee Pen	Turner	Stanley Co.	351215	4897951	63
587M	M	Pup	8/7/2006	CB	Pen	Dandee Pen	Turner	Stanley Co.	351215	4897951	63
523M	M	Adult	10/1/2006	Hard	Mush Pen	Bullhead/Hansen - N8	Hansen	Haakon Co.	301693	4909873	388
543F	F	Adult	10/1/2006	Hard	Mush Pen	Bullhead/Hansen - N8	Hansen	Haakon Co.	301693	4909873	388
550M	M	Adult	10/1/2006	Hard	Mush Pen	TB-S/Hansen - S3	Hansen	Haakon Co.	300984	4908018	388
559F	F	Adult	10/1/2006	Hard	Mush Pen	TB-S/Hansen - S3	Hansen	Haakon Co.	300984	4908018	388
600M	M	Adult	10/1/2006	Hard	Mush Pen	Hansen - N6	Hansen	Haakon Co.	302116	4910366	28
601M	M	Pup	10/1/2006	Hard	Mush Pen	Hansen - S5	Hansen	Haakon Co.	301247	4907446	28
602F	F	Adult	10/1/2006	Hard	Mush Pen	Hansen - S4	Hansen	Haakon Co.	301875	4907231	28
603F	F	Adult	10/1/2006	Hard	Mush Pen	Hansen - N10	Hansen	Haakon Co.	302787	4910291	28
607F	F	Pup	10/1/2006	Hard	Mush Pen	Hansen - S5	Hansen	Haakon Co.	301247	4907446	28
610F	F	Adult	10/1/2006	Hard	Mush Pen	Hansen - S1	Hansen	Haakon Co.	300822	4907146	28
611M	M	Adult	10/1/2006	Hard	Mush Pen	Hansen - N10	Hansen	Haakon Co.	302787	4910291	28
612F	F	Pup	10/2/2006	Hard	Mush Pen	White Dog	Turner	Stanley Co.	368228	4908161	29
613M	M	Pup	10/1/2006	Hard	Mush Pen	Hansen - S2	Hansen	Haakon Co.	301410	4907732	28
614M	M	Adult	10/1/2006	Hard	Mush Pen	Hansen - S1	Hansen	Haakon Co.	300822	4907146	28

Table 11 (continued). Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2006.

Fox ID	Sex	Age	Release Date	Release Type	Release Method	Site Description	Landowner	County	UTM Easting	UTM Northing	Total Days Acclimation
616M	M	Pup	10/1/2006	Hard	Mush Pen	Hansen - S4	Hansen	Haakon Co.	301875	4907231	28
617F	F	Pup	10/2/2006	Hard	Mush Pen	Guardrail	Turner	Stanley Co.	370443	4906159	29
618F	F	Pup	10/1/2006	Hard	Mush Pen	Hansen - N9	Hansen	Haakon Co.	302505	4909757	28
619M	M	Pup	10/2/2006	Hard	Mush Pen	Guardrail	Turner	Stanley Co.	370443	4906159	29
620M	M	Adult	10/2/2006	Hard	Mush Pen	EAC - MP'06	Turner	Stanley Co.	372368	4908183	29
621F	F	Pup	10/2/2006	Hard	Mush Pen	White Dog	Turner	Stanley Co.	368228	4908161	29
622M	M	Pup	10/2/2006	Hard	Mush Pen	White Dog	Turner	Stanley Co.	368228	4908161	29
624F	F	Pup	10/1/2006	Hard	Mush Pen	Hansen - N7	Hansen	Haakon Co.	301895	4909986	28
625F	F	Pup	10/2/2006	Hard	Mush Pen	EAC - MP'06	Turner	Stanley Co.	372368	4908183	29
626M	M	Pup	10/2/2006	Hard	Mush Pen	EAC - MP'06	Turner	Stanley Co.	372368	4908183	29
627F	F	Adult	10/2/2006	Hard	Mush Pen	EAC - MP'06	Turner	Stanley Co.	372368	4908183	29
630M	M	Pup	10/1/2006	Hard	Mush Pen	Hansen - N9	Hansen	Haakon Co.	302505	4909757	28
632F	F	Adult	10/1/2006	Hard	Mush Pen	Hansen - N6	Hansen	Haakon Co.	302116	4910366	28
634M	M	Pup	10/1/2006	Hard	Mush Pen	Hansen - N7	Hansen	Haakon Co.	301895	4909986	28
636F	F	Pup	10/1/2006	Hard	Mush Pen	Hansen - S2	Hansen	Haakon Co.	301410	4907732	28

Table 12. Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2007.

Fox ID	Sex	Age	Release Date	Release Type	Release Method	Site Description	Landowner	County	UTM Easting	UTM Northing	Total Days Acclimation
604F	F	Adult	10/8/2007	Soft - long	Pen	Twin Buttes / South	Turner	Stanley Co.	350604	4893279	395
605M	M	Adult	6/17/2007	Soft - long	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	284
608F	F	Adult	4/21/2007	Soft - long	Pen	Dandee Butte	Turner	Stanley Co.	351215	4897951	228
609M	M	Adult	6/17/2007	Soft - long	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	284
615F	F	Adult	6/17/2007	Soft - long	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	284
623M	M	Adult	6/17/2007	Soft - long	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	284
628M	M	Adult	10/8/2007	Soft - long	Pen	Twin Buttes / South	Turner	Stanley Co.	350604	4893279	395
629F	F	Adult	6/17/2007	Soft - long	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	284
631F	F	Adult	6/17/2007	Soft - long	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	284
635M	M	Adult	4/28/2007	Soft - long	Pen	Dandee Butte	Turner	Stanley Co.	351215	4897951	235
640F	F	Pup	10/8/2007	CB	Pen	Twin Buttes / South	Turner	Stanley Co.	350604	4893279	151
641M	M	Pup	10/8/2007	CB	Pen	Twin Buttes / South	Turner	Stanley Co.	350604	4893279	151
642F	F	Pup	6/17/2007	CB	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	33
643M	M	Pup	6/17/2007	CB	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	33
644F	F	Pup	6/17/2007	CB	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	33
645M	M	Pup	6/17/2007	CB	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	47
646F	F	Pup	6/17/2007	CB	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	47
647M	M	Pup	6/17/2007	CB	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	47
648M	M	Pup	6/17/2007	CB	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	47
649F	F	Pup	6/17/2007	CB	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	45
650M	M	Pup	6/17/2007	CB	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	45
651M	M	Pup	6/17/2007	CB	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	45
652M	M	Pup	6/17/2007	CB	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	45
653M	M	Pup	10/8/2007	CB	Pen	Twin Buttes / South	Turner	Stanley Co.	350604	4893279	151
700F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 20-4	Hansen	Haakon Co.	301410	4907732	31
701F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 16-3	Hansen	Haakon Co.	301601	4908543	31
702F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 16-1	Hansen	Haakon Co.	301763	4909424	31
703F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 16-2	Hansen	Haakon Co.	302148	4908295	31
704F	F	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 20-2	Hansen	Haakon Co.	300822	4907146	31
705M	M	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 9-1	Hansen	Haakon Co.	301694	4909876	31
706M	M	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 16-1	Hansen	Haakon Co.	301763	4909424	31
707M	M	Pup	10/8/2007	Soft - short	Mush Pen	BRR -WAC	Turner	Stanley Co.	369445	4906691	31
708M	M	Adult	10/8/2007	Soft - short	Mush Pen	BRR - EAC	Turner	Stanley Co.	373589	4906946	31
709F	F	Adult	10/8/2007	Soft - short	Mush Pen	BRR - EAC	Turner	Stanley Co.	373589	4906946	31

Table 12 (continued). Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2007.

Fox ID	Sex	Age	Release Date	Release Type	Release Method	Site Description	Landowner	County	UTM Easting	UTM Northing	Total Days Acclimation
710F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 9-1	Hansen	Haakon Co.	301694	4909876	31
711F	F	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 17-1	Hansen	Haakon Co.	300742	4909402	31
713M	M	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 8-2	Hansen	Haakon Co.	300899	4910334	31
714M	M	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 8-1	Hansen	Haakon Co.	301381	4909867	31
715M	M	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 20-1	Hansen	Haakon Co.	300340	4907473	31
716M	M	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 16-2	Hansen	Haakon Co.	302148	4908295	31
717F	F	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 8-1	Hansen	Haakon Co.	301381	4909867	31
718M	M	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 17-1	Hansen	Haakon Co.	300742	4909402	31
719M	M	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 16-3	Hansen	Haakon Co.	301601	4908543	31
720F	F	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 20-3	Hansen	Haakon Co.	301070	4906626	31
721M	M	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 20-2	Hansen	Haakon Co.	300822	4907146	31
722M	M	Adult	10/8/2007	Self release	Acclimation Pen	BRR -VM	Turner	Jones Co.	352463	4889541	31
723F	F	Pup	10/8/2007	Soft - short	Mush Pen	BRR - WAC	Turner	Stanley Co.	369445	4906691	31
724M	M	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 20-3	Hansen	Haakon Co.	301070	4906626	31
725F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 20-1	Hansen	Haakon Co.	300340	4907473	31
726F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 8-2	Hansen	Haakon Co.	300899	4910334	31

Table 13. Estimated densities of breeding birds by habitat type for area search counts (9 ha) conducted on the BRR during June (I), July (II), and August (III) of 2005, 2006, and 2007.

2005 Habitat	I	II	III	Average	Est. Density (/ha)
Upland Grassland	56	70	26	50.67	5.63
CRP	31	38	12	27.00	3.00
Prairie Dog Colony	52	107	46	68.33	7.59
Total	139	215	84		
Ave. Est. Density	**5.15**	**7.96**	**3.11**		**5.41**
2006 Habitat	I	II	III	Average	Est. Density (/ha)
Upland Grassland	77	21	13	37.00	4.11
CRP	69	3	0	24.00	2.67
Prairie Dog Colony	117	89	39	81.67	9.07
Total	263	113	52		
Ave. Est. Density	**9.74**	**4.19**	**1.93**		**5.28**
2007 Habitat	I*	II	III	Average	Est. Density (/ha)
Upland Grassland	--	24	2	8.67	0.96
CRP	--	20	2	7.33	0.81
Prairie Dog Colony	--	52	28	26.67	2.96
Total	--	96	32		
Ave. Est. Density	**0.00**	**3.56**	**1.19**		**1.58**

**Survey not conducted during this period.*

Table 14. Summary of breeding bird counts by species, habitat type, and survey period for counts conducted on the BRR in June (I), July (II), and August (III), 2005.

	Upland Grassland			CRP			Prairie Dog Colony			
Species	I	II	III	I	II	III	I	II	III	Total
Western Meadowlark	20	27	5	14	7	2	20	65	3	163
Grasshopper Sparrow	18	32	11	10	20	4	-	-	-	95
Horned Lark	-	-	-	-	-	-	12	23	15	50
Killdeer	-	-	-	-	-	-	3	16	26	45
Brown Headed Cowbird	17	6	-	6	5	-	2	1	-	37
Upland Sandpiper	-	5	1	-	-	-	10	-	-	16
Mourning Dove	1	-	7	-	-	5	1	-	-	14
Burrowing Owl	-	-	-	-	-	-	2	2	2	6
Eastern Kingbird	-	-	-	-	4	-	-	-	-	4
Greater Prairie Chicken	-	-	-	-	-	-	4	-	-	4
Unknown Sparrow	-	-	1	-	-	1	-	-	-	2
Dickcissel	-	-	-	-	1	-	-	-	-	1
Fly Catcher	-	-	1	-	-	-	-	-	-	1
Total	56	70	26	30	37	12	54	107	46	438

Table 15. Summary of breeding bird counts by species, habitat type, and survey period for counts conducted on the BRR in June (I), July (II), and August (III), 2006.

	Upland Grassland			CRP*			Prairie Dog Colony			
Species	I	II	III	I	II	III	I	II	III	Total
Horned Lark							57	76	31	164
Western Meadowlark	22	5		12			27	1	6	73
Grasshopper Sparrow	32	3	2	31						68
Mourning Dove	7	9	2	4	2		6		4	34
Brown Headed Cowbird	12	2		11			8			33
Unknown Sparrow							17	1		18
Killdeer							2	11	2	15
Upland Sandpiper	4	1		5	1					11
Greater Prairie Chicken		1	3	6						10
Sharp-tailed Grouse			4							4
Burrowing Owl							1	1		2
Barn Swallow			2							2
Total	**77**	**21**	**13**	**69**	**3**	**0**	**118**	**90**	**43**	**434**

* CRP lands were mowed and harvested for upland hay between counts I and II.

Table 16. Summary of breeding bird counts by species, habitat type, and survey period for counts conducted on the BRR in June (I), July (II), and August (III), 2007.

	Upland Grassland			CRP			Prairie Dog Colony			
Species	I[1]	II	III	I[1]	II	III	I[1]	II	III	Total
Western Meadowlark	--	11	1	--	8	2	--	11	2	35
Grasshopper Sparrow	--	11		--	12		--			23
Horned Lark	--			--			--	12	9	21
Killdeer	--			--			--	12	4	16
Mourning Dove	--			--			--	4	10	14
Bobolink	--			--			--	5		5
Burrowing Owl	--			--			--	4	1	5
Upland Sandpiper	--			--			--	3		3
Ferruginous Hawk	--			--			--		2	2
Brown Headed Cowbird	--	2		--			--			2
Northern Harrier	--		1	--			--			1
Unknown Species	--			--			--	1		1
Total	**0**	**24**	**2**	**0**	**20**	**2**	**0**	**52**	**28**	**128**

[1] Survey not accomplished due to weather and logistics

Table 17. Summary of small mammal captures by habitat and species for surveys conducted on the BRR during 2005.

		Habitat Type					
Period	Species	P dog	Upland	Road	Coulee	Total	(%)
Fall	*Peromyscus maniculatus*	28	7	2	47	84	96.55
	Onychomys leucogaster	1				1	1.15
	Cryptotis parva			2		2	2.30
	TOTAL	29	7	4	47	87	

Trap Nights:	2,865
Capture Success:	5.58%
Recapture percentage:	45.63%

Table 18. Summary of small mammal captures by habitat and species for surveys conducted on BRR during 2006.

		Habitat Type					
Period	Species	P dog	Upland	Road	Coulee	Total	(%)
Fall	*Peromyscus maniculatus*	16	16	21	63	116	88.5
	Cryptotis parva	3	2	2		7	5.3
	Reithrodontomys megalotis			1	6	7	5.3
	Sorex cinereus				1	1	0.8
	Microtus ochrogaster			1		1	0.8
	TOTAL	19	18	24	70	131	

Trap Nights:	2,810
Capture Success:	4.70%
Recapture percentage:	32.58%

Table 19. Summary of small mammal captures by habitat and species for surveys conducted on the BRR during 2007.

		Habitat Type					
Period	Species	P dog	Upland	Road	Coulee	Total	(%)
Fall	*Peromyscus maniculatus*	40	52	35	110	237	86.8
	Onychomys leucogaster	11	1	0	0	12	4.4
	Reithrodontomys megalotis	1	0	2	0	3	1.1
	Microtis pennsylvanicus	0	3	4	0	7	2.6
	Spermophilus tridecemlineatus	0	1	2	0	3	1.1
	Microtis ochrogaster	0	9	2	0	11	4.0
	TOTAL	52	66	45	110	273	

Trap Nights:	2,643
Capture Success:	10.33%
Recapture percentage:	34.80%

Table 20. Estimated densities for Orthoptera (grasshoppers) by habitat type for jump count surveys conducted July (I) and August (II) on the BRR during 2005.

Habitat	I	II	Ave.	Ave. Est. Den. (m^2)
Coulee	2,165	9,139	5,652	0.88
Upland Grass	507	2,129	1,318	0.21
Prairie Dog Town	91	465	278	0.04
Total	2,763	11,733	7,248	0.38

Table 21. Estimated densities for Orthoptera (grasshoppers) by habitat type for jump count surveys conducted June (I), July (II), and August (III) on the BRR during 2006.

	I		II		III			
Habitat	Total	Ave. Den	Total	Ave. Den	Total	Ave. Den	Year Total	Ave. Den
Coulee	10,842	3.01	7,187	2.00	4,028	1.12	22,057	2.04
Prairie Dog colony	121	0.03	81	0.02	136	0.04	338	0.03
Upland	485	0.13	406	0.11	395	0.11	1,286	0.12
Roadside	2,686	0.75	2744	0.76	2,038	0.57	7,468	0.69
Total							31,149	0.72

Table 22. Estimated densities for Orthoptera (grasshoppers) by habitat type for jump count surveys conducted June (I), July (II) and August (III) on the BRR during 2007.

	I[1]		II		III			
Site	Total	Ave. Den	Total	Ave. Den	Total	Ave. Den	Total	Ave. Den
Coulee	--	--	9,763	2.71	5,302	1.47	15,065	2.09
Prairie Dog colony	--	--	326	0.09	120	0.03	446	0.06
Upland	--	--	4,183	1.16	2,003	0.56	6,186	0.86
Roadside	--	--	326	0.09	702	0.20	1,028	0.14
Total							22,725	0.79

[1] No survey conducted

Table 23. Estimated densities of lagomorphs, coyotes and swift fox in Swift Fox Recovery Area (SFRA) by period and species for spotlighting surveys conducted in December, 2005.

		Sampling Nights						Density
Period	Species		1	2	3	4	Total	(km^2)
Fall 2005	*Lepus townsendii*	24	12	8	11	55		0.85
	Sylvilagus floridanus	5	11	3	8	27		0.42
	Canis latrans	0	1	3	3	7		0.11
	Vulpes velox	0	0	1	2	3		0.05

Table 24. Estimated densities of lagomorphs and meso-carnivores in Swift Fox Recovery Area (SFRA) by period and species for spotlighting surveys conducted in November, 2006.

		Sampling Nights					Density
Period	Species	1	2	3	4	Total	(km²)
Fall 2006	*Lepus townsendii*	25	20	18	24	87	1.35
	Sylvilagus floridanus	3	10	12	4	29	0.45
	Canis latrans	2	4	3	1	10	0.16
	Vulpes velox	--	1	--	--	1	0.02
	Procyon lotor	1	--	2	--	3	0.05
	Erethizon dorsatum	1	--	2	2	5	0.08
	Mephitis mephitis	--	1	1	2	4	0.06
	Taxidea taxus	--	--	--	2	2	0.03

Table 25. Estimated densities of lagomorphs and meso-carnivores in Swift Fox Recovery Area (SFRA) by period and species for spotlighting surveys conducted in November, 2007.

		Sampling Nights					
Period	Species	1	2	3	4	Total	Density (km^2)
Fall 2007	*Lepus townsendii*	18	28	24	30	100	1.55
	Sylvilagus floridanus	19	7	13	5	44	0.68
	Canis latrans	1	4	2	2	9	0.14
	Vulpes velox	1	2	1	--	4	0.06
	Procyon lotor	--	--	--	1	1	0.02
	Erethizon dorsatum	2	--	--	--	2	0.03
	Mephitis mephitis	1	--	1	--	2	0.03
	Taxidea taxus	--	1	--	--	1	0.02

Table 26. Estimated relative densities (RD) of coyote and red foxes corrected by mean sightability (= 0.775) of fecal piles for fecal line surveys conducted on the Bad River Ranches, South Dakota during spring (2005 only) and fall of 2005, 2006, and 2007.

Sample Period	Coyote[1]	Fox[2]
Spring 2005	67.2	0.0
Fall 2005	44.8	24.9
Fall 2006	160.0	12.8
Fall 2007	123.2	72.8

[1] Computed by summing all corrected indices and dividing by the total number of transects for that sampling period.
2 Includes all fox species

Appendix I

Animal Handling Protocol & Justification for use of Intraperitoneal Transmitters Implants (ITI's)

While much of our work reintroducing a population of swift foxes involves non-invasive techniques (i.e., post-release telemetric monitoring, den watches, prey and predator surveys), techniques such as trapping, marking/tagging with ear tags, pit tags and/or radio-collars, and drawing blood for disease analysis are considered by some to be invasive of the animal's safety and well-being. Techniques which involve major and minor surgical procedures, such as the use of ITI's are clearly invasive since they expose animals to the serious risk of infection and death. While such procedures may be necessary to collect data needed to discern key aspects of a reintroduction (i.e., pup survival and causes of mortality), they should not be used indiscriminately and should follow the strictest possible protocols to ensure the well being of the animals involved.

We have developed such a protocol to use ITI's in swift fox pups to determine survival, causes of mortality, and dispersal habits during the critical pup rearing stage (Kitchen et al. 1999). Pups in this stage (3 to 20 weeks) are vulnerable to disease and predators and are typically too small to be fitted with radio collars. While observations carried out at den sites can provide data relating to reproductive success, the recovery of carcasses and determination of cause of mortality is often limited. Survival, reproductive success, and dispersal are considered to be critical components that contribute to the success or failure of reintroduction efforts (Bar David et al. 2005) and having the means to assess these components may assist in developing strategies to mitigate losses and increase juvenile recruitment.

Since we are investigating the efficacy of several types of release methods (i.e., soft-, hard-, and modified hard-releases) relating to survival and dispersal of translocated foxes, we have the opportunity to test whether the type of release method effects the reproductive success of adults and survival of their offspring. By maintaining mixed-sex pairs of foxes over winter in a captive environment (i.e., soft-release pens), we may be able to increase the likelihood of breeding success. Access to high quality and abundant food may also have a positive effect on litter's sizes along with gestational and post-whelp development and survival of pups when compared to free-ranging foxes. However, overall survival of soft-released pups may depend on releasing these family groups earlier in the rearing stage than later. Increased experience with natural prey items brought back to the den could play a critical role in the development of a prey search image as pups learn to forage. Therefore, the earlier family groups can be released, the better the tools young captive-born pups will have as they develop their survival skills. By using ITI's, pups, wild- or captive-born and too small for radio-collars, can still be effectively monitored and tracked. ITI's also provide a secondary benefit by assisting in locating and trapping of implanted individuals once they are large enough to carry a radio-collar.

Determining reproductive success (litter sizes) in soft-release pens is accomplished by twice weekly checks of belowground den boxes beginning in mid-April to mid-May. Free-ranging breeding pairs are observed at natal den sites over the course of the pup-rearing period (May-August, Kitchen et al. 1999). During weekly observation for 3- 4 weeks after pups initially emerge from the den, the maximum number of visible pups is recorded during morning and evening activity periods. These observations give us the minimum number of pups that have survived to emergence and minimum survival post-emergence until pups are large enough (700 – 800 grams) to safely hold a 13-gram

transmitter. After implanting, pups can be monitored telemetrically, allowing us to monitor movements, and determine when a mortality occurred through the pre-programmed mortality sensor in the transmitter. All mortalities are located as promptly as possible and the site investigated to determine cause of death.

Preliminary data from the first two years of reintroductions suggest that females had larger home ranges than males and lower overall survival when data was censored (Kunkel et al. 2004). Moerhenschlager and MacDonald (2003) noticed that survival among translocated swift foxes in Canada was higher in males and was negatively correlated to distance traveled away from release site. They speculated that one reason for this may be due to a higher degree of dispersal experience among males prior to translocation. Fitting swift fox pups with ITI's may allow us to compare movement patterns between males and females and test for differences that may explain the lower female survival seen among translocated foxes.

Methods

Study animals will be captured using box traps (Tomahawk Live Trap Co., Tomahawk, WI) baited with rabbit and mackerel. Bait will be covered and secured at the back of the trap to prevent ingestion. Trap locations will be typically associated with den sites. All the trap sites will be on the Bad River Ranches or on other private property with landowner permission. Traps will be baited and set in early morning (before sunrise) and late afternoon (before sunset) to coincide with peak activity periods. Traps will be checked 2-3 hours later to minimize the time pups are confined within the trap. After the check the traps will be closed and captured foxes processed.

Fox pups will be immobilized using isoflorane induced anesthesia administered via a portable wildlife anesthesia machine (Bruce Heath, MD, Denver, CO) and cone mask. Captured foxes may be immobilized using a Ketamine/medatomidine combination (100 mg Ketamine and 1 mg medatomidine per milliliter) at 3 mg of Ketamine and 0.1 mg medatomidine per pound of body weight OR 1.4 mg of Ketamine and 0.05 mg of medatomidine per kg of body mass. Ophthalmic ointment will be placed into the eyes and the animal's eyes covered. Study animals will be instrumented with intraperitoneal implant transmitters (M1215) manufactured by Advanced Telemetry Solutions, Isanti, MN. Implant transmitters will be gas-autoclaved using ethylene oxide at a sterilization temperature of 94C.

Licensed TESF staff veterinarian, David Hunter will conduct the implant surgery at the capture sites. The surgical site on the fox will be prepped using standard aseptic surgical procedures. Temperature, pulse and respiration will be monitored continually during procedure. A 3-cm incision will be made in the ventral-medial area near the umbilicus along the linea alba. Omentum and small intestine will be reflected to the right quadrant and the implant transmitter inserted into the left lower quadrant of the abdominal cavity. The transmitter signal will be checked and a 4-layer closure used to close the incision. Linea Alba, subcutaneous layers and subcuticular sutures will be closed with absorbable suture. The skin will be closed with surgical glue (Vet bond). A therapeutic level of a broad-spectrum, sustained release antibiotic will be administered to prevent infection. The procedure is expected to take < 15 minutes to perform.

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