

**APPENDIX B**  
**SPECIES ACCOUNT: SWIFT FOX**

## **SWIFT FOX (*Vulpes velox*)**

### **Species Status**

The Swift Fox Conservation Team (SFCT) was formed in 1994 and included members from Canada, Federal agencies and the 10 States (including Colorado) located in the historic range of the swift fox (*Vulpes velox*). In response to a 1992 petition by Jon C. Sharps to list the swift fox, the USFWS, in 1995, issued its 12-month finding that the swift fox was warranted but precluded for listing under the ESA (USFWS 1995). The USFWS believed that a threatened listing was warranted. The swift fox was not listed at that time, however, as resources needed to complete the process were not available.

Since 1994, the SFCT has produced the Swift Fox Conservation Assessment and Conservation Strategy (CACS) (Kahn et al. 1997) and seven annual reports (Allen et al. 1995, Luce and Lindzey 1996, Giddings 1997, Roy 1998, Schmitt 2000, Peeks 2002). The compilation of existing information, collection of new biological data and implementation of swift fox monitoring and management programs contained in these documents demonstrated that swift fox distribution was more widespread and continuous than originally thought at the time of the listing decision in 1995. The data also showed that the swift fox was more adaptable to various habitat types than previously believed. In the January 8, 2001 Federal Register (USFWS 2001) the USFWS stated:

As a result of new information, originally identified threats are no longer applicable for the following reasons: 1) The swift fox is more abundant and widely distributed than previously thought; and 2) the species is more flexible in its habitat requirements than originally believed.

It was further stated that the USFWS did not believe that swift fox populations were limited by the commercial trapping of furbearers and found no indication that either parasites or disease was limiting the population. As a result, the USFWS reevaluated the threats and the five listing factors under section 4(1)(1), and stated that, "...the swift fox is not likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future" (USFWS 2001). The USFWS thereby found the petition for listing to be unwarranted and removed the swift fox from the candidate list as of January 8, 2001. The swift fox is classified as non-game in Colorado and listed as a species of special concern.

### **Description and Taxonomy**

An adult swift fox typically weighs between 2 and 3 kg and is approximately 30 cm tall and 80 cm long (Egoscue 1979, Scott-Brown et al. 1987). This equates roughly to the size of an average domestic cat. The swift fox is distinguishable from all other North American foxes, other than the kit fox (*Vulpes macrotis*), by its small size and black-tipped tail. The swift fox is differentiated from the kit fox by smaller, more widely spaced ears and a rounder head. The swift fox is light gray to buffy tan above with pale yellow to white coloring on its legs, sides and lower surface of the tail. The pelage color may be more orange during the summer months. The swift fox also has easily distinguishable black patches on either side of the snout and on the tip of the tail. The dental formula for the swift fox is: 3/3; 1/1; 4/4; 2/3; for a total of 42 teeth.

### **Historical and Current Distribution**

The swift fox is native to the shortgrass and midgrass prairie ecosystems of the Great Plains region of North America (Kahn et al. 1997). Historically, its range was believed to be as large as 1.6 million km<sup>2</sup> (Scott-Brown et al. 1987, Sovada and Scheick 2000), and extended north to south from central Alberta to central Texas and east to west from western Iowa and Minnesota to central Colorado (Hall and Kelson 1959, Hall 1981, Samuel and Nelson 1982, Scott-Brown et al. 1987). The exact extent of historic distribution is difficult to determine based simply on limited fragmented and unverifiable historical information found in museum and fur trade records and

anecdotal accounts by early naturalists and explorers. Recent vegetation mapping that delineated grassland types in the central United States (Lauenroth 1996), however, indicates the historic range of the swift fox may be 20-25% less than previously estimated.

A dramatic reduction in the range of the swift fox occurred in the early 1800s to the mid 1900s due to human settlement, land-use conversion of prairies, predator control campaigns, unregulated trapping, hunting and rodent control programs (Samuel and Nelson 1982, FaunaWest 1991, Kahn et al. 1997). According to Hillman and Sharps (1978), habitat reduction was most dramatic in the northern and eastern portions of its range. Specifically in Colorado, the swift fox historically existed throughout the plains of eastern Colorado (Cary 1911, Armstrong 1972, Hall 1981). In the early 1900s the swift fox's range had decreased significantly and by the late 1960's, the species was reported as occurring "sparingly" (Cary 1911). It is believed that the current range of the swift fox is approximately 40% of its historic range (Kahn et al. 1997).

Annual surveys conducted by the USFWS from 1972 to 1981, however, showed populations of swift fox in the southeastern portion of Colorado to be stable to slightly increasing (Sovada and Scheick 2000). The 2001 Annual Report of the SFCT (Peeks 2002) stated that over the past 25 years swift fox distribution has increased on the eastern plains of Colorado. Many researchers have found there is a wide distribution of swift fox throughout eastern Colorado with many abundant local populations (Covell 1992, Kitchen 1999). Overall, an estimated population of 7,000 – 10,000 swift fox exists on the shortgrass prairie grasslands of eastern Colorado (Fitzgerald and Kahn 1997, Finley 1999, Covell 1992). Peeks (2002) stated that in addition to being found on the shortgrass prairie, swift fox also inhabit other areas such as agricultural and mixed grass prairie habitat which encompass about 30% of eastern Colorado. Therefore, it is likely that even more than 7,000 – 10,000 swift fox exist in eastern Colorado.

### **Life History and Habitat**

#### **Behavior**

The swift fox is generally nocturnal, with daytime activities restricted to the den site (Egoscue 1979). Kilgore (1969) observed swift fox basking in the sun midday during the winter months and morning, late afternoon and early evening during the summer. The swift fox is generally "naive" as evidenced by its ready acceptance of poison baits (Bunker 1940), willingness to den near human settlements (Cutter 1958) and trapping ease (Bailey 1926).

The swift fox does not appear to exhibit any signs of territoriality (Kahn et al. 1997) as home ranges often overlap. Home ranges are often variable in size and in Colorado have been estimated to be 86 to 210 ha (Rongstad et al. 1989).

#### **Reproduction**

Except as noted, the information on reproduction is from Egoscue (1979). The swift fox typically lives in family groups of one male and two females (Covell 1992). It is monestrous and monogamous and apparently forms long-term pair bonds, breeding only once a year (Kahn et al. 1997). In Colorado, breeding generally occurs during late December to early January with a gestation period of approximately 50 days resulting in pups being born in March to early April. A litter is typically 3-6 pups. Pups are altricial at birth with eyes and ears remaining closed for 10-15 days. Pups remain below ground for approximately one month and are weaned at about six to seven weeks of age. The young occupy a separate den, but remain with the parents until August or September of their first year (Kilgore 1969, Hines 1980, Covell 1992).

#### **Diet**

The swift fox feeds opportunistically on a wide variety of small mammals, birds, reptiles, insects, plants and carrion (Cutter 1958, Kilgore 1969, Zumbaugh et al. 1985, Uresk and Sharps 1986, Hines and Case 1991, Roell 1999, Kitchen 1999, Sovada et al. 2001). Small mammals make up the majority of its diet (Cameron 1984, Scott-Brown et al. 1987, Eussen 1999, Kitchen 1999, Sovada et al. 2001). Kitchen (1999) found that this was particularly the case from October to

July. Sovada et al. (2001) found that mammals were the most frequently ingested prey during the spring in cropland and rangeland areas and in the summer in cropland areas. Specific mammals found in its diet include cottontail rabbits (*Sylvilagus* spp.), jackrabbits (*Lepus* spp.), ground squirrels (*Spermophilus* spp.), black-tailed prairie dogs (*Cynomys ludovicianus*), pocket gophers (*Pappogeomys* spp.), pocket mice (*Perognathus* spp.), kangaroo rats (*Dipodomys* spp.), harvest mice (*Reithrodontomys* spp.), deer mice (*Peromyscus maniculatus*), grasshopper mice (*Onychomys leucogaster*), prairie voles (*Microtus ochrogaster*) and woodrats (*Neotoma* spp.) (Cameron 1984, Eussen 1999, Kitchen 1999, Roell 1999, Sovada et al. 2001).

Kitchen (1999) and Sovada et al. (2001) state that insects were the most common food item in the fall for cropland and rangeland, and in the summer for rangeland areas. Other researchers, however, believe insects to be a much smaller contribution to diet and simply an alternative food source when other resources are scarce (White et al. 1995, Spiegel et al. 1996, White et al. 1996). This difference, however, may simply be attributed to habitat composition and the subsequent availability and abundance of insects.

### **Mortality**

Direct mortality of the swift fox includes predation or death due to interference competition, vehicle collisions, hunting, trapping and rodent or predator poisoning campaigns. Predation is the most common type of direct swift fox mortality (Kahn et al. 1997, Roell 1999). Predators of the swift fox can include red fox (*Vulpes vulpes*), badgers (*Taxidea taxus*), large raptors and coyotes (*Canis latrans*) (Roell 1999). A large proportion of predation on swift fox is attributed to coyotes (Covell 1992, Kitchen 1999, Fox and Roy 1995, Sovada et al. 1998).

### **Habitat**

Of all of the native North American foxes, the swift fox is the most "den-dependent" (Kilgore 1969, Scott-Brown et al. 1987), using dens year-round and life-long for such purposes as predator evasion, protection against inclement weather, and raising young. Typically excavating its own den, the swift fox may also utilize and enhance burrows made by other species such as badgers, ground squirrels and prairie dogs (Kilgore 1969, Hillman and Sharps 1978, Uresk and Sharps 1986, Carbyn et al. 1994). The swift fox dens are typically identified by a circular or slightly oval entrance approximately 17.5-22.5 cm in diameter with a dirt ramp leading from the entrance that may face any direction (Gilin 2002). Dens may have multiple openings (Hillman and Sharps 1978, Loy 1981, Uresk and Sharps 1986) and many dens may be used at any one time or throughout the year (Hillman and Sharps 1978, Loy 1981, Briden et al. 1987, Koopman et al. 1998). Dens are excavated in a number of different habitats including native shortgrass prairie, pastures, roadside ditches, fencerows, fallow fields and even cultivated fields (Cutter 1958, Scott-Brown et al. 1987, Covell 1992).

The swift fox very often chooses den sites close to roads (Hillman and Sharps 1978, Loy 1981, Hines and Case 1991, Jackson 1997, Kintigh 1999, Pruss 1999, Gilin 2002). It is believed that roads are not only travel corridors for swift fox (Loy 1981, Pruss 1999), but may also provide increased opportunity for hunting and foraging. Carrion along roads may be a very important food source (Hillman and Sharps 1978, Hines and Case 1991). In addition, the area along roadways is often higher in small mammal abundance as compared to surrounding grasslands (Pasitschniak-Arts and Messier 1999). A significant amount of swift fox mortality, however, may occur along roads. This may be due either to collisions with vehicles or coyote predation, as coyotes commonly use roads as travel corridors (Kilgore 1969, Kahn 1997, Roell 1999, Kamler 2002).

Dens are typically located in shortgrass and midgrass prairie habitats. However, the swift fox will also occupy cropland habitats (Kilgore 1969, Hines 1980, Jackson 1997, Sovada et al. 2001), pinon-juniper habitats in Colorado and Oklahoma, and the sandhills of Nebraska (Schmitt 2000). Den sites are generally found on relatively flat areas; however, they may not necessarily be selecting for any particular slope as habitat is already characterized as level to gently rolling topography (Kilgore 1969, Hillman and Sharps 1978, Egoscue 1979, Loy 1981, Jackson 1997).

Dens not only provide for swift fox needs, but can also provide cover for a number of other species of wildlife. Numerous invertebrates as well as the Great Plains toad (*Bufo cognatus*) were identified by Kilgore (1969) as inhabiting occupied dens. Kilgore (1969) found several other species of invertebrates, a prairie rattlesnake (*Crotalus viridis*) and deer mice living in abandoned dens. The Burrowing Owl (*Speotyto cunicularia*) and striped skunk (*Mephitis mephitis*) are also commonly found in abandoned dens (Cutter 1958 and Kilgore 1969).

### **Reasons for Decline**

Historically, the swift fox inhabited the shortgrass and midgrass prairie ecosystems of the Great Plains region of North America (Kahn et al. 1997). It is believed that its range was up to 1.6 million km and extended through ten states and the south-central Canadian Prairie Provinces. The most commonly cited reasons for the swift fox decline include loss of native prairie habitat, predator control campaigns, rodent and predator control programs, unregulated trapping and hunting, and competition and predation by coyotes (Kilgore 1969, Samuel and Nelson 1982, Rongstad et al. 1989, FaunaWest 1991, Covell 1992, Kahn et al. 1997, Kitchen 1999).

A tremendous loss of native prairie habitat has occurred due to conversion to agriculture and urban and rural development. For example, according to McGinnies et al. (1991), between 1890 and the 1950's, habitat converted to cultivated crops grew from 4.6 million to 40 million acres. This conversion, however, is not the only form of habitat loss. Kahn et al (1997), made the point that land ownership, rangeland and cropland management practices, habitat fragmentation and limited movement corridors, and changes in wildlife composition that occur as a result of the conversion of prairie all play an important role in limiting swift fox distribution and abundance. Finley (1999) found that the swift fox was particularly abundant in areas dominated by continuous blocks of shortgrass prairie.

Recent information, however, suggests that the swift fox is capable of surviving and thriving in vegetation types other than native shortgrass and midgrass prairies. These habitat types can include sagebrush-grassland, sagebrush-greasewood, plains-mesa grassland, and cropland (Kahn et al. 1997, Peeks 2002). The swift fox, however, does not exist in tallgrass habitats (Kahn et al. 1997). Unfortunately, the Conservation Reserve Program (CRP), established under the 1985 Farm Bill, re-vegetated millions of cropland acres into tallgrass prairie species or non-native grasses within the shortgrass or midgrass prairies. It is hoped that CRP guidelines in the future may permit participants to plant native shortgrass or midgrass species.

The impact that hunting or commercial trapping has on swift fox populations and distribution is unknown. The USFWS stated in its decision to remove the swift fox from the candidate list (USFWS 2001) that, "...available information suggests that this harvest has not limited swift fox populations." Kahn et al. (1997) stated that over 55 years of documented harvest, swift fox populations in Colorado have remained stable and widespread. Additionally, in states that have protected the swift fox from harvest, there has been no increase in distribution or abundance over the same 55 years. Furthermore, Colorado Revised Statute 33-6-203 states that, "...it is unlawful to take wildlife with any leghold trap, any instant kill body-gripping design trap, or by poison or snare in the state of Colorado." This statute does have some exemptions for landowners trying to prevent depredation damage by predators. It can only occur on properties used for commercial livestock or crop operations, however, and for only one 30-day period per property per year and there must be irrefutable evidence of damage to livestock or crops.

Rodent and predator control campaigns, which primarily consisted of poison baits, resulted in a great deal of swift fox mortality (Kahn et al. 1997). Strychnine was the most lethal as it was non-selective in application (Kahn et al. 1997). Schitoskey (1975) reported that relatively low doses of strychnine or Compound 1080 were very lethal to the kit fox. The kit fox, however, could survive repeated doses of zinc phosphide.

It is also believed by some that predation or interference competition with coyotes and other canids may be an important limiting factor in the recovery of the swift fox (Scott-Brown et al. 1987). Kitchen (1999) found that there is a high level of spatial and dietary resource overlap between the swift fox and coyote, which could increase the potential for competition. The home ranges of swift fox were overlapped by coyote home ranges and all swift fox home ranges included some coyote sign. Although there was a high degree of dietary overlap in that the swift fox and coyote utilized the same prey items, the diets varied seasonally and in the volume of individual prey items. Interference competition was identified with 48% of swift fox mortality being attributed to coyotes. However, 58% of the mortality occurred during the breeding season when both species tend to travel much greater distances and all of the mortalities occurred outside of the fox's denning area. Kitchen (1999) believes that although predation or interference competition may occur, the swift fox may be better able to coexist with coyotes than other fox species due to year-round den use (escape cover) and some dietary partitioning. Therefore, mortality due to predation or competition may not be as limiting as previously believed.

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