

Diet of Captive Bred Swift Fox (*Vulpes velox hebes*) in Large enclosures and when released to the wild. Clio Smeeton, Kenneth V. Weagle, and Hossein Etemadi.
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ABSTRACT:

Introduction

A breeding colony of swift fox (*Vulpes velox*) has been maintained at the Cochrane Wildlife Reserve near Cochrane, Alberta, since 1972. Foxes have usually been kept in breeding pairs, one pair per pen; the largest pens are approximately 0.016 hectares. Breeding pairs (the colony usually consists of 25 pairs) were kept in separate pens due to costs and the logistical implications. The small pens reduced the possibility of the availability of a useful prey base of natural prey items. This reduced the opportunity for foxes, which are to be released to the wild, to learn vital hunting skills in their formative months (age 2 to 5 months).

In October 1993 six swift foxes were put into a 8.08 hectare pen. The major use of this large pen was for behavioural observations on Swift fox. The most important of the observational studies was to examine their response to the exposure to a prey base and the opportunity to develop hunting skills. From the time the Swift foxes were released into the pen, they were observed to show a high degree of social behaviour and in early 1994, one pair bred successfully producing three cubs. In the pen the Swift foxes fed a regular diet of chicks and horse meat. The present study was designed and conducted to examine the diet of the population through scat analysis and to make deductions on the development of the ability to hunt in captive bred Swift fox.

Methods:

The large pen (8.08 ha), in which the scat sampling was conducted was typical of the aspen parkland in the foothills of Rocky Mountains. A distribution of the vegetation types in the pen are shown in Figure 1. The three major vegetative types are described below. The habitat type was different from the release sites for the Swift fox reintroduction program that are short grass prairie.

The Swift fox population in the pen was made up of yearlings (3 males and three females) born in the spring of 1993 in captivity at the Cochrane Wildlife Reserve. They had been taken from their parents and placed in the pen in October 1993. Before that date they were in a typical breeding pen measuring approximately 10 m by 10 m. The six Swift foxes were fed a diet of dead, day old, chicks and raw meat (either horse or road killed mule or white-tailed deer, or moose). The daily ration of food over the year

averages four chicks per fox and approximately 110 g. of meat. In the spring of 1994 one of the Swift fox pairs produced a litter of three kits. This meant that during the experiment the population in the large pen was nine individuals (six adults and three kits).

The scat analysis was divided into three components: 1) prey base study and reference collection, 2) large Pen scat analysis, and 3) incidental scat collection from Grasslands National Park during the 1994 releases.

During the period of July and August 1994 a collection was made of small mammals and insects in the area (but outside) of the large pen at Cochrane Wildlife Reserve. The small mammals were collected during 12 nights of snap trapping using a variety of baits (peanut butter, cat food, and a paste made of jam, bread and milk). The trapped mammals were identified, weighed, measured, and at least one sample of each species retained for reference. Reference slides were prepared of the hair. Smaller specimens were injected with formaldehyde and preserved in 70% alcohol, and larger specimens were skinned. The skins were dried and the skeletons were cleaned and kept for reference. In addition feathers from a day-old chick were slide mounted for reference.

Insects were trapped by hand using a butterfly net. Representative samples of each species were killed by exposure to gasoline fumes and dry mounted.

These reference collections were used to confirm the identification of animal remains within the scat.

A total of 97 Swift fox scat were collected from the large pen from July 27 to September 6, 1994. The pen was divided into 83 quadrants (33 m by 33 m) as shown in Figure 1. The pen contained six artificial and three natural dens (prepared by the Swift fox). To increase the efficiency of scat collection a series of 10 flat rocks (approximately 0.25 m by 0.25 m.) were placed along a route that was walked daily for six weeks. These rocks acted "landmarks" where the Swift fox regularly defecated. The daily route also visited the den sites (both artificial and natural) that were known to be active during the study. The daily collection occurred at approximately 5:00 PM each day. The Swift fox population in the large pen was fed a weighed amount of food at approximately 8:30 PM each day.

The release of captive bred Swift fox to GNP occurred on September 11, 1994. The release sites were monitored daily for an ten day period after the release. During this period Swift fox scat found at or near the release sites was collected for analysis.

All scats collected were analysed using the following method. The scat was soaked in water for 30 minutes. After soaking but while still in the water the contents were pulled

apart using two pairs of dissecting tweezers. The water was then sifted through a series of sieves down to a mesh size of 0.5 mm. The sifted contents were identified and stored in 70% alcohol or formaldehyde. Identification of hair and fine matter was done with a 10X hand lens of an American Optical dissecting scope (X10 ocular and X4, X10, X40 and X100 exocular). The species identification of the material whether mammalian or insect was done by comparison with the reference collection.

Results:

Reference Collection:

In trapping for the reference collection 217 trap nights produced a total of 34 specimens, in addition to the trapping specimens were salvaged from domestic cat kills. A total of eight species were collected and prepared for the scat identification reference collection (*Sorex arcticus* (Arctic shrew), *Sorex hoyi* (Pygmy shrew), *Sorex monticolus* (Dusky shrew), *Lepus townsendii* (White-tailed jack rabbit), *Tamiasciurus hudsonicus* (Red squirrel), *Peromyscus maniculatus* (Deer mouse), *Microtus pennsylvanicus* (Meadow vole), *Microtus longicaudus* (Long-tailed vole)).

Insects of sufficient size to be consumed by Swift fox were collected from the following orders, Coleoptera (2 species), Diptera (1 species), Odonata (1 species), Orthoptera (6 species). These were not identified, as it was discovered that where their remains occurred in scat, there was insufficient material to make specific identifications.

Scat Analysis from Large Pen:

The supplemental food provided to the nine Swift foxes, over 41 day study period, was 87675 g averaging 238 g/fox/day. A total of 97 scats were collected from the pen over the 42 days of study. The average number of scats collected per day was 2.3 and the average weight of a scat was 2.6 g. Seventy-five (75) scats were analysed at the Cochrane Wildlife Reserve, and 23 scats were sent to the University of Toronto, for analysis.

The process of the scat analysis made it impossible to provide an estimate of weight for contents of the scat. The analytical data was summarised in two categories, primary content of the scat and presence of food items in the scat. The results of the analysis are presented in Table 1.

Grasslands Swift Fox Scat:

Twenty-one (21) scats from Grasslands National Park in Saskatchewan were analysed. The results of the analysis can be found in Table 2.

Table 1: Summary of the food item primary content and number of occurrences in the 75 scat from the large pen study.

Food Item	Primary Content () number of Scats	Occurrence () number of Scats
Horse Meat	43% (32)	53% (40)
Day-old Chicks	7% (5)	49% (37)
Vole	49% (37)	67% (50)
Unknown Bird	1% (1)	
Insects		24% (18)
Other		7% (5)

Table 2: Summary of the food item primary content and number of occurrences in the 21 scat collected in Grasslands National Park during the 1994 release..

Food Item	Primary Content () number of Scats	Occurrence () number of Scats
<i>Microtus spp.</i>	14% (3)	43% (9)
<i>Lagurus curtatus</i>	5% (1)	5% (1)
<i>Peromyscus maniculatus</i>	10% (2)	29% (6)
Unknown Mammal	43% (9)	57% (12)
Day-old Chick	5% (1)	10% (2)
Insects	24% (5)	86% (18)

Discussion:

Seventy-six percent (76%) of the scat collected in the large pen contained wild prey species. Seventy-two percent (72 %) of the scat contained either, or both of the food types supplied regularly to the animals. Of the 75 scats examined 23% contained only wild prey and 20% contained only food from supplemental feeding.

The high occurrence of wild prey in the scat, even with a supplemental diet of approximately 238 g of day-old chicks and horse meat per day, indicates that the captive raised Swift Fox, when exposed to wild prey, utilized it on a consistent basis. The nature of the study did not allow for the association of the scat with a particular individual Swift fox. This made it impossible to examine the development of hunting skills by the three kits that were born in and lived in the large pen over the study period. Because a high percentage of the scats examined contained wild prey it was assumed that the kits were successfully hunting.

The limited number of scats that were collected from Grasslands National Park and analysed showed that newly released Swift fox quickly begin to hunt wild prey. Of the 19 Swift Fox released in Grasslands National Park three were the juveniles born and reared in the large pen. Two of the 21 scat analysed in the study were collected in the area of their release site. The analysis of these scats did not show differences from the other 19 samples. The sample size was too small to make any deductions on the impact of rearing in larger pens on the hunting success in the wild. The day-old chick that was found in one scat from Grasslands National Park was from food provided to the newly released swift fox on the first night of the release. If this food was not eaten during the first night it is collected and removed to avoid predator attraction.

In comparing the literature on Swift fox scat content wide variations were found (Table 3). These variations show that the Swift fox is an opportunistic feeder and will take most any prey available to them. Table 1 shows that there was consistent presence of insect content in the Swift fox diet. In the present study insects were present in 86% of the scat analysed. The identification of the insects in the scat from both the large pen and Grasslands National Park was difficult because of the extensive maceration of the food. Generally the remains of the insect were limited to fragments of chitin and in rare cases parts of legs or thorax.

Grasslands National Park during August and September (until the first hard frost) supported an extensive grasshopper population. It has been postulated that the grasshopper made up an important component of the Swift fox diet in Grasslands National Park. This has led to the policy of planning the release of the captive bred juveniles during late summer. It was assumed that the presence the grasshoppers would result in a readily available diet for the released foxes while they were adapting to their wild surroundings. The present scat analysis, although limited in numbers, supported this policy.

Table 3: A comparison of the scat analysis from Swift fox in Grasslands National Park with literature data.

Food Group	Uresk & Sharps, 1986	Hines & Case, 991	Zumbaugh & Choate, 1985	Rongstad et al, 1989		Present Study
				Area 1	Area 3	
Mammals	49.00%	100.00%	65.2 % *	41.00%	74.00%	90.00%
Insects	27.00%	56.00%	7.7% *	14.00%	10.00%	86.00%
Birds	6.00%	40.00%	18.4% *	42.00%	12.00%	0.00%
Plants	13.00%	54.00%	1.8% *			
Other			6.8% *			10.00%
Location	S. Dakota	Nebraska	Kansas	Colorado		Sask.
Sampling Dates	May to Sept	?	November to January	Year Round		Sept

* Per cent of stomach content by volume

Literature Cited:

Hines, Terrence D. and Ronald M. Case (1991) Diet, Home Range, Movements and Activity Periods of Swift Fox in Nebraska. *Prairie Nat.* 23(3):131-138

Rongstad, Orrin, J., Thomas R. Laurion and David E. Anderson (1989) Final Report, February 1989, Ecology of Swift Fox on the Pinon Canyon Manoeuvre Site, Colorado. Submitted by, Wisconsin Co-operative Wildlife Research Unit, University of Wisconsin to Directorate of Engineering and Housing, Fort Carson, Colorado.

Uresk, Daniel W. and Jon C. Sharps (1986) Denning Habitat and Diet of the Swift Fox in Western South Dakota. *Great Basin Naturalist* 46(2):249-253.

ZUMBAUGH, D.M. & CHOATE, J.R. (1985). Winter food habits of the swift fox on the central high plains. *Prairie Nat.* 17(1): 41-47.