Captive breeding of Swift fox for reintroduction: Final Report Funding Bodies 1994 to 1997.

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ABSTRACT:
The Swift fox captive breeding program at Cochrane Ecological Institute has been in existence since 1972, and has contributed 841 Swift fox for reintroduction between 1983 and 1977. The ESRF has supported the program from 1994 to 1996. During this period a total of 197 Swift fox from the captive breeding program have been released. Variations in the kit production from the captive breeding colony have been caused by two main factors, 1) only 16% of pairs where both are young of the year produce kits, and 2) females do not produce its after the age of eight years. The releases in 1997 were designed to reduce the captive breeding colony from 25 to 12 producing pairs of wide genetic heterozygosity. Research at CEI has followed three main directions during the period 1994 to 1997, 1) the development of improved release methods for captive raised animals, 2) behavioural research on captive Swift fox to improve their survival capability in the wild, and 3) the development of voice printing as a population censuring method for Swift fox. CEI made the decision to continue the captive breeding after the time recommended in the National Recovery Plan because of low numbers in the wild (1996-97 survey) and wild trapped Swift foxes from the USA are not available. To date the reintroduction program in Canada has not reached a sustainable population number. CEI has made arrangements with Grasslands National Park to continue releases in the park, and are negotiating a Memorandum of Intent with Saskatchewan for continued releases there, CEI will continue to breed and release Swift fox until 2000, providing funding can be secured for the project.

Introduction

The Swift fox reintroduction program, in Canada, began in 1971 and 1972 when Beryl Smeeton of the Wildlife Reserve of Western Canada, Cochrane, Alberta (now Cochrane Ecological Institute) imported two pair of Swift fox from Colorado. Mrs. Smeeton's intention was to start a program that would see the Swift fox once again living on the Canadian Prairie. In 1977 a cooperative agreement was signed between the Wildlife Reserve of Western Canada (Beryl Smeeton) and the University of Calgary (Dr. Steven Herrero) to start the field work involved with reintroduction of the Swift fox. The agreement outlined a series of research projects to be conducted as M.Sc. thesis. The Canadian Wildlife Service became involved with the project in 1978 after the Committee on the Status of

Endangered Wildlife in Canada (COSEWIC) designated the Swift fox as an 'extirpated' species[1] in Canada. Alberta Fish and Wildlife division were invited to join the project in 1978 but they declined and did not join until 1984. Saskatchewan joined the project in 1983 when they signed a cooperative agreement with the Canadian Wildlife Service.

The research conducted by the University of Calgary involved three projects as follows:

- Carlington, B.G. 1980 Re-introduction of the swift fox (Vulpes velox) to the Canadian prairies. Master's Degree Project, Faculty of Environmental Design, University of Calgary, Calgary, Alberta, Canada.

- Reynolds, J. 1983. A plan for the reintroduction of the swift fox to the Canadian Prairies. Master's Degree Project, Faculty of Environmental Design, University of Calgary, Calgary, Alberta, Canada.

- Schroeder, C. 1985. A preliminary management plan for securing swift fox for reintroduction into Canada. Master's Degree Project, Faculty of Environmental Design, University of Calgary, Calgary, Alberta, Canada

Significant funding for the University of Calgary projects were provided by the WWF.

The combined effort of the University of Calgary and the Smeeton's breeding program at the Wildlife Reserve of Western Canada resulted in the first release of Swift fox on September 13, 1983. From 1983 to 1997 there have been a total of 841 captive bred Swift fox have been released to the wild.

In 1984 the management of the project was taken over by a 'Technical Committee'. Under this committee additional releases were conducted, and a feasibility study began in 1989. The results of the feasibility study were presented in Brechtel et al (1993). The feasibility study concentrated on the calculation on survival rates using radio collared animals. A total of 155 Swift fox were radio collared in the experiment, 33 were translocated animals from the USA, 41 were captive raised and released in the spring and 81 were captive raised and released in the fall.

In 1991 the Cochrane Ecological Institute (CEI) was involved in the releases for the first time. It was apparent from this involvement that improvement was needed in the release procedures and the monitoring of released animals. In 1992 CEI working in cooperation with Grasslands National Park, began research on release procedures and began post release monitoring in Grasslands National

[1] 'extirpated' applies to any species of fauna or flora no longer existing in the wild in Canada, but existing elsewhere (COSEWIC, 1978)

Park, West Block area.

In 1993 and early 1994, CEI met with the government of Canada and Alberta to negotiate a new lease agreement for the Swift fox colony and to present to the government a plan to monitor the releases in the area of Grasslands National Park West Block. These meetings resulted in government contributions to the program of a total of $20,000 ($10,000 from Canada and $10,000 from Alberta) per year until 1997 with the hope of matching contributions from ESRF. ESRF only contributed $9,500 per year and only until 1996. This resulted in a serious under funding of the program, over a four year period. These funds were supplemented by contributions from Petro Canada ($5,000) and AMOCO ($5,000) from 1994 to 1997.

The research objective of the Cochrane Ecological Institute in relation to the Swift fox, as presented in the 1993/94 meetings, were :

(1) to achieve the first successful reintroduction of an extirpated mammalian species

(2) to develop non-intrusive methods of monitoring wild populations, methods which will not impact adversely on fragile populations of extirpated/endangered species

(3) to develop a blueprint for the recovery of extirpated/endangered species which can be used by other countries.

This report deals with the activities of the CEI and not the Swift fox reintroduction program as a whole. It should be emphasised, however, that CEI has produced over 70% of all Swift fox that have contributed to the Canadian Reintroduction program. It should also be noted that at the present time CEI has the only breeding colony of Swift fox in the world.

Description of Breeding Facility

CEI is situated in the foothills of the Rocky Mountains and within the historic range of the Swift fox. The facility consists of 160 acres of 50% native mixed grass prairie, 10% wetland, and 40% mixed woodland. At present, the large ungulates using the CEI are Moose (*Alces alces*) and Whitetail deer (*Odocoileus virginians*). There is a varying population of coyote (*Canis latrans*), and a fluctuating population of waterfowl, passerines, and raptors.

Three types of housing for the captive bred Swift fox are used at CEI:

1. Single Pair Enclosures - CEI has a total of 23 single pair enclosures. These enclosures average 18 m. X 12 m. in size, and are made of 2.5 m. X 3 m.

chain link panels with a 0.6 m. overhang and 0.6 m. groundwire piled with rocks. The floor of the enclosures consists of native prairie and 5% of the enclosures included aspen trees (*Populus tremuloides*). Each enclosure contains two artificial den boxes. The den boxes consist of three connected chambers and are covered with an insulated "A"- frame.

The single pair enclosures contained two breeding age Swift fox. These animals varied in age from juveniles (less than one year) to 14 years.

2. 9 - Hectare Enclosure - The 9 hectare enclosure of native transitional prairie was completed in November 1993. The enclosure consists of 40% open prairie, 10% bog, 50% mixed aspen and spruce groves. It is surrounded by a 2.5 meter high fence with a 0.6 m. over hang and a 0.6 m. ground wire. Eight widely spaced artificial den boxes and one artificial "mound" (expanded polystyrene on wire over a three chambered box) are contained within the 9 hectares. Of the eight artificial shelters, three are in the woodland, and the remaining six in the open country.

3. 1.7 - Hectare Pen - A group of aged, unrelated adult Swift fox which had spent their entire lives in single pair breeding pens, were introduced into a 0.7 hectare enclosure in October 1994. The enclosure is natural prairie with mixed aspen and spruce trees, there is no under storey in the enclosure and no open country. Six artificial den boxes are widely spaced within the pen.

CEI Bred Swift Fox Released 1994 to 1997

During the period 1994 to 1994 five organisations were involved with the release of Swift fox in the Canadian reintroduction program. They were CEI, government of Alberta, government of Saskatchewan, Canadian Wildlife Service and Grasslands National Park. During this time the Swift fox destined for release in Alberta were transported by CEI to government of Alberta personal in Medicine Hat, AB. From this point the releases were handled entirely by Alberta. The government of Saskatchewan handled the release of animals in the Wood Mountain and Grasslands National Park East Block areas, and CEI in co-operation with Grasslands National Park handled the releases in the GNP West Block area. The Swift fox for these latter two release sites were transported by CEI to the GNP headquarters in Val Marie where they were divided for the final transport for release.

Because of the lack of records from the government of Alberta, no information can be provided on the Swift fox releases by the Alberta government, and it should be noted that the Alberta government has not released captive bred Swift foxes since 1995. This report, therefore, only provides information on the releases in the GNP West Block area and Wood Mountain area of

Saskatchewan.

Information on the Alberta/Saskatchewan Border area and the releases in Alberta may be obtained from the government of Alberta and a study done in the Border area by Axel Moehrenschlager.

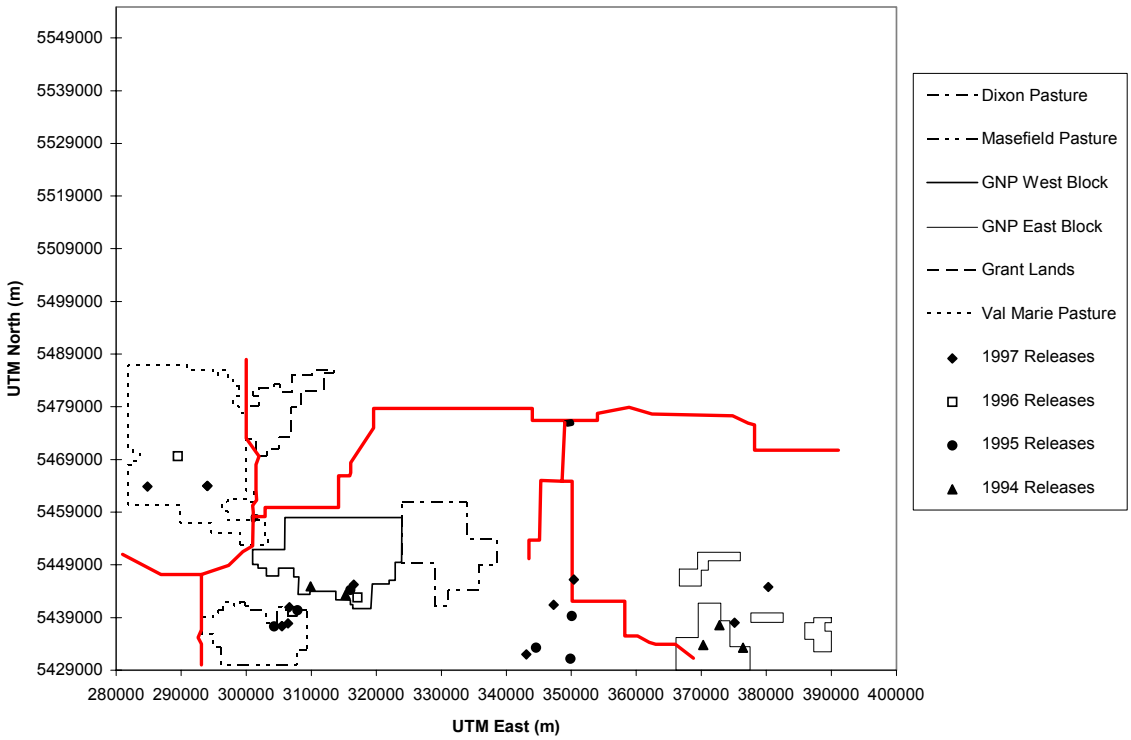
Table 1 and Figure 1 provide a summary of the Swift fox releases in which CEI was involved from 1994 to 1997. This data is only for south central Saskatchewan.

Table 1: Summary of the swift fox release sites for 1994 to 1997 (releases by Cochrane Ecological Institute only).

Date	UTM East	UTM North	Number	Facility	Identifier of Animals
12-Sep-94	309900	5444900	8	CWR	S473, S474, S472, S475, S476, BETH, ANGUS, S471
12-Sep-94	315300	5443300	2	CWR	BETTY AND BOMBADIER
12-Sep-94	370300	5433800	5	CWR	S468, S469, S470, ALERIC, DAINTY
12-Sep-94	372800	5437600	3	CWR	S479, S478, S477
12-Sep-94	376400	5433300	1	CWR	DELBERT
4-Sep-95	307900	5440400	4	CWR	Foxfire (male) S-495Falernan (male) S-496Fiddledeedee (female) S-499Five-oh (male) S-500
4-Sep-95	304300	5437300	4	CWR	Frank (male) S-488Ferocious (male) S-489Firdella (female) S-484Fred (male) S-485
4-Sep-95	316000	5444200	8	CWR	Fargy (male) S-503Foster (male) S-504Farceur (female) S-505Foxglove (female) S-508Didsbury (male) S-404Delors (female) S-398Dandelion (female) S-421Dreyfuss (male) S-423
4-Sep-95	344600	5433300	2	CWR	Fame (female) S-506Fammulus (male) S-509
4-Sep-95	349900	5431200	5	VZ	Fizz (male) VZ 27Faust (male) VZ 24Fierabras (male) VZ 25Frilly (female) VZ 23Fabulous (female) VZ 26
4-Sep-95	350100	5439300	3	CWR	Finnegan (male) S-478Foudroyant (male) S-479Fleet (male) S-480Factum (male) S-481Fellow (male) S-482
9-Sep-96	289500	5469600	3	CWR	Getaway, Gambit and Grover
9-Sep-96	317100	5442800	5	CWR	Geoconda, Ginger, Geotto, Gladiator, Gypsy
9-Sep-96	307100	5440100	4	CWR	Gladstone, Gregory, Glee and George
9-Sep-96	275150	5444700	6	CWR	Giddy, Gershin, Godot, Giftie, Grishkin, Griselda
9-Sep-96	307100	5440100	4	CWR	Globetrotter, Glenville, Ghost, Garnet
29-Aug-97	294027	5464005	2	CWR	Adult pair (male S547 female S535)
29-Aug-97	316527	5445224	6	CWR	Adult pair (male S539 female S514)with 4 cubs(male S569,male S570,maleS571,femaleS572)
29-Aug-97	305521	5437383	4	CWR	Adult pair (male S517 female S511) with 2

					cubs (female S589 female S590)
29-Aug-97	293973	5463990	2	CWR	Adult pair (male S353 female S497)
29-Aug-97	375100	5438000	2	CWR	2 cubs (male S604 male S605)
29-Aug-97	343100	5432000	4	CWR	4 cubs (female S595 female S596 female S597 female S598)
29-Aug-97	East Block	GNP	3	CWR	3 cubs (male S579 female S577 female S578)
29-Aug-97	350400	5446200	4	CWR	4 cubs (male S582 male S583 female S580 female S581)
29-Aug-97	284805	5463888	5	CWR	5 cubs (male S584 male S585 male S588
29-Aug-97	347300	5441400	3	CWR	3 cubs (female S557 female S558 female S559)
29-Aug-97	306655	5440975	4	CWR	4 cubs (female S565 female S566 female S567 male S568)
29-Aug-97	East Block	GNP	2	CWR	adult pair (male S379 female S492)
29-Aug-97	East Block	GNP	2	CWR	adult pair (male S497 female S462)
29-Aug-97	306435	5437861	6	CWR	Adult pair (male S501 female S493 with4 cubs (female S573, female S574, female S575, male S576)
29-Aug-97	305512	5437383	6	CWR	adult pair (male S498 female S 407)with 4 cubs (male S 591 female S 592 female S593 male S594)
29-Aug-97	East Block	GNP	6	CWR	adult pair (male X66 female S463) with 4 cubs
29-Aug-97	380300	5444800		CWR	unknown
29-Aug-97	East Block	GNP	5	CWR	5 cubs (male S599 male S601 male S603 female S600

Figure 1: Location of Swift fox releases in south Central Saskatchewan from 1991 to 1997.



In addition to the Swift fox released in Saskatchewan Table 2 gives the number of animals that were provided to the government of Alberta for release over the same period .

Table 2: Number of Swift fox provided to the government of Alberta for release from 1994 to 1997.

Year	Number
1994	23
1995	30
1996	10*
1997	0

* Released in Saskatchewan

From 1994 to 1997 the number of kits produced and released per year varied greatly. This variation resulted from both administrative and biological reasons. In 1995 a significant reduction was experienced in kit production. The reasons for the reduction were as follows:

1. Of the 25 breeding pairs eight (8) were both (male and female) juvenile animals. Studbook analysis has shown that only 16% of pairs where both are juvenile produce kits.

2. Of the remaining 17 pairs three (3) had females that were eight years or older. Analysis of the stud book has shown that females eight years or older

produce kits.

3. The Canadian Wildlife Service did not permit the importation of six breeding age animals from a Colorado rehabilitation facility.

When the biological reasons for low production in 1995 were determined steps were taken to increase production in subsequent years. The production in 1996 was slightly better than 1995 and was back to a more expected level by 1997.

The high number of releases in 1997 was mainly a result of the Reintroduction Program administration. Throughout the program the government has stated that captive breeding would end in 1997. This decision was made with a lack of knowledge of either the number of animals in the wild or an estimate of what number of animals were needed in the wild to constitute a sustainable population. It was the opinion of CEI that to eliminate the captive breeding colony without these two numbers would be a gross mistake, and possibly a waste of over 15 years work and money.

In 1996 the Canadian Wildlife Service (CWS), who were the owners of the captive breeding colony at CEI at that time, request CEI's help in formulating an exit strategy for CWS from Swift fox captive breeding. The exit strategy was subsequently designed that turned over of the ownership of the captive breeding colony to CEI. To accommodate this move the government of Alberta issued a Zoo Permit to CEI. This was finally accomplished in the early summer of 1997.

CEI, in an attempt to reduce the number of animals in the breeding colony, had a larger than normal release in 1997 and reduced the number of breeding pairs from 25 (as from 1994 to 1997) to 12. In this way a maximum release was made to coincide with the end of government involvement with captive breeding, but the colony was not disbanded in case a sustainable population were not present in the wild. Pairs are young, proven producers and of the widest genetic heterozygosity.

Research Conducted in 1994 to 1997

To support and improve the captive breeding contribution to the Swift fox reintroduction program, CEI conducted a series of research projects over the period 1994 to 1997. The titles and abstracts of these projects are provided here for your information.

Swift Fox scat content in a large captive enclosures and when release to the wild. Clio Smeeton, and Kenneth Weagle. (poster session, The Fifth Prairie Conservation and Endangered Species Workshop, Saskatoon, SK, 18-19 February 1998)
ABSTRACT: The ability of captive bred swift fox (Vulpes velox) to hunt prey in the wild has been questioned. A study was conducted to examine the prey

hunted by captive bred swift fox in a large enclosure (8.08 hectares) at the Cochrane Ecological Institute, and immediately after their release to the wild. The examination of scat 75 scat from the large enclosure showed that 50% of the primary contents of the scat was wild prey and wild prey occurred in over 67% of the scat. During the study period the normal diet of day old chicks and horse meat was provided to the animals. A total of 21 scat were collected from the immediate area of the swift fox release sites in Grasslands National Park, Val Marie, Saskatchewan during the 7 days immediately following the release. These scat contained a minimum of 6 different food items with insects occurring in 86% of the scat and being the primary content in 24%. The findings indicate that when exposed to prey species in large enclosures captive bred swift fox have the ability to hunt and show a relatively high selection for wild prey. The occurrence of prey species in the scat in the release areas indicate that the captive bred animals actively hunted prey immediately upon release. The high occurrence of insects in the scat from release sites support the policy of releasing the animals in early September when grasshopper populations are at their peak.

Captive breeding of the Swift fox, Vulpes velox at the Cochrane Ecological Institute, Cochrane, Alberta, Canada. Clio Smeeton and Ken Weagle. (paper, The Fifth Prairie Conservation and Endangered Species Workshop, Saskatoon, SK, 18-19 February 1998)

ABSTRACT: An analysis of the Swift fox captive-breeding program at Cochrane Ecological Institute, Cochrane, AB Canada from 1972 to 1994 is presented. During that period CEI provided 557 animals to the Swift fox reintroduction program. These were produced through the breeding of 96 animals of which 20 came directly from wild stock. The 169 litters produced averaged 3.3!1.5 kits per litter with a range of 1 to 7 kits. No apparent pattern could be found in relation to the impact of lineage, age or number of mates on fecundity. The maximum number of kits produced by a female was 35 and for a male was 35. 86% of the litters produced at CEI were born between April 15 and May 16 with litters being whelped as late as June 26. Swift fox can produce in their first season with 19% of the females and 18% of the males which were one year old and mated with at least a two year old mate producing litters. 11% of the pairs that were both one year old produced litters. Females did not produce litters after the age of eight years, but males produced litters to the age of 14 years. Protocols were presented for Feeding, Housing, Animal Handling and Immunization of the captive -breeding Swift fox colony.

The reintroduction of Swift fox to the West Block of Grasslands National Park, Saskatchewan, using captive bred animals. Clio Smeeton and Ken Weagle. (paper, The Fifth Prairie Conservation and Endangered Species Workshop, Saskatoon, SK, 18-19 February 1998)

ABSTRACT: In 1993 the reintroduction of Swift fox to the West Block of

Grasslands National Park, West Block began. Between 1993 and 1996, 94 captive bred Swift fox were released into the park and the areas to the south of the park (Masefield Pasture). To reduce the initial mortality of the released animals a method involving the use of Portable Protective Shelters was developed (PPS system). The use of the PPS system was shown to keep the animals in the general release area and thought to reduce the initial mortality that had been documented to be high. Monitoring data from the area from 1994 to 1997 has shown that the population has established itself and appears to be expanding from the immediate release area. No less than 10 den sites have been identified in the area several of which have been documented to have produced kits. Although the actual population numbers are not determined and sustainable population level is unknown, the experiment has shown that captive bred animals alone can be successfully used to reintroduce Swift fox to suitable habitat.

BEHAVIOURAL ASPECTS OF THE SWIFT FOX (*Vulpes velox*) REINTRODUCTION PROGRAM. Weagle, K. and C. Smeeton. The Proceedings Of the 2nd International Conference on Environmental Enrichment, Copenhagen Aug 1995. ABSTRACT:

The Swift fox reintroduction program began in Canada in 1983, prior to this date a captive breeding colony of Swift fox was established at the Cochrane Ecological Institute. Captive bred animals have contributed 646 young to the releases vs. 64 wild caught Swift fox translocated from the United States. Because the Swift fox is extirpated in Canada and has substantially reduced numbers in the USA little is known of their social behaviour. It was postulated that their behaviour (living in social groups rather than independently) could significantly affect the reintroduction program. Observations were made on three groups of animals at the captive breeding colony, three sibling pairs in a 9 hectare enclosure, five aged animals in a 0.6 hectare enclosure and 22 breeding pairs in small enclosures. It was found that the Swift fox appeared to prefer live in groups, that rearing animals in larger enclosures resulted in more successful hunting habits, and that vocalisation played an important part in Swift fox breeding and survival. These findings have resulted in a change in the release strategy of the Swift fox to the wild, with new efforts being concentrated on building or adding to colonies in areas of suitable habitat rather than releasing smaller groups over wide areas of prairie.

Data Summary and Scent Post Survey for Swift Fox in the West Block, Grasslands National Park 1995. Cochrane Ecological Institute, P.O. Box 484, Cochrane, AB, T0L 0W0, November, 1995

No abstract available.

CONFIDENTIAL REPORT TO Alberta EcoTrust: **NON INTRUSIVE POPULATION ESTIMATOR for SWIFT FOX USING VOICE PRINTING,** by,

COCHRANE ECOLOGICAL INSTITUTE, COCHRANE WILDLIFE RESERVE, P.O. Box 484, Cochrane, AB, T0L 0W0

As this research is not completed as yet and an abstract was not provided.

Diet and hunting behavior of captive-bred swift fox (*Vulpes velox/Vulpes velox hebes)* intended for release. Samantha Kirkhope, Institute of Ecology and Resource Management, School of Agriculture, King's Buildings, West Mains Road, Edinburgh, Scotland, EH9 3JG. ABSTRACT:

Previous studies have investigated the diet of wild populations of swift fox (Uresk & Sharps 1986, Zumbaugh et al 1986, Hines & Case 1991), two studies have examined the diet of captive swift fox in large group enclosures (Carlington 1980, Stephens & Etemadi 1994), however there have been no investigations into the diet of captive breeding pairs maintained in single-pair enclosures. Scats from 20 single-pair enclosures were examined to determine whether a) swift fox were supplementing their diet through hunting, and b) if the level of hunting behavior could be increased through the introduction of environmental enrichment. Ten enclosures had environmental enrichment introduced in the form of wood-piles, and regular scattering of bird-seed, whilst the remaining ten enclosures were maintained as controls. 1571 scats were collected and analyzed, based on modifications to a technique developed by Uresk & Sharps 1986. Food items within the scats were recorded according to frequency of occurrence. Results show the presence of hunting behavior in both the control and enriched pens with distribution of food items displaying similar patterns. Frequencies of occurrence were significantly higher for microtines in the experimental enclosures The primary contents of scats indicates a higher level of hunting behavior of small rodents in the enriched pens than in the control pens. High occurrences of vegetation were discovered, with very few scats containing less than one type of vegetation. The presence of hunting behavior within the single-pair enclosures has important implications for those foxes destined for re-introduction, and for the welfare of those retained as part of the breeding colony. Every effort should be made to encourage and increase the levels of hunting behavior already present.

CAPTIVE SWIFT FOX BEHAVIOR DURING THE SUMMER MONTHS. E C Telling, Institute of Ecology and Resource Management, University of Edinburgh, West Mains Road, The King's Buildings, Edinburgh EH9 3JG.

Abstract: Captive swift fox summer behavior was observed over eight twenty-four hour time periods. Eight different 'family' groups were examined for differences in behavior with and without kits. There was no temporal difference in behavior pattern between wild and captive swift fox. Captive swift fox exhibited diel activity patterns peaking at 0230h, 0800h and 2100h. Kits partook in more investigatory and play behaviors than adult swift fox. Females were significantly affected by the presence of kits. Wild born adult fox did not behave differently to captive born adults. The performance of particular behaviors were weakly correlated to temperature and windspeed.

The last two papers were done as M.Sc. thesis in cooperation with University of Edinburgh, Scotland and both have been submitted to The Fifth Prairie Conservation and Endangered Species Workshop, Saskatoon, SK, 18-19 February 1998.

An additional paper is under preparation on the biology of captive breeding but has not been completed as yet.

Need for Captive Colony

Over the four year period three developments have indicated that there is still a need for the captive breeding colony at CEI. These developments can be summarized as follows:

- On June 16, 1995 the United States Federal Registry /Vol. 60, No. 116/ Friday June 16, 1995 pp 31663 - 31666 published the Twelve Month Finding on the petition to list the Swift Fox (Vulpes velox)as Endangered under the Endangered Species Act. **Their finding was that the listing of the Swift fox was "…warranted but precluded by other higher priority actions. … The warranted but precluded finding elevates the swift fox's candidate species status from category 2 to category 1."**

- The Swift fox translocation program conducted by the government of Canada ran into problems in 1996. In 1995 twenty Swift fox were captured in Wyoming and translocated to Canada. In 1996, after an increased trapping effort only seven Swift fox were trapped for translocation. In 1997 the government of Canada stopped the translocation program because of budget restraint. The apparently lower numbers in the US also has brought into question the ethical issue of removing a listed endangered species from the USA. The Canadian Swift fox Recovery Plan was based on the availability of animals for the USA to support the program, this source has now been removed.

- The survey conducted in Canada in 1997 (Cotterill, 1997), found a lower number of Swift fox (289) than was thought to be in the wild. Even though the survey may not have used appropriate methods to survey the Swift fox population, it did show that present numbers can not be considered at a sustainable level using criteria such as those outlined by Mace and Lande (1991).

The above developments support the conclusion by CEI that the Swift fox captive breeding colony was still needed to support the Canadian Reintroduction program. It also supports the moves by the governments of Alberta and Canada to transfer the colony to CEI and provide appropriate permits for its continuance, even though these two governments will no longer be involved financially with the breeding program.

Program Success

The evaluation of the Swift fox reintroduction project is a difficult thing to do. The difficulty lies with the following operational deficiencies:

- release monitoring has been limited (some radio tracking in the late 1980's, and the present CEI data) and sporadic
- behavioral research has been limited (one thesis from U of C in 1996 on one den site in the wild and two thesis from CEI on captive colony)
- project coordination has been difficult at best and the Recovery Team was relatively ineffectual

One study in 1996/97 attempted to estimate the wild population of Swift fox in Canada (Cotterill, 1997). This study was based on statistically questionable methodologies when it was applied to a species that was discontinuous in its potential range. The estimate of the Canadian Swift fox population from this survey was 289 foxes (95% confidence interval was 179 - 412 foxes).

As a result the question of what the status of the Canadian population is, still remains unanswered.

The captive breeding program can be classified as a success. The production of the Swift fox for release can now be done on a regular basis and the breeding biology is understood to the point where production can be estimated. Graduate research has provided extensive insight into the Swift fox behavior in captivity, and has established that the captive animals (even after generations of captivity) still hunt when wild prey is available in their breeding pens. The development of new release methods using the Portable Protective Shelter has increased the initial survival of the released Swift fox and has increased the success of the reintroduction project as a whole. Finally, from research done by CEI in the West Block area of Grasslands National Park it has been established that by using newly developed release methods, a population of Swift fox can be established in the wild using only captive bred animals. The research does not establish what population level is necessary to produce a sustainable population, or address the associated questions of the impact on sustainability of the present population fragmentation.

The success of the GNP West Block program can be summarized by looking at the accumulated data on Swift fox "signs" in the area over the four year period (Figure 2). The presence of no less than 10 den sites and at least three confirmed natal dens is the most compelling evidence of the success of the GNP West Block project. Additional evidence can be seen by the results of an experimental voice printing system being developed by CEI (Figure 3).

Future of Captive Breeding

The results of the Swift fox population census in 1996-97 (Cotterill, 1997) has demonstrated that the program has not met the target population in the national recovery plan (400 animals in the wild). In addition no research has been done to attempt to establish what a sustainable population level is for the Canadian Swift fox. It is therefore concluded that CEI was correct in **not** closing down the captive breeding program in 1997 as the National Recovery Plan stated.

In relation to the future distribution of captive bred Swift fox, for release to the wild, the government of Canada no longer is involved in the program. The government of Alberta has stated that they do not want to continue releasing captive raised Swift fox in Alberta, and have not released captive bred animals into Alberta since 1995. Grasslands National Park has stated, in writing, that will continue releasing captive raised Swift fox within the park; and the CEI and the government of Saskatchewan are presently developing a Memorandum of Intent for the continued release of captive raised Swift fox in Saskatchewan.

It is therefore the intention of CEI to continue the breeding of captive Swift fox for reintroduction for the immediate future. Because of the lack of research the population size for a sustainable population is not known. It is hoped that research that is presently finishing in the Alberta/Saskatchewan border area may shed light on this problem. In addition research on the use of voice printing in population estimation presently being done by CEI may provide a non-intrusive method to better estimate the number of animals in the wild.

CEI is committing to the captive breeding until the year 2000 providing that funding can be raised for the colony and additional research. In 2001 the project will be evaluated. The funding necessary for the reduced level of breeding and research are estimated as follows:

Yearly requirements for the Captive breeding Colony	$25,000
Yearly Releases and pre and post release monitoring	$ 5,000
Voice Printing Research	$37,100
Population Estimate 2000/2001 using voice printing	$25,000

Literature Cited

Brechtel, S.H., L.N. Carbyn, D. Hjertaas, and C. Mamo. 1993 **CANADIAN SWIFT FOX REINTRODUCTION FEASIBILITY STUDY: 1989 TO 1992 - REPORT AND RECOMMENDATIONS OF THE NATIONAL RECOVERY TEAM.** Unpublished Report, Edmonton, Alberta Environmental Protection

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Figure 2: Summary of data collected on the Swift fox population in the area of GNP West Block from 1992 to 1997 (From CEI,1995a)

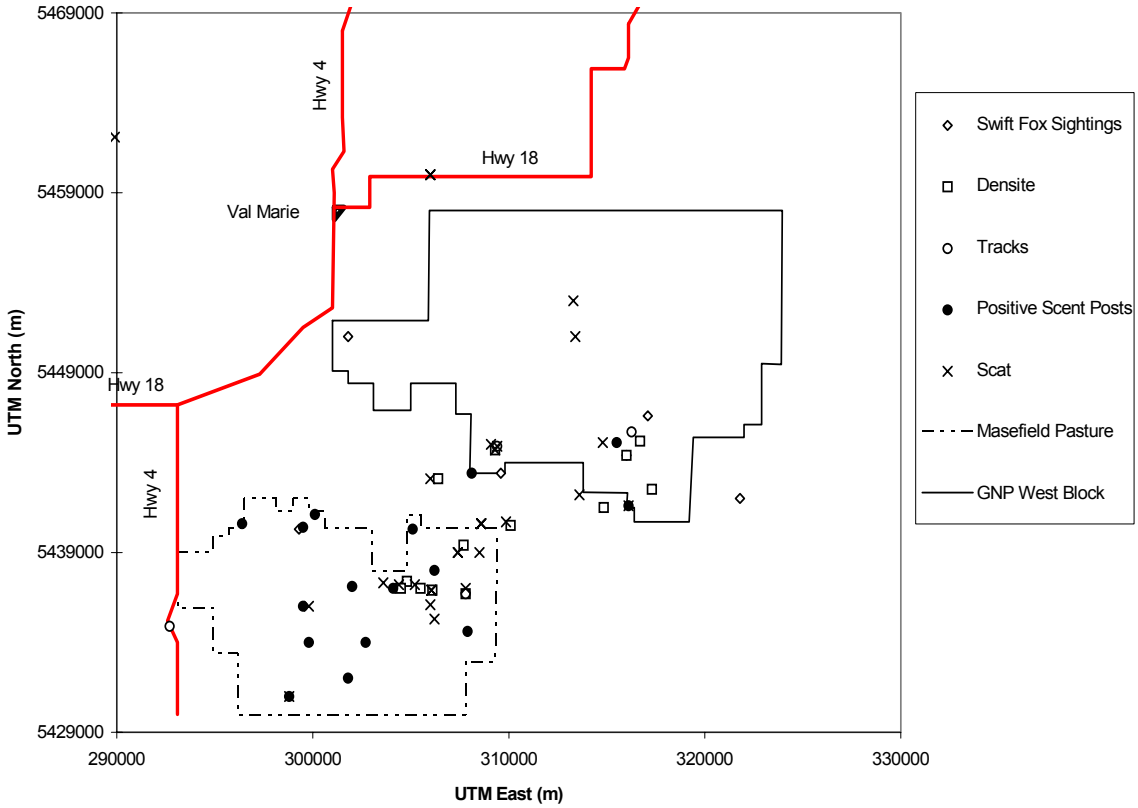
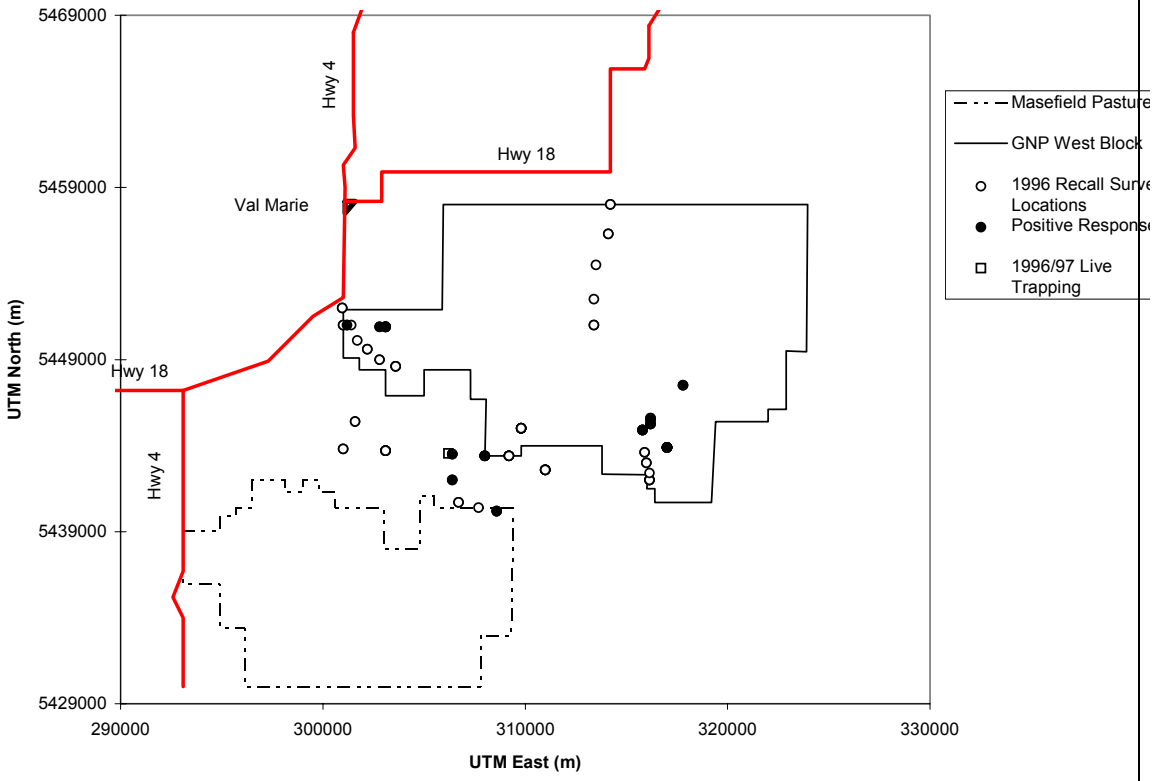


Figure 3: The results of a playback recall survey of GNP West Block during March 1996 (from CEI, 1995b)



EXCERPT FROM 1994 to 1996 AUDIT

The following two pages are excerpts from the 1994 Audited Financial Statement for the Cochrane Ecological Institute/ Cochrane Wildlife Reserve Society.

Statement Of Operations and Surplus

	Year to April 30			
RECEIPTS	**1996**	**1995**	**1994**	**1993**
Donations	68,384	67,724	53,306	28,120
Grants	29,000	44,500	44,050	83,364
Special Projects	11,596	5,138		
	108,980	117,362	97,356	111,484
DISBURSEMENTS				
Special Project	21,377	5,275		
Salaries and Benefits	13,555	23,242	19,119	31,468
Volunteer Meals	7,955	12,613	11,641	1,880
Telephone	8,136	7,477	7,934	5,856
Repair and Maintenance	2,334	6,145	6,510	6,002
Feed	6,954	5,719	6,270	8,227
Advertising and Promotion	1,378	3,773	4,210	6,556
Travel	1,006	429	3,452	4,919
Utilities	2,844	3,245	3,338	1,541
Wetlands program	982	3,347	2,694	
Goods and Services Tax	3,200	2,287	2,593	1,918
Casual Labor			1,942	
Automotive	19,362	11,187	1,827	8,339
Office	10,704	4,454	1,601	2,099
Animal Pens and Enclosures	5,680	8,983	1,559	7,386
Professional fees	2,437	2,498	3,250	4,746
Insurance	2,022	4,733	571	531
Interest and Bank Charges	379	735	226	966
Rent				12,000
Bad Debt		1,167		
Amortization	6,903	6,457	3,937	2,712
	117,208	113,766	82,764	107,137
Excess Receipts over Disbursements	(8,226)	3,596	14,682	4,347
Gain (loss) on disposal of assets			(2,885)	2,070
EXCESS FOR THE YEAR	**33,446**	**41,674**	**11,797**	**6,417**
Surplus at Beginning of Year	41,674	38,078	26,218	19,864
SURPLUS AT END OF YEAR	**33,446**	**41,674**	**38,078**	**26,261**

The shaded items above indicate where the $9,500 contribution of the ESRF was committed.

Statement of Changes in financial Position

	Year End April 30			
	1996	**1995**	**1994**	**1993**
CASH PROVIDED (USED FOR)				
OPERATIONS				
Excess of receipts over disbursements	(8,228)	3,596	11,797	6,417
Items not involving cash:				
Amortization	6,903	6,457	3,937	2,712
(Gain) loss on disposal of assets	(1,325)	10,053	2,885	(2,070)
Changes in Non-cash operating working capital:				
Accounts Receivable	(33)	1,490	(649)	(2,790)
Prepaid Expenses				12,000
Accounts Payable	4,348	(2,618)	1,617	973
	4,315	(1,128)	923	10,183
FINANCIAL ACTIVITIES				
Advance from Director	(933)	7,137	38,839	11,165
INVESTMENT ACTIVITIES				
Purchase of Capital Assets	(3,567)	(10,651)	(57,860)	(40,327)
Proceeds from disposal of assets			5,815	6,560
	(3,567)	(10,651)	(52,054)	(33,767)
INCREASE (DECREASE) IN CASH	(1,510)	5,411	6,336	(5,360)
Cash at beginning of year	14,579	9,168	2,832	8,192
CASH AT END OF YEAR	**$13,069**	**$14,579**	**$9,168**	**$2,832**

As at April 30, 1996 the total owed to the director is $60,468. His amount is non-interest bearing with no fixed terms of repayment.

FULL AUDITED STATEMENT AVAILABLE ON REQUEST