CANID NEWS

Newsletter of the Canid Specialist Group

No. 2, January 1994

Edited by

David Macdonald & Laura Handoca

at the

Wildlife Conservation Research Unit, Oxford University

WILD CRU
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PEOPLE'S TRUST
FOR ENDANGERED SPECIES

CONTENTS..

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Canid News is produced by the IUCN/SSC Canid Specialist Group. It aims to report on all aspects of the conservation of the Canidae, the dog family. The contents will include articles on conservation issues and related scientific advances, range maps, captive breeding surveys, news items and a bibliography. The frequency of publication of Canid News depends on the Canid Specialist Group finances; we hope to publish at least three issues annually.

Canid News is distributed free to members of the Canid Specialist Group and to many relevant libraries and authorities. However, because our funds are precarious, it would be appreciated if as many as possible of those receiving it could volunteer an annual subscription.

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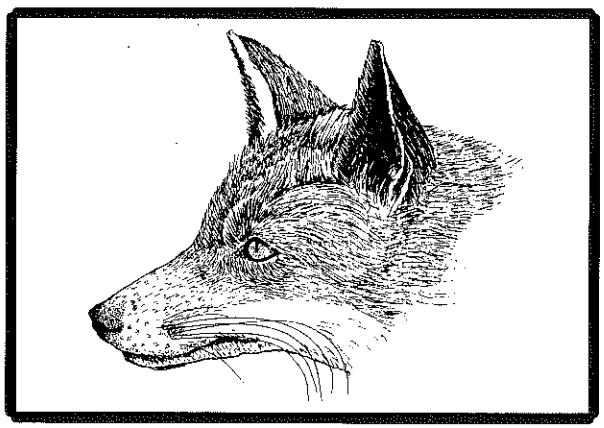

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participation of researchers and wildlife managers involved with wild dogs in Kenya, Tanzania, Zambia, Zimbabwe, Botswana, Namibia and South Africa. The PVA was the product of a huge administrative effort by Joshua Ginsberg, and he and I are soon to complete and publish a *Lycaon* Action Plan as a result. The LAP presents results on population biology and modelling of the remaining wild dog populations, information on current status, research and veterinary studies and draws management strategies and action plans. The largest populations of *Lycaon* occur in southern and eastern Africa, and for this reason the PVA and *Lycaon* Action Plan concentrate in these regions. Populations in western and central Africa are critically endangered. Modelling suggested that the most critical variables affecting long term survival are population size and, most important of all, the integration of multiple populations into a single metapopulation. Due to the ability of wild dogs to disperse, multiple sub-populations can ensure that local extinction need not lead to population extinction. The action plans for *Lycaon* are extensive, including plaus for a continent-wide monitoring system, and plans for more coordination between veterinary and ecological research.

Representatives of the CSG also played an active role at the Canid CAMP meeting in Texas in May 1993, and others were active at the Southern and Eastern African Rabies Group meeting at Ondestepoort, South Africa, where I delivered a paper on the conservation implications of rabies. In South America, Juli-ana Brandão attended the First Workshop on Management and Conservation of Bush Dogs that took place in Americana, Brazil, in March 1992. She also participated of the Maned Wolf Workshop organized during the Canid CAMP Meeting in Texas.

As a result of the joint Canid, Hyaena aud Aardwolf CAMP, organized jointly by three Specialist Groups and the AAZPA Canid Taxon Advisory Group, a preliminary Conservation Assessment and Management Plan has been compiled. The status of the 34 species and 221 distinct taxa (subspecies) recoguized in the family Canidae was evaluated: two species are now listed as critical (Ethiopian wolf and wild dog), four as endangered (small-eared zorro, maned wolf, dhole, red wolf), and six as vulnerable. At subspecies level eight taxa are listed as critical, 10 endangered, and 15 vulnerable. 29 taxa were recommended for one of four levels of captive programme and a plan was proposed to re-allocate the 3,600 canid zoo spaces available.

The main conservation and research recommendations arisiug from the CAMP were:

- To develop an immediate action plan for *in situ* and *ex situ* conservation of *Canis simensis*;
- disease monitoring on *Canis simensis* and *Lycaon pictus* populations;
- a genetic comparison of African wild dog populations, surveying all three regions; further surveys of East and West African wild dog populations;
- clarify taxonomic issues, specifically for *Dusicyon* and *Speothos*, and conduct surveys and collect basic ecological information of all South American canids, particularly the little known *D. vetulus* and *D. sechurae*;
- survey on most Asian canids, distribution and density estimates and limiting factors, in particular the critically endangered *Cuon alpinus sumatrensis*.

Expertise

Members of the CSG contribute to a wide variety of debates on cauid conservation. For example, the distressing disappearance of wild dogs from the Serengeti has prompted debate which has occupied thousands of man hours of CSG time during almost two years. In this case, a working group of international scientists which I coordinated reviewed the scientific debate, which concerned the possible roles of stress due to handling and of disease in the disappearance of these dogs, aud produced various evaluations of the evidence. Growing out of this effort, a panel of experts coordinated by Joshua Ginsherg analyzed various data and produced a report that has been distributed to all interested parties. Ginsberg and colleagues concluded that handling had not significant effects on rates of mortality of wild dogs in any of the ecosystems studied, and therefore handling seemed an improbable cause to the demise of the Serengeti dogs. The results of this aualysis will be published shortly. Meanwhile, the CSG attaches such importance to *Lycaon* that it has established a special *Lycaon* Working Party to coordinate research aud conservation efforts throughout the species' range. The LWP is chaired by Dr Gus Mills, who is assisted by Dr Scott Creel as secretary.

In the same vein, Claudio Sillero represents the CSG in fostering the conservation of the Ethiopian wolf. Of special concern in this case is the possibility of starting a captive breeding programme in order to safeguard the genetic identity of this, the rarest canid, from hybridization with domestic dogs. The SSC is currently organizing a mission to Ethiopia to draft plans for an integrated *in situ* and captive breeding programme for the Ethiopian wolf and other endangered Ethiopian wildlife. The CSG has raised funds for the production of an Action Plan for this species too, which will be written by Claudio Sillero and published during 1994.

Liaison

Much of our work is liaison, an occupation which is vastly time-consuming and which produces results which are often both valuable but intangible. Nonetheless, our correspondence files are hefty. We are naturally enthusiastic to liaise with other IUCN/SSC groups and have been in close touch with the Captive Breeding and Hyaena Specialist Groups at the Texas CAMP, with the CBSG and the Antelope Specialist Group over conservation plans in Ethiopia, and with the Veterinary Specialist Group regarding rabies in *Lycaon* and the debate on handling effects.

David Macdonald

Bat-eared Foxes in the Serengeti *by Barbara Maas*

Disease can be a powerful force affecting the sex and age structure of animal populations. This report examines the impact of rabies on bat-eared fox groups in the Serengeti National Park.

Taxonomy and Distribution

Bat-eared foxes (*Otocyon megalotis*) are comparatively small nocturnal canids, which live in two disjunct populations in the eastern and southern parts of Africa (Figure 1). Their head, back and the upper part of their legs are a grizzly grey, while their chest and the underside of their body vary from a light buff to a rich honey tone. Other parts of the animal's body, such as the backs of the ears, the lower parts of the legs, the upper side of the tail, as well as a raccoon-like "face-mask" are black, and it is these parts which are most easily visible at night. As suggested by their name, the most outstanding physical features of bat-eared foxes are their phenomenally out-sized ears. These can measure up to 13 cm in an animal which stands to an average shoulder height of 30 cm (Kingdon, 1977; Smithers, 1983).

Bat-eared foxes are the only species in the genus *Otocyon*. The species is set apart from the rest of the Canidae on the basis of several morphological characteristics associated primarily with its dentition. Firstly, bat-eared foxes have between one and four pairs of extra molars, as a result of which they have more teeth than any other heterodont placental mammal (Sclater, 1900). Secondly, a modification of the insertion point of the digastric muscle allows the animals to open and close their jaws up to five times per second.

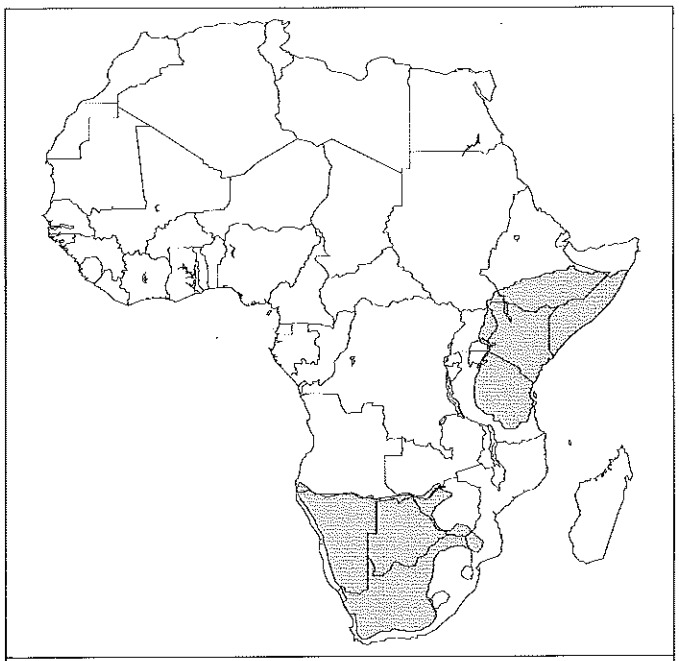


Figure 1. Distribution map of bat-eared foxes on the African continent. After Smithers (1983).

Dr. Barbara Maas undertook this study as part of her doctoral thesis from the University of Cambridge. Currently she is a member of the Wildlife Conservation Research Unit at Oxford, where she is seeking funds for a postdoctoral study of rabies in small canids in the Serengeti.

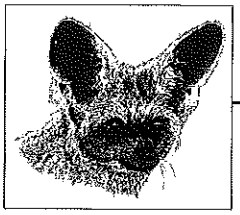
Diet

Although the ears of bat-eared foxes may also serve a thermoregulatory function, their main purpose, like that of the anatomical features described above, seems to lie in facilitating effective prey detection. Bat-eared foxes, to a greater extent than other canids, have virtually given up preying on vertebrates and feed on insects (Nel, 1978; Berry, 1980; Smithers, 1983). Sharp hearing and rapid movement are vital in prey capture. In parts of the southern African population, where wild fruit and berries are available, these may also form a substantial part of the species' diet (Smithers, 1983; Kuntzsch & Nel, 1992).

In the Serengeti, as well as in many parts of southern Africa, *Hodotermes mossambicus* (a relatively large harvester termite) and dung beetles constitute the most important sources of food for bat-eared foxes (Nel, 1978; Lamprecht, 1979; Malcolm, 1986; Maas, 1993). In my study area both termites and dung beetles were more abundant in areas inhabited by bat-eared foxes than those which were not, and local differences in *Hodotermes* foraging density were inversely proportional to territory size. Furthermore, *Hodotermes* foraging hole density was also positively correlated with a variety of demographic and reproductive variables, such as litter size and female recruitment rate (Maas, 1993). One of the main consequences of this unorthodox diet is that in contrast to animals which feed on larger prey, the collection of a sufficient quantity of very small food items is directly dependent on available foraging time. This relationship is intensified during nutritional bottlenecks, which can occur as a result of a reduction in availability (e.g. a drought), an increase in physiological requirements (e.g. during reproduction) or a combination of both.

Canid Diseases – an Historical Overview

Rabies occurs in all parts of the African continent. Although the domestic dog is most frequently associated with the transmission and maintenance of rabies in African countries, the number of wildlife cases too is likely to be high. However, reliable information on rabies in African wildlife is scarce, not least because of the enormous practical



difficulties associated with effective monitoring. The first documented rabies cases in Tanzania were reported in 1932/33 (see Rweyemamu *et al.*, 1973), but rabies had not been confirmed in the Serengeti National Park until 1986 (Maas, 1993). However, prior to this date there were anecdotal accounts of disease-related mortality in wild dogs (*Lycaon pictus*) (Schaller, 1972; Malcolm, 1979). Even before that time, Leaky (1969) attributed large fluctuations in the number of bat-eared foxes near his camp to periodic outbreaks of disease. So far wild dogs and bat-eared foxes continue to be the only Serengeti carnivores for which rabies has been confirmed in the laboratory (Gascoyne *et al.*, in press; Maas, 1993). The problem of disease related mortality in Serengeti carnivores is further complicated by the recent occurrence of distemper in the Kenyan Massai Mara Game Reserve (K. Alexander, pers. com.), which is situated to the north of the Park and is part of the same ecosystem. Without laboratory confirmation the clinical symptoms of canine distemper and canine hepatitis are difficult to distinguish from those caused by rabies infections (Macdonald, 1980) and it is thus possible that the problem is even more complex than it appears at first. Certainly, a disease like rabies in the fragile Serengeti ecosystem raises perplexing conservation problems (Macdonald, in press).

Rabies Mortality in the Serengeti

Between 1986 and 1989, 90% (N = 94) of the mortality suffered by a population of known individual bat-eared foxes was caused by disease (Figure 3). In contrast, the proportion of foxes which were killed by predation or road accidents was negligible (6%). During the four years of the study, two separate disease outbreaks affected the population, the first in 1987 and the second in 1988. The outbreaks were short, lasting for approximately seven weeks in 1987 and five weeks in 1988. All animals submitted for post mortem analysis were diagnosed as rabid. Although only three post mortem examinations could be carried out, it was assumed that animals which disappeared shortly after they had been observed to show clinical symptoms had died of the same cause. The majority of infected animals developed the paralytic form of the disease and did not show any furious symptoms. Instead, an initial stiffness and lack of coordination in the animals' hind limbs progressively developed into complete ataxia. At the same time, the sick foxes grew increasingly weak and sometimes suffered violent convulsions and cramp-like seizures, which affected their entire body and during which they frequently cried out. Other symptoms included conjunctival and scleral congestion,

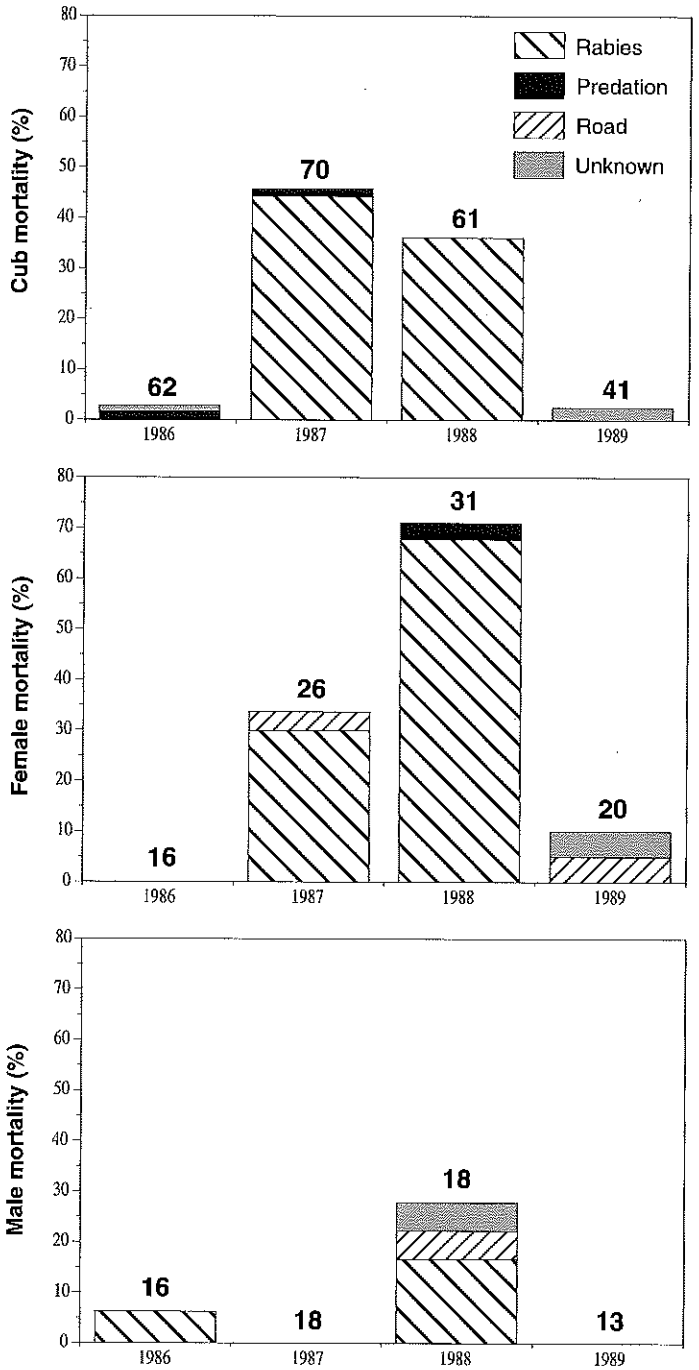
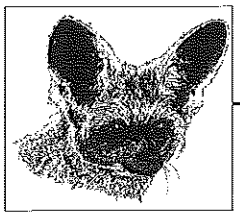


Figure 3. The influence of different causes of mortality on different parts of the bat-eared fox population between 1986 and 1989.



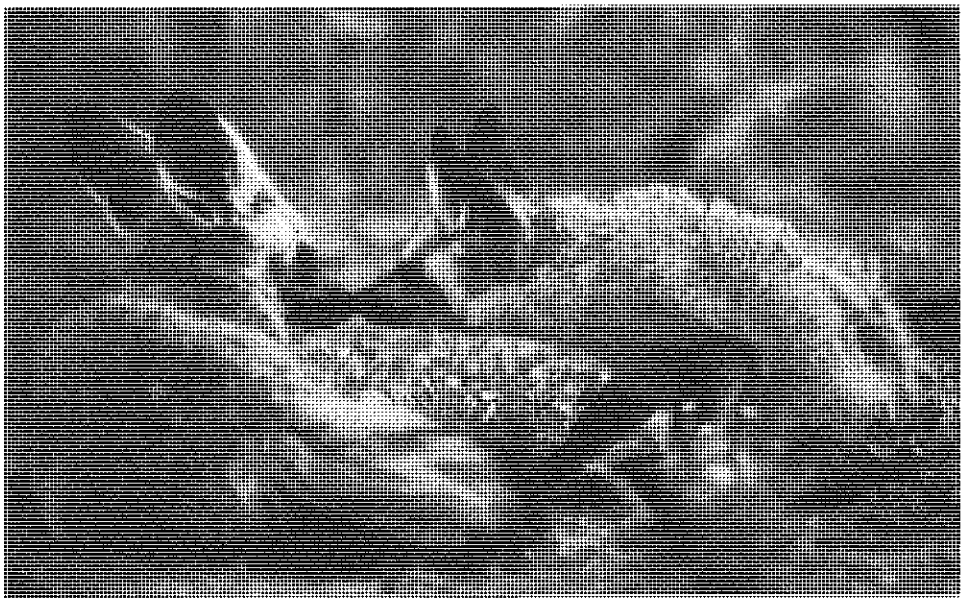
accompanied by varying degrees of discharge from the eyes. However, increased salivation was not observed. Some individuals developed an almost "obsessive" tendency to pick up food items and carry them around in their jaws. Infected foxes soon became too weak to forage and usually died within a week of the onset of clinical symptoms. Animals which showed signs of restlessness were actively avoided by other group members and although this was true also for several animals suffering the terminal stages of paralytic rabies, others received increased amounts of grooming and contact behaviour.

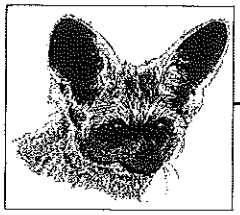
Looking at the study population as a whole, it was found that approximately 20% of all males and cubs (N = 19 and N = 234 respectively) and about 60% of all females (N = 48) were affected by the disease. Furthermore, mortality data presented in Figure 3 show that during the four years of the study, rabies was the major cause of death in both adult and juvenile bat-eared foxes. However, a comparison of proportional adult mortality revealed that in both years the proportion of females which fell victim to the disease was significantly larger than the proportion of males. Further examination of the data showed that in both groups of adults fewer animals died during the 1987 outbreak than during that of the subsequent year. In contrast, the proportion of cubs which died from rabies was the same in both years. The data on male and female rabies-related mortality suggest that in years in which rabies outbreaks occurred, females were at least 11 times more likely to die from rabies than were males.

"rabies was the major cause of death in both adult and juvenile bat-eared foxes; about 60% of all females were affected by the disease"

Differences in Susceptibility?

Although some continue to consider rabies an inevitably fatal disease, the outcome of rabies infections is believed to depend on factors such as virus strain and pathogenicity, dose of infection, host susceptibility and route of transmission (see Baer, 1991). Seropositive animals may be showing subclinical infections or seroconversion may occur in association with recovery from clinical rabies (Andral & Serie, 1957; Fekadu & Baer, 1980; Fekadu *et al.*, 1981). Today ample evidence exists for physiological mechanisms (Martin, 1989) by which exposure to stressors can increase the susceptibility of individuals to infectious disease (Fowler, 1986; Workman & La Via, 1987; Jeppesen, 1988; Wemelsfelder, 1990, see Martin, 1989 for a review). There has also been accumulating evidence which indicates a possible link between immunocompetence and the susceptibility to rabies (Wiktor *et al.*, 1980, quoted in King & Turner, 1992; Sriwanthana *et al.*, 1989; Wandeler, 1991). In 1975, Winkler reported that stress and physical condition can influence the length of the incubation period in foxes. McLean (1975) stated that in raccoons, more females than males were found to have rabies serum neutralising antibodies. He continued to argue that in the same species, latent rabies infections may be reactivated by stress (see also Johnston & Beauregard, 1969), although this view has become





increasingly disputed. Nevertheless, female bats are over-represented in rabies samples submitted for examination in the United States (C. Rupprecht, pers. com.), and it was found that in some ungulates, females experience a period of postpartum immunosuppression.

While the 1987 epidemic took place at a time when the cubs were almost fully grown, the 1988 outbreak reached the population in November, when females were in mid-lactation. Furthermore, rainfall in November and thus insect availability was exceptionally low in 1988. November usually marks the early part of the rainy season and brings with it a dramatic increase in insect availability. After four months of dry season during which food supplies became increasingly scarce, the animals are at a nutritional low, a fact which is reflected in their poor physical condition during this time of year. Thus, a delay in the onset of the rainy season signifies a nutritional dilemma at a time when, as a consequence of lactation and the cost of parental care, nutritional demands on adults are greatest. This is particularly relevant, since compared to other canids for which this information is available, the costs of lactation are high in bat-eared foxes (Maas, 1993). It is therefore possible that poor physical condition, aggravated by reduced availability of food and water was associated with higher mortality rates in lactating females in 1988. Restricted access to food, due to lack of rainfall would also affect male bat-eared foxes, and hence may explain the difference in male mortality rates between the two years. However, a judgement on whether greater susceptibility in females, and particularly lactating females, is related to differences in condition, or whether the observed differences are indeed related to the same phenomenon, must be postponed uutil information on the presence of rabies neutralising anti-bodies, physical condition and immune status are available.

Differences in Exposure?

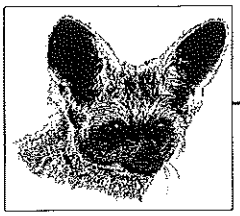
Differences in exposure rather than susceptibility may provide an alternative explanation for the observed intra- and intersexual differences in disease-related mortality. It has been suggested that rabies is sometimes transmitted from one individual to another through social grooming. However, disease transmission through social grooming cannot explain the observed differences in male and female mortality rates, since in bat-eared foxes males are more active groomers than are females. Furthermore, both territorial and antipredator defence are almost exclusively performed by males, and intra- and intergroup aggression is rare in bat-eared foxes. Hence, increased exposure of females through intra- or interspecific antagonistic encounters is also an unlikely explanation for the observed phenomena.

"the data on male and female rabies-related mortality suggest that in years in which rabies outbreaks occurred, females were at least 11 times more likely to die from rabies than were males"

However, rabies transmission from one female to another during communal suckling may provide a possible route of infection, since rabies transmission via maternal milk has been reported in other species (Constantine, 1967; Afshar, 1979). In family groups with more than one breeding female, females always suckle each other's cubs communally. Thus infected cubs may pass the disease on to other females through abrasions on the females' teats.

Rabies in the Serengeti

In most areas where rabies epidemics occur, one species is predominantly involved in maintaining the disease, while others – so called "spill-over species" – are less severely affected. In the Serengeti National Park



rabies has so far been confirmed only in bat-eared foxes and wild dogs. The disease is also widespread among the domestic dog population which inhabits the surrounding areas (S. Gascoyne, pers. comm.). It is unlikely, however, that these three species will remain the only ones implicated in the transmission of rabies in the Serengeti ecosystem, once further studies get under way. Gascoyne's work, as well as the present study, emphasise the urgent need for more information on the scale of rabies infection in Serenegti carnivores. More information is necessary in order to identify the role which wildlife species and domestic animals play in the transmission and maintenance of rabies in the area, both in view of its conservation implications and in terms of minimising human exposure.

"a disease like rabies in the fragile Serengeti ecosystem raises perplexing conservation problems"

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The Maned Wolf in Captivity by Adriana Gomes Consorte-McCrea

This article is a brief account of a six month study of aspects related to the breeding of maned wolves in captivity, conducted at the São Paulo Zoological Park Foundation, Brazil.

Introduction

The maned wolf (*Chrysocyon brachyurus*) is the largest South American canid and is easily identified by its long dark legs, orangy brown coat and dark mane (see illustration below). In addition to its distinctive appearance, it has some interesting habits, including a solitary lifestyle and largely frugivorous diet.

The maned wolf's survival in the wild is threatened by a number of factors, including hunting, superstition and habitat loss to farms (Encke, 1970). Some local rural people attribute mystical qualities to several parts of the wolf's anatomy (eyes, skin, tail), which are used as "talisman" or for medicinal remedies. They also consider the wolf a threat to domestic poultry. Meanwhile, as its habitat is encroached upon by ever-expanding farms, the wolf is forced into increasing proximity with people. The species is classified as "Vulnerable" in the IUCN Red Data Book.

The situation regarding environmental protection and the creation and maintenance of ecological reserves is still precarious in the areas where wild maned wolves remain, so it is important that zoological institutions around the world take responsibility to protect and breed animals in captivity. Unfortunately captive breeding has not proved to be easy.

At the São Paulo Zoological Park Foundation (São Paulo state, Brazil) attempts to breed maned wolves repeatedly met with problems; females did not seem able to rear their litters. Other zoos have also experienced difficulties, with the female maned wolf eating, burying or abandoning her newborn pups. The work reported here, which was undertaken as part of the author's apprenticeship to the Mammals Section of the Zoo, aimed to remedy these breeding difficulties.

Adriana G. Consorte-McCrea graduated in Biological Sciences at the Federal University of São Carlos, SP, Brazil, and has been studying the relationships between privacy and performance of the maned wolf in captivity since 1987, when she undertook her apprenticeship at São Paulo Zoo. Since 1993 she has been coordinating the Alta Floresta Centre for Environmental Studies at the Cristalino Ecological Institute, a Brazilian NGO which aims to help researchers study the meridional Amazon.

Maned Wolves in the Wild

Maned wolves inhabit cerrado vegetation and swampy areas from central and south eastern Brazil to north eastern Argentina and eastern Paraguay and Bolivia (IUCN, 1982) (see map, page 41).

Forming stable monogamous pairs, maned wolves are not abundant anywhere (Coimbra-Filho, 1972). Each pair occupies a territory of about 25-30 km² encompassing a variety of vegetation types (Red Data Book, 1982). The pair shares the territory and frequently the same resting, foraging, urinating and defecating sites, but they generally travel independently outside the whelping season (Carvalho, 1988). Although the female does not appear to depend upon her partner's help in caring for the pups, the fact that male maned wolves show a high rate of vocalization, scent marking and territorial defence may make an important indirect contribution to the female and pups (Dietz, 1984). Certainly, paternal care is the general rule amongst canids (e.g. reviews in Macdonald, 1992) so it might be expected in the maned wolf.

Maned wolves are highly territorial in the wild (Carvalho, 1976; Dietz, 1984). They inhabit relatively open regions with long vegetation cover, making it difficult for them to see other wolves, so they rely on long distance communication. Kleiman (1972) describes barking, a highly visible threat display, and scent marking with faeces and urine. Maned wolves are opportunistic generalists, small animals (rodents, insects) comprising about 30% of their diet and fruits 70%, including "fruta-do-lobo" – wolf's fruit (Dietz, 1984; Gomes da Silva, 1988). Foraging begins just after sunset and ends after sunrise.

Captive Breeding Problems

Females in captivity in the southern hemisphere show only one oestrus per annum, between March and April. Following a gestation period of approximately 66 days, births occur between June and August. The problem of neonatal infanticide in captivity must be solved if captive breeding is to be more successful. Neonatal infanticide amongst primaparous females is recognized as a general phenomenon amongst many mammals, especially felids, and is reviewed by Guittin (1982). The persistent neonatal cannibalism shown by the São Paulo maned wolves may be caused by stressful conditions.

The Zoo Routine

At the time of the study, the collection at São Paulo comprised 3 pairs of wild-caught adults which had never bred

successfully at the Zoo. The facilities for the maned wolves consisted of a large (200 m²), well vegetated island enclosure, surrounded by a ditch and open to public view, and three adjacent fenced areas with dens which were not visible to the public (enclosure 126). Each fenced enclosure contained a 4 x 12 m concrete floor, a 3 x 4 m covered den, and a tunnel giving access to the island (see Figures 1, 6 & 7).

Only one pair of wolves was allowed onto the island each day, so the 3 pairs were subject to a daily rotation scheme, each spending one day on the island (from 8.30 a.m. to 5 p.m.) followed by two days in their fenced enclosure. Enclosure 126 was cleaned on a daily basis at 10.30 a.m. and food trays were introduced at 4.30 p.m.

A total of 127 hours of direct observation was recorded between August 1987 and January 1988 (i.e. 6 months of the females' anoestrous period). Each observation of a pair lasted 30-60 minutes, and took place between 8 a.m. and 6 p.m. Of the total, 39 hours were devoted to wolves on the island enclosure, the remaining 88 at enclosure 126. During this time the wolves were subject to varying amounts of privacy. In October pair A was removed from the island-sharing rota, followed by pair C from 17th November. For the latter part of the study pair B thus had exclusive access to the island territory. We hoped to test the hypothesis that privacy plays an important role in the maned wolf's reproductive behaviour in captivity.

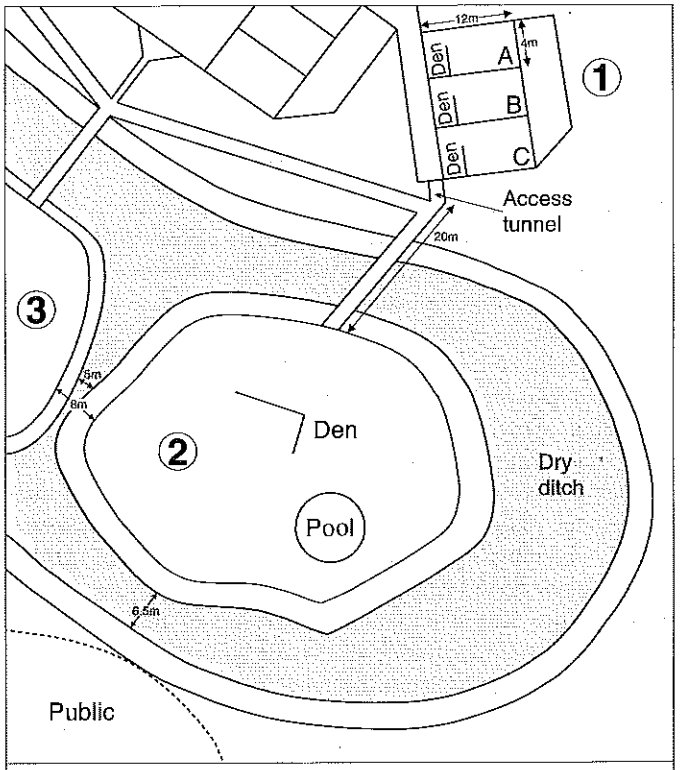

Figure 1. Layout of maned wolf fenced and island enclosures at São Paulo Zoo.

Potential Causes of Stress

1) Inappropriate Diet

From faecal analysis, Gomes da Silva (1988) reported the wild maned wolf diet to consist of the following:

cerrado fruits	39%
"wolf's fruit"	38%
medium & large mammals	5%
small mammals	4.9%
Dasypodidae	3.8%
Equimydae (Clyomys)	3.7%
Miscellaneous	**5.6%**
Total vegetable proportion	**77%**
Total animal proportion	**17.4%**

Carvalho (1988) recommended that a suitable daily diet for maned wolves in captivity might consist of the following (depending on availability): 900 g seasonally available fruits (e.g. avocado, pineapple, peeled orange, caqui, banana, cerrado fruits), and 400 g animal matter (e.g. egg, 1/2 chicken, chicken's head and neck, cow's stomach and cartilage, 1 or 2 chicks).

At São Paulo the maned wolves' daily diet comprised 1100 g of animal food and 200 g of vegetable matter. Their diet would thus appear to be too rich in meat but the animals eat all the meat provided. It is likely that this is a common fault in captive maned wolf diets, and the Maned Wolf SSP Propagation Group (at Front Royal, USA) is currently studying the effects and potential health hazards of an excess of meat in the species' diet.

2) Disturbance from humans

Whilst in the island enclosure the wolves are disturbed very little by humans, other than by the presence of zoo visitors, and the dens and good vegetation cover provide tolerable privacy from audiences. In enclosure 126, however, where the wolves spend most of their time, they are disturbed by keepers at least twice a day. To a species which in the wild roams alone over large distances the regular presence of humans in a confined space could play a significant part in increasing stress.

3) Proximity of other wolves

Maned wolves are territorial, but their low density in the wild means that aggressive intraspecific encounters are probably infrequent. At São Paulo, however, the three pairs are kept in close proximity, leading to potentially stressful levels of territorial aggression. The pair on the island is separated from the other wolves in enclosure 126 by about 20 m, so vocalizations are the main form of communication available. The pairs in the fenced enclosures are in continual auditory, olfactory and visual contact through the bars, which in combination with the restricted space available provides highly unnatural conditions. Moreover, each pair appears to treat the island enclosure as its own territory, and the timetabled sharing brings each pair into contact with the

territorial scent markings of the previous occupants.

Observations of Behaviour

1) Vocalizations

The graphs in Figure 2 illustrate differences in the vocalizations shown by pair B while in enclosure 126 and on the island during the study. The "bark" is a long-range communication (often preceded by amicable intra-pair interactions), and is used most often on the island, when other wolves are more distant. In the enclosure barking is much rarer than growling, a short-distance aggressive vocalization. The trends in frequency of the types of vocalization are probably due to the change in management. After mid-November only pair B had access to the island enclosure. From November to January there was an increase in barking by the male on the island and an increase in growling whilst in enclosure 126. This could be a result of more "natural" territorial behaviour due to the visual and olfactory isolation of the island couple from the other maned wolves. We also suggest that restricting contact between pairs to just vocalizations results in more amicable inter-pair interactions.

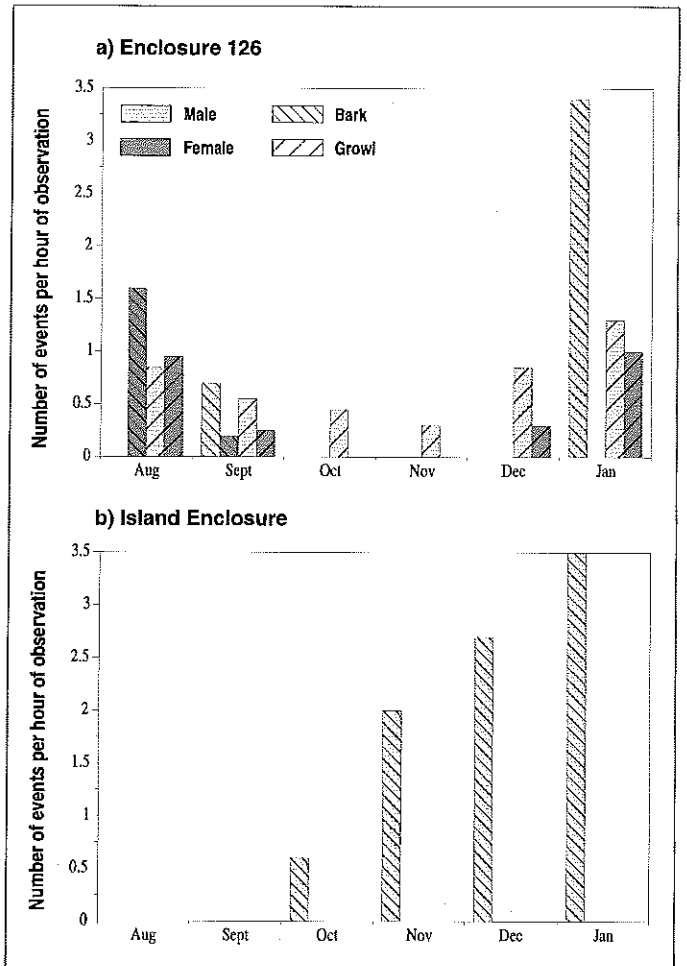

Figure 2. Vocalizations of maned wolf pair B.

2) Scent marking

Contrary to expectation (Dietz, 1984), males urinated more frequently than females during the anoestrous period, both in enclosure 126 and on the island. Stress due to the constant close proximity of other maned wolves may intensify the male's territorial behaviour, resulting in unnatural levels of scent marking. There are no clear trends in behavioural changes in scent marking between November and January.

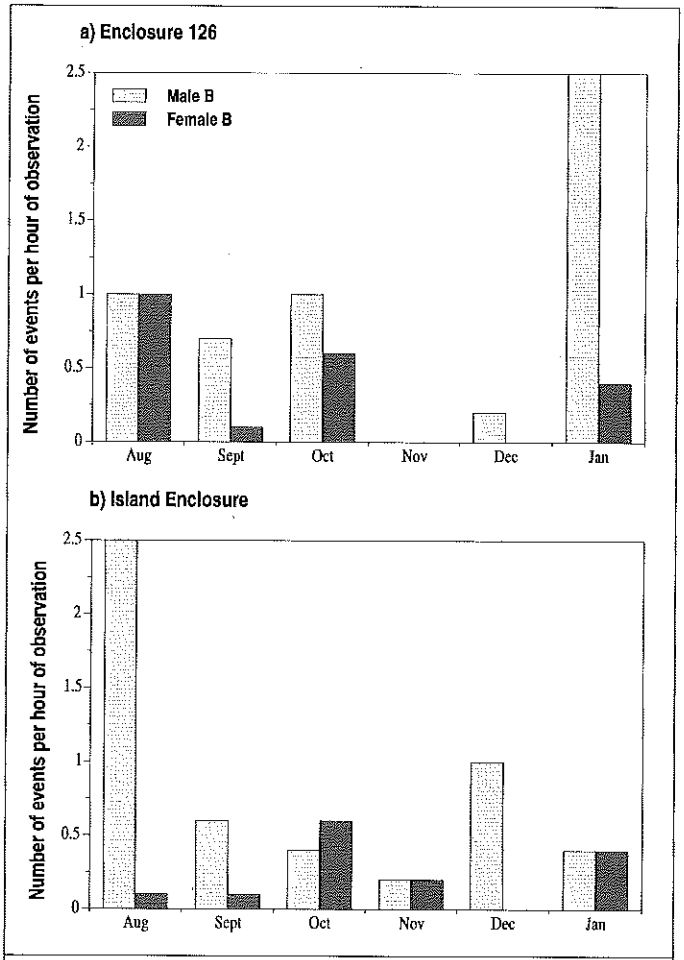

Figure 3. Urine scent marking behaviour.

3) Locomotion

Females spent more time than males lying down, out of sight of observers and neighbouring maned wolves. Males were less timid, spending more time than females moving around, perhaps linked to a greater role in territorial defence. Both males and females spent nearly twice as long standing still on the island as in enclosure 126, probably in response to the greater degree of isolation from the other wolves and the more natural surroundings of the former environment.

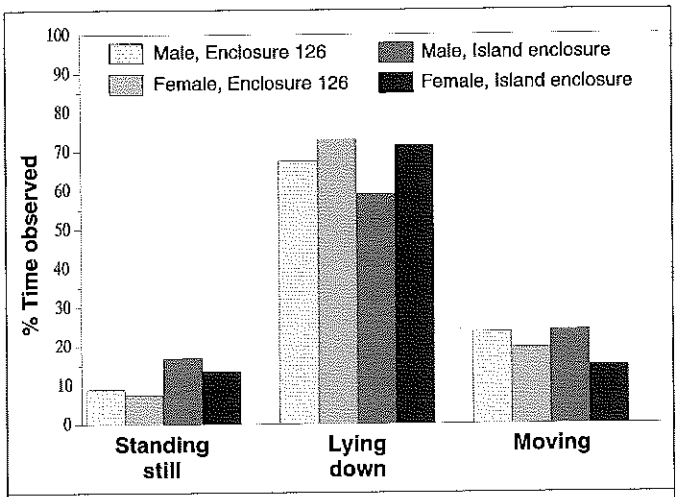

Figure 4. Locomotion of maned wolf pair B.

4) Intra-pair movements

Inside the enclosure, most movements serve to increase the distance between male and female, in stark contrast to behaviour on the island, where movements towards each other were more common. The rise in voluntary movements towards the partner increased considerably in the last 2 months of the study, after the other pairs ceased to be allowed access to the island. This might indicate that pair B felt more relaxed in their territory in the absence of other wolves' scent marks. The almost complete lack of distance-decreasing behaviour in enclosure 126 is not very surprising, given that members of a maned wolf pair tend to forage alone in the wild.

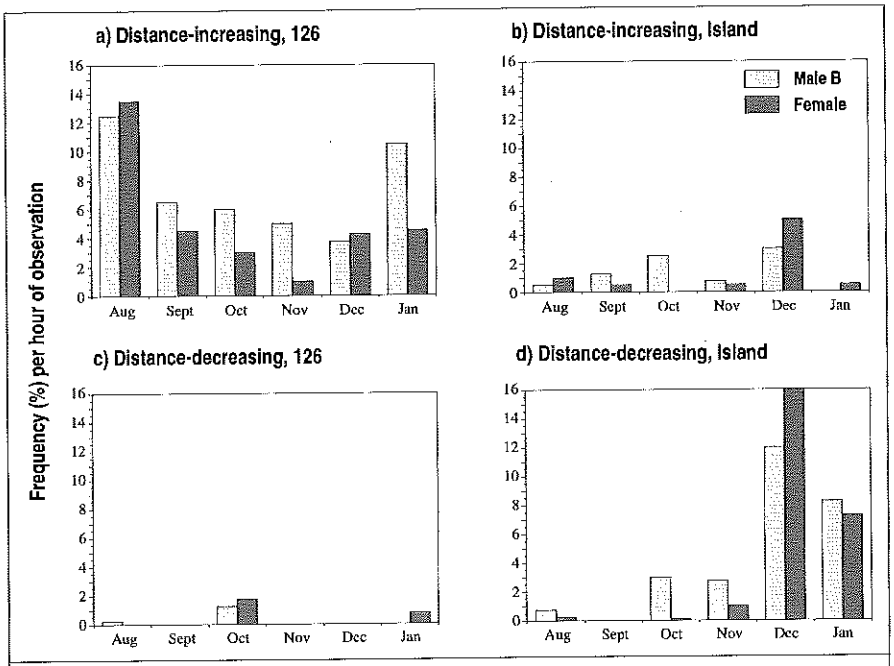

Figure 5. Intra-pair movements for maned wolf pair B.

Conclusions

Based on knowledge of the ecology of the species, analyses of the material collected from behavioural observations, and on data from captivity we suggest that the wolves we observed had been subject to stress, caused mainly by the uninterrupted presence of other pairs of maned wolves. This social stress appeared to affect several aspects of their behaviour, and could be the cause of the captive breeding problems. Measures to increase privacy, particularly by allowing only one pair access to the island territory, resulted in an increase in amicable behaviour within the pair and a decrease in intra-pair alarm and aggressive behaviour.

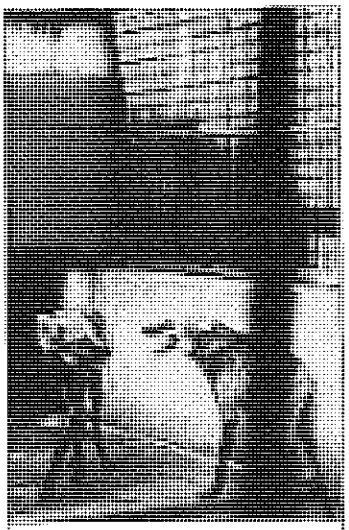

Figure 6. Intra-pair aggressive behaviour in enclosure 126.

The long term use of the island by one pair would appear to fulfil three important privacy requirements:

1) Isolation from human interference
2) Visual and olfactory isolation from other maned wolves
3) Sufficient space to give the male and female opportunity to be apart.

To avoid stress it would therefore seem important to attempt to isolate neighbouring pairs as far as possible. It would also be advisable to provide several potential dens in each enclosure, allowing the female to choose one that suits her and her pups, and giving more space to the male. Provided that they can den separately, male and female can be kept together after parturition. Privacy could also be enhanced by reducing interference from zookeepers.

An enclosure equipped with vegetation offers natural options of denning and facilitates other natural wolf behaviour (such as digging, chewing plants and walking). A diet closer to the composition found in the wild, with an extra supplement of fibre for those who do not have access to vegetation could also be considered.

Currently the maned wolf's natural environment is not receiving sufficient protection to make reintroduction feasible in the near future. In the meantime, it is important that knowledge of the species' ecology is applied to its requirements in captivity in order to maximize the potential of the captive population.

Breeding Improvements

On a practical front some progress has been made in a number of zoos. Manipulation of factors such as security for the female have improved captive breeding results. Following the success achieved by Frankfurt Zoo in 1968 (Faust & Scherpner, 1968), other zoos have achieved good results in the rearing of pups by their own mothers (in Brazil, successes are recorded at Curitiba Zoo, Sorocaba Zoo, and most recently, São Paulo Zoo). Hand-rearing still remains a useful option, but it is not problem-free (Acosta, 1972; Diniz & Deutsh, 1980; Rodden & Blakely, 1987).

Since our study, the breeding situation at São Paulo Zoo has improved. On 5th June 1988 female B gave birth on the island, but the pups were never seen. Unfortunately, the additional privacy that had been afforded the pair before the birth was replaced by considerable management interference after the birth of the pups. The male was removed from the island and isolated in enclosure 126, the zookeepers went into the island enclosure to attempt to see the pups, and the grass inside the enclosure was cut. When, on 26th June 1989, female B gave birth to a litter of three female pups, the zoo management decided to hand rear them.

In the following year several wolves died from disease, after which male C and a new female occupied the island enclosure. On 10th June 1992 two male pups were born. On this occasion the male was not removed and no attempt was made to touch the pups. The two pups were successfully reared by the female and have now attained maturity. In 1993 the management introduced a new routine involving some sharing of the island enclosure by more than one pair of wolves. It remains to be seen what effect this will have on future breeding success.

Acknowledgements. I am grateful to Dr. D. Macdonald and Laura Handoca for their invaluable participation; to Dr. J. Gipps, Dr. D. Waugh, Dr. H. Lucker, Dr. W. Encke and Dr. B. Matern for receiving me at their zoos; Dr. J. Dietz, Melissa Roddeu, Dr. Lilian M. Diniz and Dr. C. Carvalho for all the information and Dr. F. Simon and the São Paulo Zoological Park Foundation for making this work possible.

Figure 7. Maned wolves on the island enclosure.

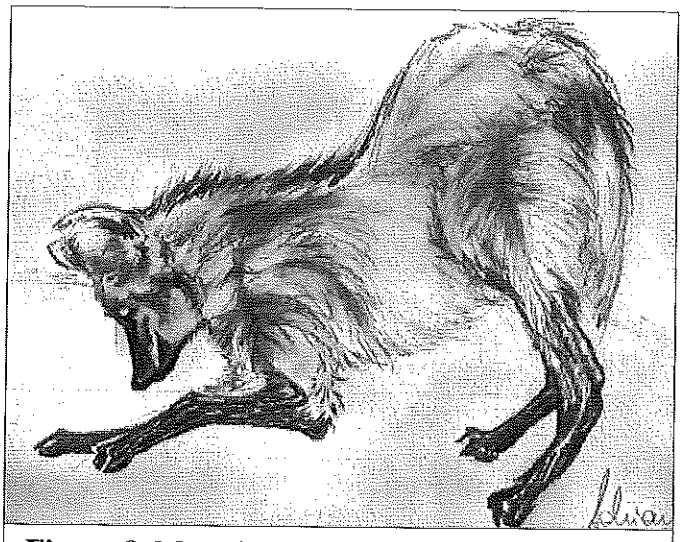

Figure 8. Maned wolf in play posture (illustration by Adriana G. Consorte-McCrea).

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Reintroducing the Swift Fox *by Clio Smeeton*

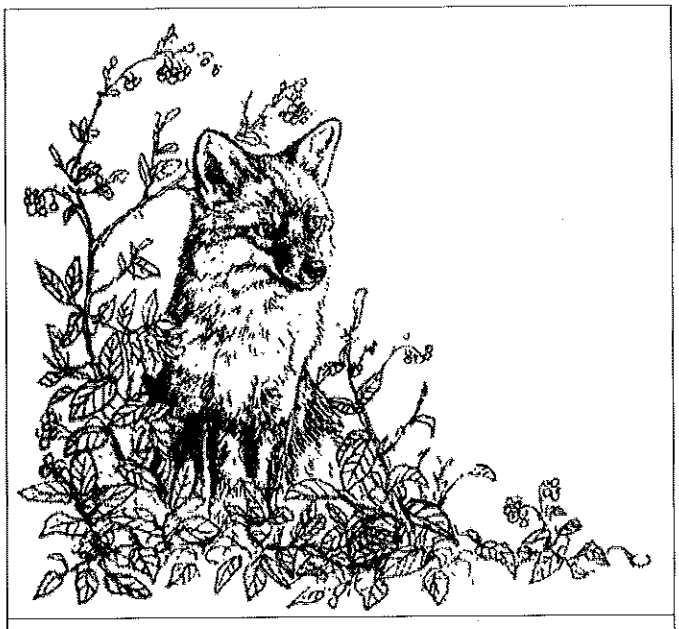
A new method of release assayed in Grassland's National Park may increase the survival rate of reintroduced swift foxes in Canada.

Introduction

The swift fox (*Vulpes velox/V. v. hebes*), unique to the great plains of North America, was declared extinct in Canada in 1978. This small canid shared its historic great plains range with a wide variety of now extirpated or remnant species, including the prairie dog (*Cynomys ludovicianus, C. leucurus, C. gunnisoni* and *C. parvidens*). Unfortunately the swift fox vanished from the greater part of its range before possible links within the ecosystem provided by the colonial prairie dog and the swift fox could be investigated.

The swift fox, because of its small size, is preyed upon by both aerial and terrestrial carnivores. The country which comprises its range is extremely exposed and escape opportunities provided by badger (*Taxidea taxus*) diggings and abandoned prairie dog burrows probably have a significant effect on swift fox survival.

The mixed grass prairie is a brutal region far from the ameliorating influences of the seacoast. Dry winds roll unhindered across the flat lands or eddy around the butts at speeds of up to 129 km/hr. A clear sky arcs over plants and animals adapted to temperature extremes swinging through 80°C. This is the shortgrass prairie setting of Grassland's National Park which, once completed, will contain over 900 km² of short and mixed grass prairie, the last substantial representation of that habitat left in North America.



Swift fox, by Canadian artist Samara Carriér.

Agency Involvement

Swift fox have been bred at the Cochrane Wildlife Reserve (CWR), a non-government organization, since 1971. The Canadian attempt to reintroduce this species has been in operation since 1983. The reintroduction of an extirpated species always involves the cooperation of many agencies, and the swift fox re-introduction project is no exception to that rule. The participants in the programme have been four non-government breeding facilities which are responsible for producing the foxes for reintroduction, genetic management, quarantine, tattooing, necropsies and pathology. The Government agencies involved are both federal: Canadian Wildlife Service, and provincial: Alberta Forestry Lands and Wildlife and Saskatchewan Environment and Renewable Resources. Government agencies are responsible for the importation of swift fox and for the animals after release.

Clio Smeeton and her parents founded the Cochrane Wildlife Reserve, a Registered Charity which is devoted to the breeding and re-introduction of endangered species. The CWR has been breeding swift fox for re-introduction and release since 1971, and currently holds the world's largest breeding colony of this species. CWS is very grateful for the generous support of the FFPS and Whitley Wild Animal Protection Fund in 1993.

The attempt to reintroduce any extirpated species is a venture into uncharted territory and naturally the agencies involved arranged the varied aspects of reintroduction in order of priority. From the winter of 1991-92 onwards, the monitoring of released swift foxes was not considered a priority activity by the federal and provincial governments. Behavioural observations, habitat utilization, and prey-base studies (which had ceased in the mid 1980's) were also considered of low priority by the government agencies.

Reintroduction Methods and Sites

Sample sizes for projects such as the swift fox reintroduction programme must necessarily be small. Between 1989 and the spring release of 1991 government agencies radio-collared 10% of the autumn-released cubs and 100% of the spring-released animals. The first part (1983-1991) of the Canadian swift fox reintroduction took place in southern Alberta and Saskatchewan in shortgrass prairie from which the prairie dog had been extirpated (a total of 561 swift foxes). The animals were released into privately held land or Crown lands with grazing rights held by the farming community.

129 swift foxes were released in the autumn's of 1992 and 1993. At the instigation of the CWR and with the agreement of Parks Canada some were concentrated in Grassland's National Park (GNP) and its environs, the last

area in Canada to contain populations of the black-tailed prairie dog (*Cynomys ludovicianus*). No radio-collaring or monitoring by the government agencies was undertaken for the autumn 1992 and 1993 releases.

The greatest concentration of government effort was expended on the spring releases of 1990 (27 foxes) and 1991 (28 foxes) in an effort to establish (a) the best time for release and (b) the most suitable animals for release; wild-caught, quarantined translocated animals or yearling captive-born cubs. Considerations of release methods were not part of the spring release experiment or of the post-1988 autumn releases.

Research in South Dakota

A team from the Cochrane Wildlife Reserve spent 13 days in the South Dakota Badlands National Park and Ardmore (August 4-16th, 1993) live-trapping swift fox as part of the U.S. federal government's selenium research, and to gather blood samples for exciting new genetic research on the species. The taxonomic status of the Northern swift fox (*Vulpes velox hebes*) is currently unresolved, but blood was collected from the last remaining swift foxes (15 left from an estimated population of 40 in 1992) of the Ardmore population in South Dakota. Merriam described the South Dakota swift fox as the Northern race, so it is hoped that DNA analysis on the blood of these foxes, carried out by Dr. Robert Wayne (London Institute of Zoology/UCLA), will shed light on the taxonomic uncertainties.

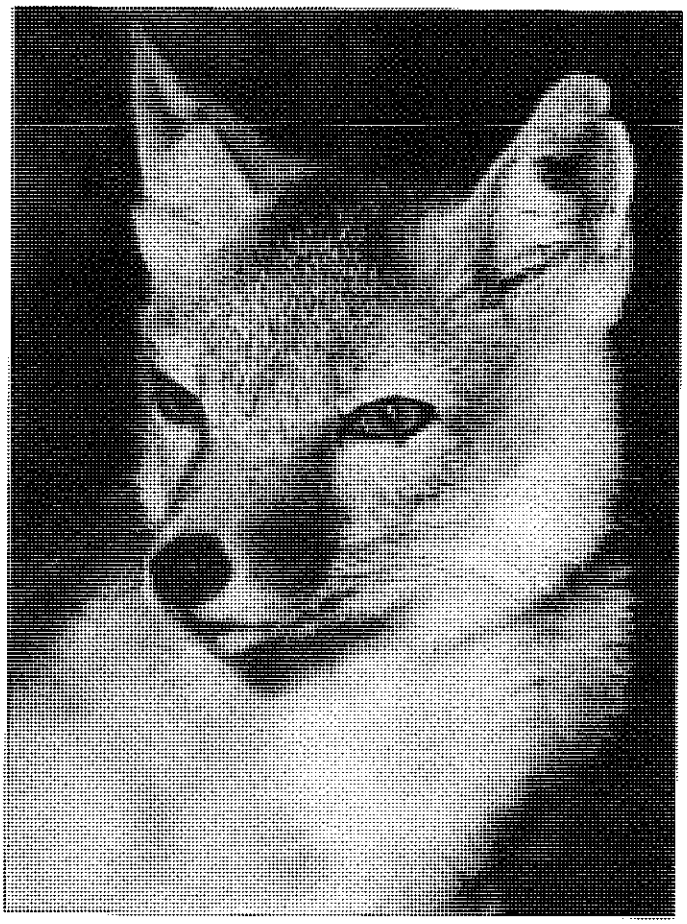
If this subspecies designation proves valid, the South Dakota swift foxes belong to the same race as the now extinct Canadian population. It was thought that it would be beneficial to apply as far as possible the den site criteria of the wild, established South Dakota swift fox population to the proposed reintroduction sites in Saskatchewan's GNP. Therefore the research incorporated the gathering of information concerning the typical characteristics and den site requirements chosen by wild swift foxes in this area.

1993 Releases

In 1993, prior to the releases (16th August-7th September) a team of four from the CWR surveyed the Western Block of GNP for signs of predator and swift fox activity and to research suitable release sites. All observations, combined with the South Dakota research were used to establish the selection criteria for the 1993 reintroduction sites.

"the 1993 releases consisted of 54 cubs of the year"

In an attempt to enhance survival, a new method of release was introduced. Each released fox was provided with a portable protective shelter (PPS), closely resembling the fox housing used at the CWR. It was believed that the released foxes would recognize the PPS as one familiar thing



in an alien world. The shelters were designed to provide immediate protection from predators for the foxes at the release site, giving them a safe bolthole while they established the bounds of their new ranges.

Each PPS comprises a central foxbox and a folding A-frame cover. The foxbox, 45 cm long, 23 cm high and 23 cm wide, is divided into two chambers with entrance holes 15 cm in diameter at opposite ends of each long side. Foxboxes for breeding pairs in the CWR have the same construction, but are 60 cm long with an additional chamber.

The A-frame cover is made from 12 mm plywood, 60 cm long, 90 cm high and 45 cm wide at the base. Hinges along the top allow the sides to fold flat against each other, and hinges along the upright side of each end allow the triangular end pieces to be folded flat against the sides. The whole A-frame can thus be lashed to a backpack frame. Entrance and exit holes on either side of the frame are placed at opposite ends from each other so that the wind does not whistle through the frame. A-frame covers used for breeding pairs in the CWR are built in the same way, but are bigger and do not fold up, and the empty space above the foxbox is filled with insulation in order to regulate the temperature inside the foxbox.

The 1993 releases consisted of 54 cubs of the year released without radio-collars. CWR released 16 foxes

(5 litters) in 5 sites within GNP. All foxes were released using PPS (one per litter), and post-release monitoring was carried out at all 5 sites. Saskatchewan Environment and Renewable Resources staff undertook 2 releases, 15 animals to Wood Mountain, where foxes have been released yearly since 1989, and 8 animals released on the periphery of GNP. PPS were not used, and no monitoring was done for either release. Canadian Wildlife Service personnel undertook the release of 15 animals into the Southern Alberta Release sites, the core release area for the swift fox re-introduction programme since 1983. Foxes were released at the side of the road, without PPS, and no monitoring was done.

"of the 5 litters released using PPS, 3 were still using the shelters the following day, and for the next 48 hours"

Monitoring of PPS-based Releases.

After release, the 5 sites where PPS were used were monitored constantly by CWR staff for 24-48 hrs (using nightlighting techniques and binoculars). Once the foxes had established themselves in their own dens (12-24 hrs after release), the observers patrolled each site frequently, both by day and night, over a 10 day period. Information was gathered on behaviour and spoor, and scat samples collected. This patrolling was repeated for a further 10 days, 34 days after the initial monitoring.

Of the 5 litters released using PPS, 3 were still using the shelters the following day, and for the next 48 hours, even though natural dens had also been excavated and were in use. The remaining two litters established dens very close to the PPS, and continued to use the PPS as a focal point. Only one litter ceased to use the PPS during the first 12 hours after release. The PPS for this litter of two was placed in a lower, more brushy, less exposed area, and the foxes disappeared into the bush on release. However, they subsequently returned to the release site and were observed there 48 hours later. With the exception of this litter, all the cubs released spent their first 12 hours of freedom within 200 m of the PPS. During the next 24 hours they moved a little further away and established dens. After this, the focal point of their territories became the new dens, with the PPS of more peripheral importance to home range establishment. Hunting during daylight hours occurred in close proximity to PPS and natural den site, although nocturnal activity was more widespread.

The home ranges used by the swift fox using PPS made it possible for the CWR and GNP staff to follow up on the released animals four and a half weeks later. The follow up on the reintroduced animals in Grassland's (20-28th October) confirmed sightings of 6 of the 16 animals released, fresh spoor, scat and in-use den sites.

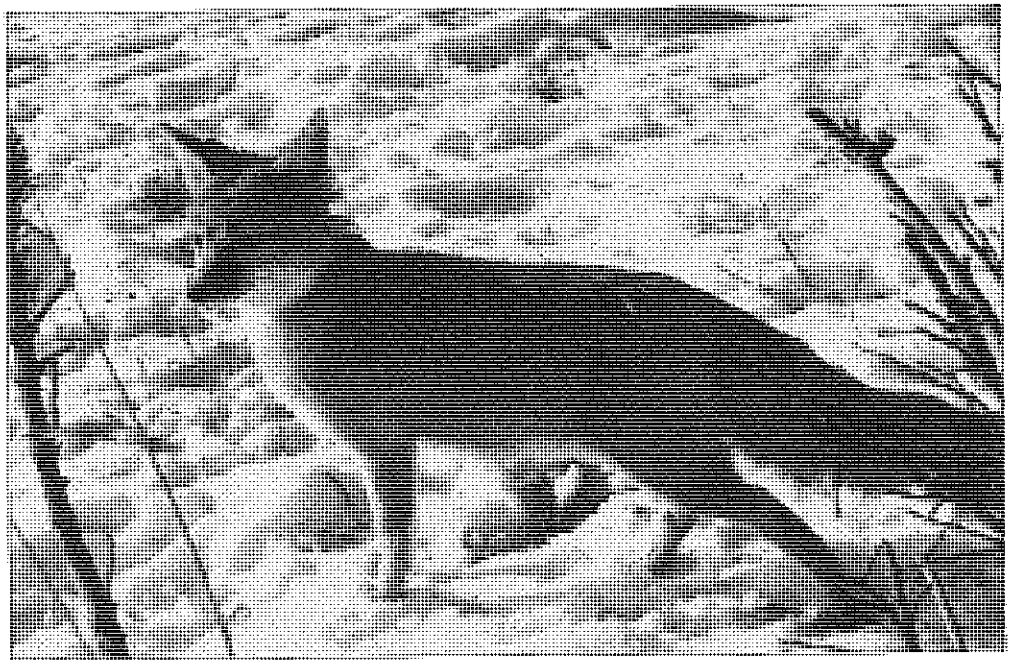
CWR staff researched the 1993 southern Alberta release sites 4 weeks after release but had no confirmed sightings of swift fox. No spoor, scat or in-use den sites were found. A hunting party visiting the area gave a good description of seeing what they believed to be a single swift fox.

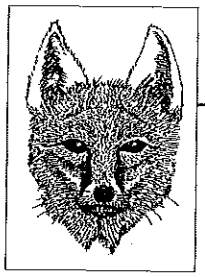
Research Plans

At present, the data available are too few to establish whether the use of PPS has an appreciable effect on the survival of reintroduced swift foxes. Field observations seem to indicate that the use of PPS and the application of release site criteria to the reintroduction sites reduces the rapid dispersal of released animals and encourages the establishment of home ranges in the areas where the animals are set free. Research is needed on the post-release behaviour and the further refinement of the release methodologies.

1992 and 1993 have seen a bloom in the coyote population. The wet spring and summer of 1993 have also adversely affected the populations of the normally abundant Richardson's ground squirrel (*Spermophilius richardsonii*). Coyote are a significant predator of Richardson's ground squirrel and of swift fox. The relationship between the swift fox predators and prey needs to be researched so that target sustainable population levels can be estimated.

The present methods of monitoring the released foxes





for mortality estimates do not adequately estimate survival rates. Future programmes will have to incorporate cost-effective monitoring, so that range size, dispersion, movement patterns, and mortality can be better determined.

The CWR has developed a research programme that will address: (1) Habitat utilization, (2) Population and behavioural dynamics, (3) Food habits, (4) Sub-species definition, and (5) Contaminant impacts. This research programme is presently under way. It will be supported by post-graduate research, charitable foundations and corporate sponsorship and private donations. Government support has also been requested.

Recent Developments

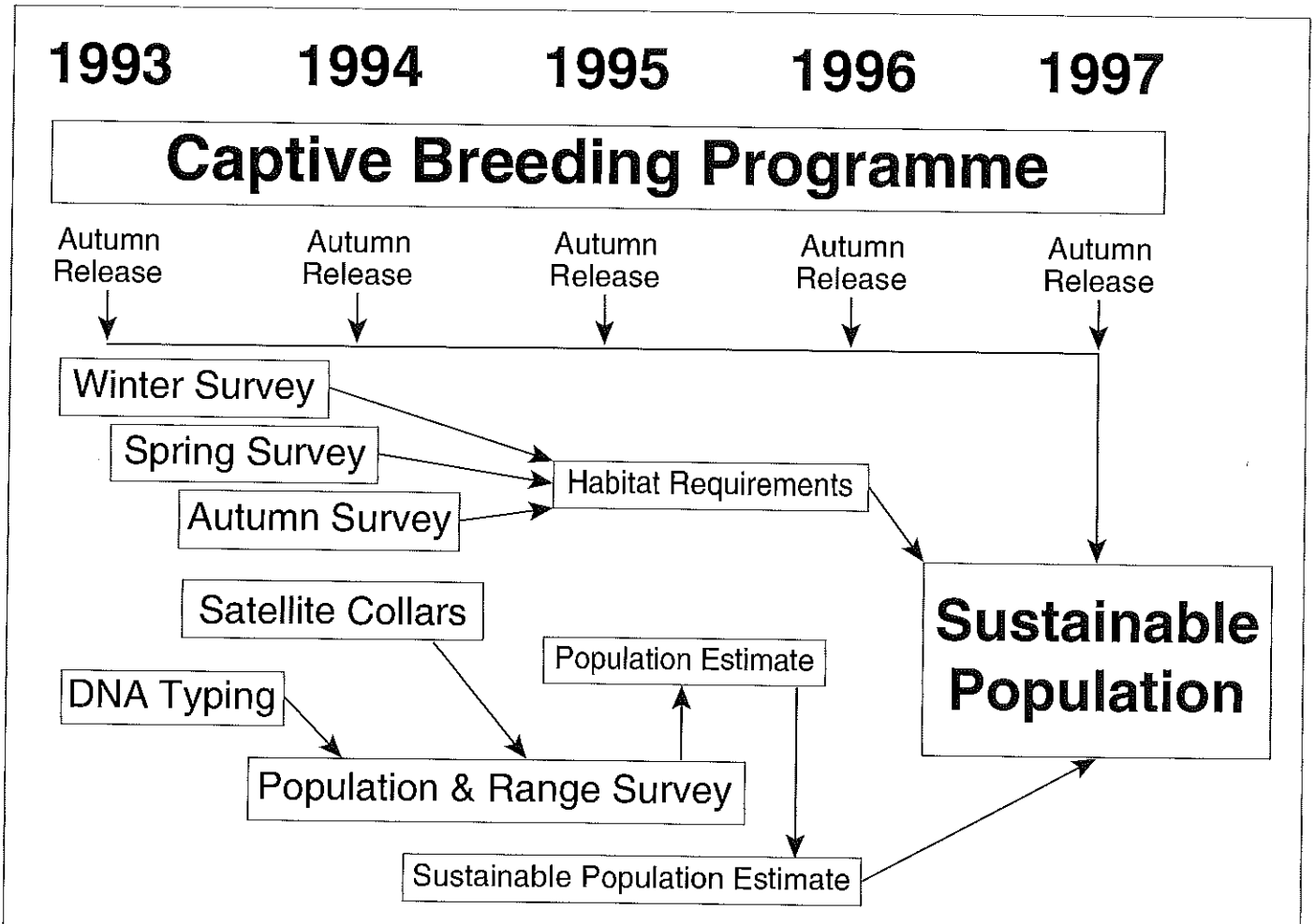
Six yearling swift foxes (3 litters: 3 males, 3 females) were recently released into an 8.3 ha enclosure containing artificial dens. These widely separated dens consisted of foxboxes covered by A-frame shells, and one artificial mound (foxbox covered by chickenwire and polystyrene insulation).

When the cubs were released in the area, their behaviour was monitored in the same way as for the litters released into GNP. Although the area was smaller, and the release not preceded by 48 hrs of travel, the behaviour of the six cubs was very similar to that of the litters in GNP. They too used the artificial dens, and are in fact still using them. This is probably due to the fact that the weather is extremely cold, making the ground too hard to dig, and there are no naturally occurring holes for them to use.

Swift foxes have not been kept in this way before, and it is hoped that observations of their behaviour, particularly during the breeding season, can provide much needed information on how swift foxes behave in groups.

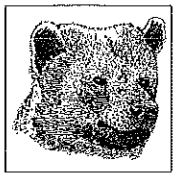
News Flash

Staff from CWR, just returned from GNP, reported that by 13th January swift foxes released using PPS had established dens and were still resident in the areas where they were freed.
(Photos by Bill Rackstraw)



Schematic of study design and implementation, 1993-1997.

Bush Dogs in Paraguay



A new population of bush dogs, *Speothos venaticus*, has been located in the Mbaracayú Reserve of eastern Paraguay. The Mbaracayú Reserve's 62,500 ha comprise the last single tract of undisturbed, subtropical moist forest remaining in that region in Paraguay. Located between 24°00' south and 55° west, the Reserve protects the most significant remaining example of Alto Paraná forest type and includes several species found in the largely destroyed Atlantic Forest of Brazil. The Nature Conservancy (in cooperation with the Fundación Moisés Bertoni) is managing the area, which also protects species such as jaguar (*Panthera onca*), giant otter (*Pteronura brasiliensis*), probably maned wolf (*Chrysocyon brachyurus*) and giaut armadillo (*Priodontes maximus*), according to the Aché Indians of the area.

The Aché discovered the bush dogs in September 1992 (two females and probably one male) and in February 1993 (three males). Coming from a tradition of hunting and gathering, these Indians now subsist on crops of manioc, corn and beans, occasionally supplementing their diet with fruits and animals of the forest.

I met with the Aché in April 1993 to document their acconnt. They showed me the locations where the bush dogs had been found and gave me information about their experience with the species. I found remains of bush dogs and pacas (*Agouti paca*), as well as fresh dog tracks. The two areas ranged from high and medium forest to flooded low forest and marshes at an average of 170 m above sea level. The areas were close to streams or waterbeds with sandy bottoms and sloped embankments.

The Aché provided me with information on the bush dog which indicates that:

a) Bush dogs range widely across a variety of ecosystems, in relation to available prey.

b) Their main sources of food are paca and nine-banded armadillo (*Dasypus novemcinctus*), although they may also prey on agouti (*Dasyprocta azarae*). In autumn their diet is based almost exclusively on armadillos, which are well-fed after the summer. When the dogs eat an armadillo they leave the shell intact (as distinct from jaguars and other felids which damage the shell). When the bush dogs eat paca, they consume the flesh without crushing the bones.

c) Packs are formed by up to ten dogs in some periods of the year. They hunt in groups, but old individuals do not seem to participate actively. They encircle their prey and if it reaches its underground den, the bush dogs take turns digging it out.

d) At night they give a call, resembling the sound of the Muscovy duck (*Cairina moschata*), lasting only a few minutes.

e) They tend to inhabit the dens of their prey, but whether they have permanent or temporary dens, or only occasionally occupy a den is still not clear.

f) The Aché made some attempts to domesticate the bush dogs. They captured one young dog which they trained to retrieve agouti for them, but in most cases the adults died from what appears to have been stress, as described by the Indians. They typically capture the dogs by reaching into their dens, burrowed beneath trees.

The bush dog is the most endangered mammal in Paraguay and this is the first time the canid has been found in a protected area of the country. The size of the population in the Mbaracayú Reserve is unknown and represents one of the bush dog's southernmost distribution points in South America. The most recent information on Paraguay's bush dogs in the wild dates from 1988, when biologists of the Itaipú hydroelectric dam captured a pair with three pups in January and a female with two pups in February of that year (Itaipú Binacional, 1988). A breeding centre of native species is maintained by the Itaipú company and more than 40 bush dogs have been bred successfully at the centre.

It is still not known whether Mbaracayú Reserve is large enough to sustain a viable population of bush dogs. This species of canid should be considered a "flagship species". Conserving the bush dog would promote conservation of the habitat, resulting in the preservation of a significant number of other species in the Reserve.

Acknowledgments: Special thanks to the Aché Indians, Tito Tycuarangi, Lucio Cheugui, Julio Mbeyagongi, Catalina Tycuarangi y José Tapinongi, and to Miguel Morales and Ramón Villalba of the Fundación Moisés Bertoni. Appreciation to Bonnie J. Hayskar for her assistance while drafting this article.

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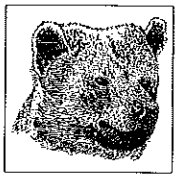
Marcelo D. Beccaceci

South American Bush Dog Workshop



The Second Workshop on Breeding and Management of Bush Dogs in South America took place at Itaipú Binacional (Paraguayan side) from 8-11th October 1992. The Workshop was coordinated by Dr. Maria Cecília Penteado Buschinelli, coordinator of the Bush Dog Management Plan for the Brazilian Zoo Society (SZB), and Dr. Eduardo Huerta, Head of the Department of Ecosystems of the Itaipú Binacional (Paraguayan side).

On the first day of the workshop Dr. Buschinelli presented a summary of the First Workshop as a background for later discussions. Juliana Brandão, on behalf of the Canid Specialist Group, then presented a summary of the Canid Global Conservation Assessment and Management Plan, held in Fossil Rim, Texas in July 1992. Dr. Buschinelli reviewed the captive breeding situation of bush dogs across the world, based on information sent by Dr. Dmoch, the Bush Dog Studbook keeper. In particular, she warned the participants of problems encountered with inbreeding in the captive population.

The next presentation, by Mr. Jorge van Humbeck, Head of the Fauna Division of Itaipú Binacional Zoo (Paraguayan side) discussed the success of this zoo's captive breeding efforts concerning the bush dog, and the methods used to diminish inbreeding, such as introducing new wild animals to the captive population. Two surveys had been made in the area around the Itaipú Hydroelectric Company, and with the help of indigenous people they captured, in 1988, one female and three cubs. In the following year one female and two cubs were caught 1 km from the previous capture site. Capture involved blocking the burrows at the base of trees and cutting them down. The animals were not aggressive, but in captivity suffered persistent diarrhoea.

Following these presentations, Dr. Huerta invited the participants to discuss genetic variability studies, suggestions for breeding pairs for the next breeding season, and field studies on bush dogs. The conclusions of these discussions are given below.

Genetic Variability Studies

Two assumptions are generally made with respect to *Speothos venaticus*:

1) That there are at least two subspecies, one occurring in the north and the other in the centre of Latin America.
2) That the captive founder population represented poor genetic variation. This may be particularly applicable to individuals taken from Paraguay, where most were captured in very close proximity.

In order to plan both the management of the captive bush dog population and an effective reintroduction programme, it is important to test these assumptions using genetic studies. The group therefore discussed ways of determining levels of genetic variation within populations and among individuals of the captive population. Three methods were proposed: a) skin transplant, b) electrophoresis, and c) DNA fingerprinting.

The first method, testing the Histocompatability Complex using skin transplants, was considered to be inadvisable for bush dogs, due to difficulties of interpretation, and likely stressful effects. Electrophoresis was considered to be a more promising method of assessing variation in the bush dog. The group decided that a literature survey would be made. Also, a survey on biochemical and haematological parameters for the species is to be carried out at Itaipú Labs, utilizing samples of animals held in Brazilian and Paraguayan Zoos. This work could be undertaken by Brazilian and Paraguayan researchers, and the electrophoresis study should involve as many samples as possible. Both the Universidad Nacional de Assunción, Paraguay and a Brazilian University will be contacted to assess their interest. The results will be coordinated by Dr. Buschinelli.

The third method proposed, DNA fingerprinting, was considered to be the most accurate method of assessing genetic variability, and it was also noted that Dr. Schreiber from Heidelberg University was beginning some molecular research on *Speothos venaticus*.

It was concluded that initial efforts should focus on electrophoresis, and that the DNA fingerprinting analysis should be carried out at a foreign institute, in a country that signed the Biodiversity Convention during the Earth Summit, and that both a Brazilian and a Paraguayan researcher should be involved.

Mating Priorities

To combat the inbreeding problem in the captive South American population and maximize its genetic variation the best mating

combinations for the next breeding season were discussed. Using the SPARKS Computer Program, a list of the optimal zoo matings was produced. As a result discussions will be initiated concerning interchange of animals, coordinated by Dr. Buschinelli.

Field Studies

Knowledge of the bush dog in its natural environment is poor. Since one of the main justifications of maintaining a captive population of a rare species is to facilitate reintroductions, it is important to ascertain the requirements of wild bush dogs. Top priority was assigned to determining the species' distribution, surveying levels of deforestation and degradation in the bush dog's geographical range and cencussing the populations. A second tier of priority will focus on studies of home range, habitat use, activity patterns and diet.

It was proposed that a suitable study site should be chosen based on the results of the distribution survey. Bush dogs would be captured, anaesthetized, and samples and measurements taken from all individuals caught. Three or four individuals from different packs will be radio-collared in order to determine home range and habitat use, and to assess seasonal differences in these parameters. It is hoped that such a study will be made possible by cooperation between Itaipú Binacional, Dirección de Parques Nacionales (M.A.G.), Instituto de Bienestar Rural, Universiad Nacional Assunción, O.N.G etc. Interchange of information between researchers in all fields relating to the bush dog will greatly enhance the effectiveness of the conservation and management of this species.

Juli-ana Brandão

Workshop Participants: Adauto Luís Veleso Nunes: SZB; Ana Maria Beresca: São Paulo Zoo; Emerson: Itaipu BR; Evelio Vidal Narvàes: Reserva de Fauna Entidad Binacional; Flavio Colman: Museo Nacional de Historia Natural; Hélio Martins Fontes Jr.: Itaipú BR; Jorge van Humbeck: Itaipú PA; José Bezerra Leite Filho: CESP; Julian Ortiz Leria: Itaipú PA; Juli-ana Brandão: CSG; Karina Schiaffeno: Parque Nacional Yguazú; Dr. Ladislau Nagy: Univ. Nacional Assunción; Leonilda: Itaipú BR; Dr. Manuel M. Ventre: Univ. Nacional Assunción; Maria Aparecida Pereira Pinto: CESP; Martha Motte P.: Museo Nacional de Historia Natural; Nelson Aquiles Péres: Itaipú Binacional BR; Nora Neris de Colman: Museo Nacional de Historia Natural; Paulo Sirks: CESP; Dr. Ramon Pistilli; Ronaldo Gonçalves Morato: CESP; Wanderlei de Moraes: Itaipu BR; Wilfrido Sosa Y.: Centro Datos para la Conservación.

Impact of Hunting on Argentinean Foxes

In January 1993 we began a study of the impact of hunting on the culpeo fox in Patagonia, and the potential role of sink-source dynamics in the species' response to hunting. The study is being conducted under an agreement between the wildlife agency of Neuquén province and the University of Florida. It is funded by the Wildlife Conservation Society (NYZS), the Lincoln Park Zoo Scott Neotropic Fund, the American Society of Mammalogists, and the Camara Industrial de Peleteria (Fur Traders Association of Argentina). The support from fur traders (obtained via the Argentinian National Wildlife Agency) is an indication of the potential for future collaboration to achieve sustainable alternatives for furbearing species in the region.

The study involves the trapping and radio-tracking of culpeos in both a hunted and an unhunted area. To date we have radio-collared 24 animals. We are also collecting carcasses from hunters (the hunting season has just begun) evaluatiug prey availability, and running scent stations to evaluate population trends.

In addition we are coordinating a regional survey of furbearers throughout Patagonia which began in 1992. Twelve institutions (including provincial wildlife agencies, the National Institute of Agrarian Technology, and the National Parks Service) and 23 people are participating in this survey. During the winter of 1992 we ran 890 scent stations in 20 areas of six Patagonian provinces, and we intend to continue to do this in future years to obtain information on our hunted furbearer species throughout the region. We are obtaining information on relative densities of three *Dusicyon* fox species (*D. culpaeus*, *D. griseus*, and *D. gymnocercus*) and two skunks (*Conepatus chinga* and *C. humboldtii*).

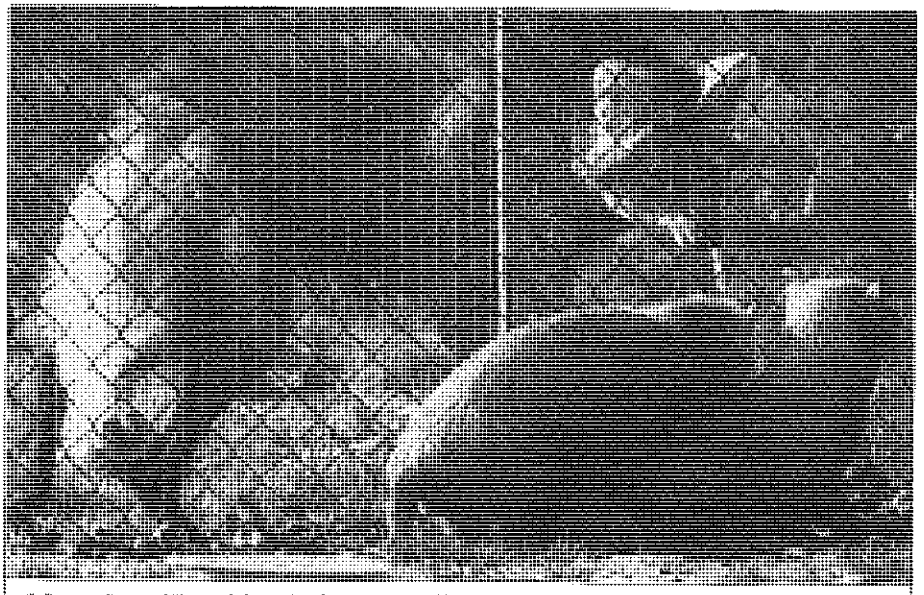
Exports of *Dusicyon* have declined markedly from the levels of the early and mid 1980's, although they are still heavily hunted in some areas of Patagonia. We believe that the main reason for this trend has been a decline in the demand. The price offered to hunters for *Dusicyon* furs in Patagonia has decreased

steadily since we began to work here in 1987. The reason for this may be the distorted exchange rate between domestic and foreign currency which makes exporting goods a less profitable option. Changes in consumer interests in Europe may also have been influential.

Whatever the driving force is, we have seen hunters become progressively less interested in trapping foxes here for their fur during the last few years (they are still trapped in some areas to control predation on sheep). Our limited data on population trends and our experiences whilst visiting areas all around Patagonia coordinating the regional monitoring programme seem to indicate that densities of the different *Dusicyon* species are not declining, or at least they are not doing so at a rate comparable to the decline in exports.

Fortunately, due to changes introduced in 1992, all four species of foxes exported from Argentina are now in the same Appendix of CITES. In the past, furs of *D. gymnocercus* and *Cerdocyon thous* have been exported as *D. griseus*, so we still need to clarify the extent of the trade in those species. It is now clear that *D. griseus* was not harvested as heavily as previously thought, due to this obfuscation of trade figures. Evaluations of population trends are currently underway, as a result of which it may be necessary to consider removing the species from the Significant Trade species list.

Andrés J. Novaro &
Martín C. Funes



Maned wolf and bush dogs at Kilverstone Wildlife Park. Photo by Clare Hawkins.

Maned Wolf Captive Breeding Report

Although exact data on the status of the maned wolf (*Chrysocyon brachyurus*) in the wild are lacking, the species is plainly endangered, and has therefore been included in WA List II (Washington Agreement on Trade in Endangered Species). In order to obtain an overview of the status of the maned wolf in zoological gardens an international studbook was established. When I took over the management of the studbook in 1980, only 60.59 individuals (60 males, 59 females) were kept in just over 30 institutions. Since then, however, the number of animals and the number of institutions keeping them has been increasing. At the end of 1992 206.191 animals were kept in 125 institutions.

Although this is a positive development, one cannot be happy with the status which has been achieved. Many problems of maintenance and husbandry impede a greater rearing success. In 1992, for example, a total of 38.33.25 births (38 males, 33 females, 25 sex unknown) was registered, of which 23.18.25 died. Thus 79% of all animals born died immediately or shortly after birth. Taking into account that some of the surviving animals had to be hand-reared, these breeding results cannot be regarded as successful. Poor breeding results had also been recorded for several previous years, so world wide efforts were taken to improve the situation.

In 1986 the maned wolf was included in the SSP (Species Survival Plan) of America. Melissa Rodden in Washington D.C. began to collect and assimilate information on the biology and maintenance of this South American canid, resulting in 1987 in the publication of a Handbook for Husbandry and Management of Maned Wolves (by Melissa Rodden [Front Royal] and Mike Blakely [Kansas City]).

One year later a masterplan was published which was especially written for the Americas. Many studies on the biology, maintenance and veterinary problems of this species were discussed at various meetings. In 1992 the SSP included 21 American institutions where 40.30 animals were kept. Despite these advances, of the 7.7.3. animals born in these zoos only 4.3. survived.

In 1990 the Maned Wolf EEP (Europäisches Erhaltungszuchtprogramm; a cooperation of various institutions for better management of endangered species) was established in Europe, and I was elected as co-ordinator. In 1990 more than 30 European zoos became members of the EEP, and this number grew to 50

in 1992. By the 31st December 1992 77.82 animals were kept in these 50 institutions, and during 1992 10.18.13 pups were born, of which just 8.9. survived. The mortality rate of young animals is still too high.

Besides the EEP and the SSP other regions have also been trying to improve the conditions of captivity (and thereby the breeding success) of their maned wolves. Steve Young from Melbourne Zoo was elected as Species Co-ordinator for the Australasian region and in 1989 he published a Handbook for Husbandry and Management of the Maned Wolf.

In 1990, as the studbook keeper and EEP co-ordinator I published the analysis of a questionnaire on "Keeping and breeding the Maned Wolf". Fifty four zoological gardens experienced in the maintenance and husbandry of maned wolves took part in this questionnaire. This was followed in 1993 by the publication of recommendations for the keeping and breeding of maned wolves in the European region.

Bernd Matern

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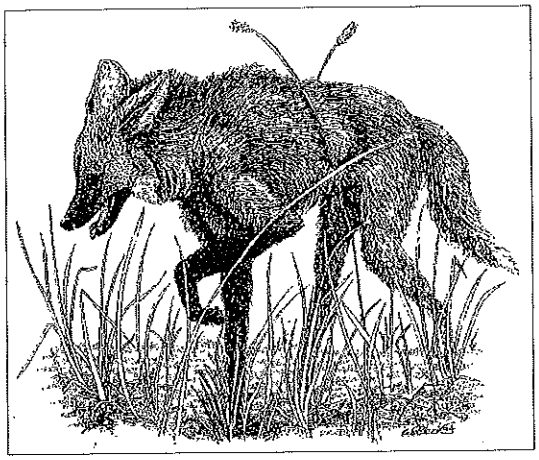
Spontaneous Neoplasm in a Maned Wolf

This report describes a case of spontaneous neoplasm in a maned wolf (*Chrysocyon brachyurus*) belonging to the Buenos Aires City Zoo.

Case report: A soft tumour was detected in the croup of a 13 year old female maned wolf in the course of a routine examination. The subject did not present any clinical alterations, and was active and healthy. During surgery, a pink and yellow poorly delimited mass was found. This showed symptoms of extensive areas with haemorrhage, central necrosis, and had a firm consistency. The mass was composed of interlacing bundles of straplike fibres which tended to



intersect at right angles rather than blend in curving bundles. The basic cell was fusiform with centrally placed cigar-shaped nuclei and several mitotic figures. Special techniques revealed no cross striated filaments.

In view of these morphological characteristics and local invasivity, the tumour was classified as a Leiomyosarcoma. Two years after the discovery of the tumour, the subject does not present local regrowth of the lesion, or evidence of metastasis. In a future work the complete case will be developed, and the possible differential diagnosis will be presented together with the presence of tumoural smooth muscle in skeletal muscle.

Dr. A. Margarita Mas

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New Protection for the Maned Wolf in Argentina

On 10th December 1992 the Province of Corrientes, Argentina issued Decree No. 1555, declaring the maned wolf, South American swamp deer, pampas deer and river otter as living Natural Monuments (as defined in the Panamerican Convention of Washington, 1943) within its territory (Argentina has a Federal system of government). The species involved are listed in the IUCN Red Data Book and are on Appendix 1 of CITES. Despite existing protection populations were still declining in the Province, justifying the introduction of stronger legal protection measures.

The Decree proposes a complete and permanent ban on hunting of these species within the Province, and prohibits the capture and trade of dead or living specimens (except in the case of scientific research projects designed to facilitate recovery of the species involved). Activities which may result in the alteration of a species' habitat must be authorized by the Fauna and Flora Directorate, and the Decree will be supported by the Head of the Ministry of Agriculture, Industry and Commerce. Violation of the Decree will be penalized, the size of the penalty being established by the Fauna and Flora Directorate.

The IUCN has expressed congratulations to the authorities responsible for this recent attempt to improve the conservation of these endangered species and their habitats.

Laura Handoca

Research Priorities for Disease Monitoring in Canids

Disease monitoring and medical management are integral components of a Canid Global Action Plan. For *in situ* conservation, early recognition of catastrophic disease events is essential to determine when intervention is necessary to avert population declines and extinction. Currently, the impact of disease on wild populations cannot be assessed because no central reporting system for canids exists. Unfortunately, the very species that require the most intensive management are those we know least about.

As habitat constraints isolate and concentrate populations, the risk of a catastrophic infectious disease outbreak within a population multiplies. The impact of disease on *in situ* conservation efforts may also increase with canid reintroductions or translocations. The reintroduced or translocated canids can expose the indigenous wildlife to new variants of pathogens or parasites, and the captive-reared canid may be immunologically naive to most organisms in the new environment. Strict quarantine, good preventative medical programmes and constant disease monitoring will be required to avert post-reintroduction epidemics.

Captive propagation programmes too will have limited success if the general and reproductive health of the canids cannot be assured and longevity extended through preventative medical programmes. For most canids, knowledge of diseases has been confined to those causing death. However, subclinical diseases can have a major impact on reproductive function or general well-being. Development of effective preventative medical programmes requires knowledge of what diseases affect each species. Lack of information on species susceptibility to infectious diseases and on species-specific diseases is the single greatest limitation to developing effective preventative medical programmes for canids. Lack of knowledge of genetic diseases restricts the possibility of eliminating these diseases from populations through selective breeding.

Formation of a centralized disease reporting system for canids should be top priority for the Canid TAG. The foundation of an effective disease reporting system should include data from complete necropsy examinations and medical records, and not just "causes of death". For an individual animal, the reported "cause of death" is only the MOST significant disease in the animal that leads to its demise and usually does not reflect the spectrum of other diseases in the individual. Information on all diseases will be necessary to calculate disease prevalences in the canid population. Disease prevalences in captive canids then can serve as the basis for developing the best medical strategies for conserving canids.

Species in critical status also may require in situ medical management (such as rabies vaccination) periodically to ensure population survival. If these animals carry vital genes for disease resistance, temporary medical intervention to avert extinction should not interfere with long-term evolutionary trends in disease resistance. In very small populations, we cannot afford the luxury of sacrificing the individual just to ensure that the continued evolution of disease resistance is not temporarily interrupted.

Because infectious diseases pose one of the greatest threats to existing populations of canids, the short-term goal of the veterinary advisors to the Canid Action Plan should be to determine the geographic and species ranges of the common infectious diseases. Species-specific diseases, which usually signify a genetic predisposition, also should be determined, because the prevalence of these diseases will increase in populations with few founders and will pose a significant threat to the survival of these populations. In order to determine the optimal systems for disease mauagement in canids in the future, the present emphasis should be on definition of the disease problems in canid populations.

Research Priorities

1) Develop a disease-monitoring network for canids that includes field biologists, veterinary pathologists, zoo and field veterinarians, microbiologists and epidemiologists.
2) Acquire infectious disease serology and haematoparasite data on wild canids whenever handling free ranging animals. Serology should be performed in a centralized laboratory for consistency of results, and the results should be reported to a centralized disease database.
3) Provide both retrospective and prospective disease information to a centralized database. Initiate systematic collection of tissues from canids that die (both captive and free-ranging when possible) for histopathology. The MEDARKS medical records and (soon-to-be-developed) pathology programmes will provide a standardized means to input data into this database.
4) Assign veterinary and veterinary pathology advisors to all SSPs or SSCs for canids.

Recommendations for disease monitoring of free-ranging canids

Serological Screening

Continuous serological screening for infectious disease in free-ranging populations provides invaluable baseline data for predicting changing disease patterns and for averting devastating enzootics. Serum should be obtained during any immobilization procedure for radio-collaring, translocations, or other research studies. If possible, all sera should be evaluated in the laboratories recommended by the Canid TAG and reported to a central databank for consistency and effectiveness of this disease screening.

Dr. Linda Munson, the Canid TAG pathologist, will maintain the central Canid Infectious Disease Serology Databank. Data submitted to this Databank will be used to alert conservationists of disease trends and epizootics in wild canid populations and will not be used for publication without

authorization from the submitting scientist. To assist the field biologists in submitting serum for screeniug, Dr. Munson is acquiring permits for importation of canid serum, can forward samples to the appropriate laboratories, and report results back to the field biologists. To submit serum samples or serological data to the canid infectious disease serology databank, contact:

Dr. Linda Munson
Department of Pathobiology
PO Box 1071
University of Tennessee
College of Veterinary Medicine
Knoxville TN 37901-1071
USA
Tel. 1 615 5469230
Fax. 1 615 5460310

Linda Munson

Red Fox Rabies in France

In 1989 rabies prevalence in France reached a new height. In 1990 oral vaccination of foxes was carried out over mnch of the contaminated part of the country, and there has since been a continued decline in the numbers of rabies cases (Figure 1).

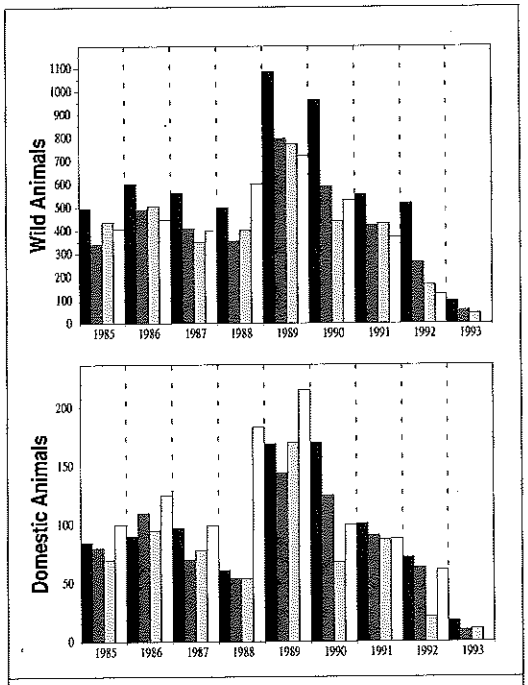


Figure 1. Seasonal rabies prevalence in France from 1985-1993.

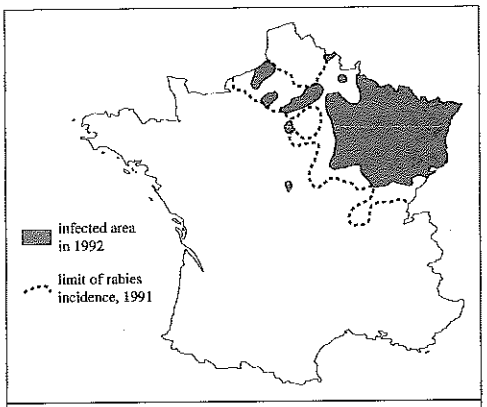


Figure 2. Changes in rabies distribution in France

The oral vaccination campaign of autnmn 1992 was extended to cover the total area contaminated by the disease in France: 111,558 km² (compared to 80,860 km² in spring 1992). Baits were dropped from a helicopter at an average density of 13 per km.

Of the foxes surveyed, 1175 out of 1990 (59%) showed at least one tetracycline coloured mark (the bait coating contains tetracycline as an uptake biomarker) in the canine tooth, and 414 out of 761 (54%) showed blood sero-neutralising antibodies.

The total number of animal rabies cases in 1992 was 1285, a reduction of 41% compared to 1991. A significant part of the country previously invaded by rabies is today considered as being rabies-free (Figure 2).

Research into the efficacy of vaccine-baits and baiting procedures was undertaken this year at the Laboratoire d'Etudes sur la Rage et la Pathologie des Animaux Sauvages (CNEVA, Malzéville). This research deals with the efficacy and safety of a new low-pathogenicity rabies virus, called SAG_2 (obtained by mutation at the CNRS, Gif sur Yvette). It also involves field trials using camera-traps to check which animal species take the baits. Surprisingly, results showed that of animals taking the baits only 3% were foxes. However, this low rate is consistent with a 70% proportion of foxes having consumed at least one bait when the bait density is 13 per km².

Marc Artois

Appeal for Information

This is an appeal from the Chairman of the IUCN/SSC Veterinary Group for information on any diseases which are perceived to be a threat to populations of canid species.

We are keen to receive details of the causes of any morbidity or mortality of canids, both in the wild and in captivity. Reference to reports, scientific papers, newspaper articles, etc. relating to disease in all its aspects as it may affect canids are also of concern to us, and we would be grateful if you would be kind enough to draw our attention to any such publications or send us photocopies for our database. Please also inform us of any specialist wildlife disease diagnostic laboratories of which you are aware.

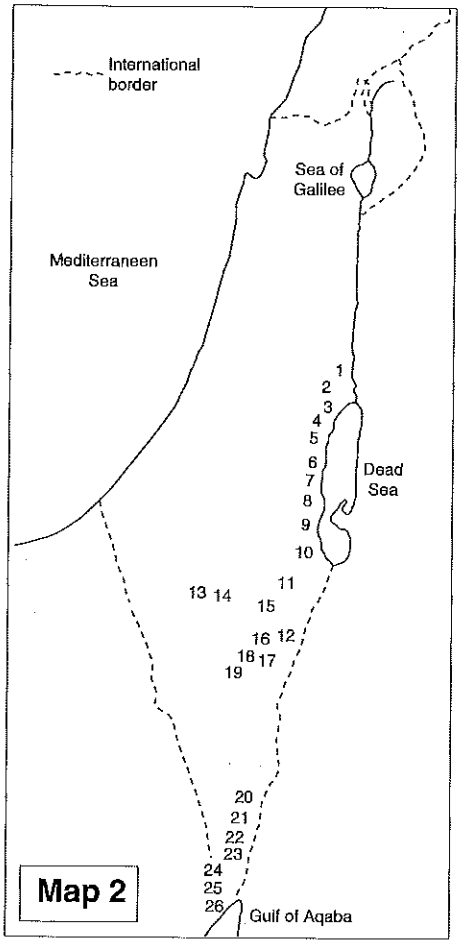
In return, we hope to be able to offer you the service for which our Group was formed. We would particularly like to draw yonr attention to the extreme importance of obtaining specialist veterinary advice whenever wild animal capture, translocation, reintroduction or restoration projects are components of your Action Plans. The risk of the transmission of important diseases of humans, domestic livestock and other wild animals when wild or captive-bred animals are translocated, even over short distances from one ecozone or biotope to another, can be considerable, and must be minimized by appropriate screening, quarantine and where necessary, vaccination.

Please send any information or enquiries for further information to:

Michael H. Woodford
Chairman, IUCN/SSC Veterinary Group
500 23rd Street, N.W.
Apt. B-709
Washington, D.C. 20037
USA
Tel./Fax. 202 331 9448.

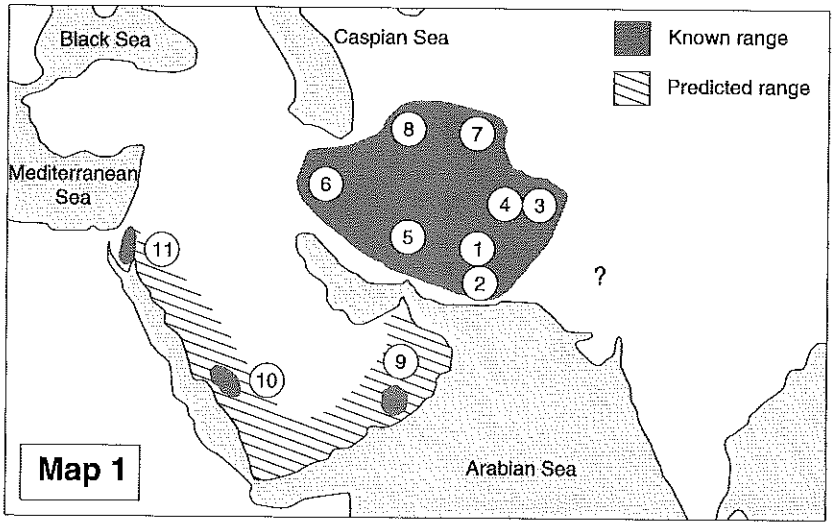
Michael Woodford

Blanford's fox (*Vulpes cana*) appeal



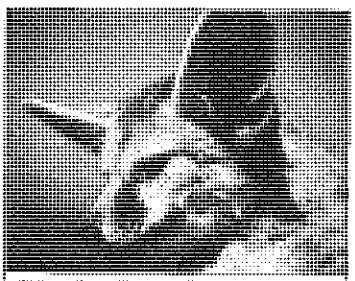
Key to Map 2.
Distribution of Blanford's fox in Israel. Each number corresponds to a site at which specimens were observed or trapped, or where identifiable remains were found.

1	Ein Duyuk	14	Nahal Darokh
2	Wadi Qelt	15	Ein Marzeva
3	Nahal Qumran	16	Ma'ale Enmar
4	Nahal Qidron	17	Nahal Holit
5	Nahal Mashash	18	Nahal Geled
6	Ein Gedi	19	Nahal Neqarot
7	Nahal Hever	20	Nahal Qetura
8	Nahal Ze'elim	21	Nahal Yotvata
9	Nahal Boqeq	22	Timna valley
10	Nahal Peres	23	Nahal Eteq
11	Nahal Hatira	24	Har Shehoret
12	Ein Yahav	25	Nahal Netafim
13	Ein Avedat	26	Nahal Gishron



Key to Map 1.
Distribution of Blanford's fox based on previous literature (dark shading) and the predicted range in the Middle East (hatched shading).

1	Baluchistan	4	Kandahar	7	Uzbekistan	10	Asir
2	Makran	5	Fars	8	Turkmeniya	11	Negev & Sinai
3	Waziristan	6	Khuzistan	9	Dohfar		

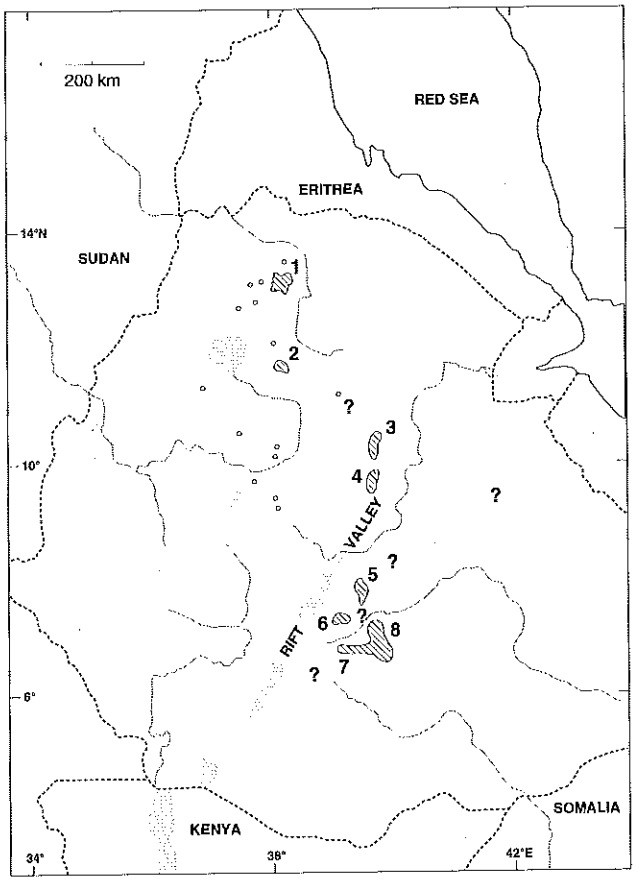


Blanford's fox. Photo © Steve Kaufman

The Blanford's fox was formerly recorded in the region of the Iranian Plateau, with a handful of museum skins collected from Baluchistan in the south to Turkmeniya in the north, and from Khuzistan in the west to Waziristan in the east. Then, in 1987 it was reported in Israel, where a detailed study of its biology has just been completed. It emerges that this tiny fox is a specialist of cliff habitats. Sponsored by the Nature Reserves Authority of Israel, the Fauna and Flora Preservation Society and the People's Trust for Endangered Species, a survey of the species distribution in Israel was undertaken, and the maps published here are taken from the report published by Geffen, E., Hefner, R., Macdonald, D.W. & Ucko, M. (1993) in Oryx (27, pp. 104-108). Additional reports of Blanford's foxes in Oman and Saudi Arabia suggest that the species may be widespread in remote mountainous areas of the Middle East. We are eager to produce a more complete distribution map. We have already received helpful data from Dr. M. Gallagher of the Omani Natural History Museum. He notes that Blanford's foxes are quite common in Jabal Samhan, Dhofar, but that in years of work in Oman he has never heard a report of it elsewhere (although the search is now on!). The map published in Oryx, and reproduced here, was a first attempt to stimulate interest in this fox. We would welcome further reports that will fill in more precise details of its range.

David Macdonald & Eli Geffen

Ethiopian wolf (*Canis simiensis*)



The map showes the geographic distribution of the Ethiopian wolf or Simien jackal, *Canis simensis*. Dotted lines represent country boundaries; discrete mapped populations are shown as hatched areas.

This rare canid is found only in a few mountain ranges of Ethiopia, where it preys upon the ubiquitous molerats and grass rats that characterize the Afro-alpine ecosystem. There are probably less than 500 Ethiopian wolves left, surviving in small isolated populations, all over 3,000 metres above sea level. To arrive at this population estimate areas of Afro-alpine habitat potentially available for the wolves were calculated from 1:50,000 topographic maps. Population estimates are informed guesses for all but the Bale Mountains. These should be taken as conservative estimates; without appropriate data on each population it is not possible to estimate their upper limit.

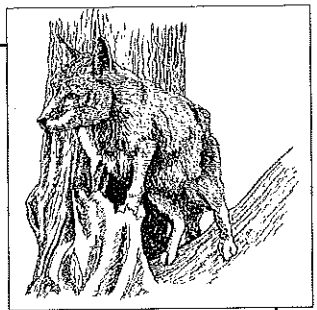
Open circles indicate records prior to 1925 (Yalden et al., 1980). Question marks indicate uncertain or unconfirmed records. Numbers refer to discrete populations as compiled by Gottelli and Sillero-Zubiri (1992), with area of habitat available and likely adult population size.

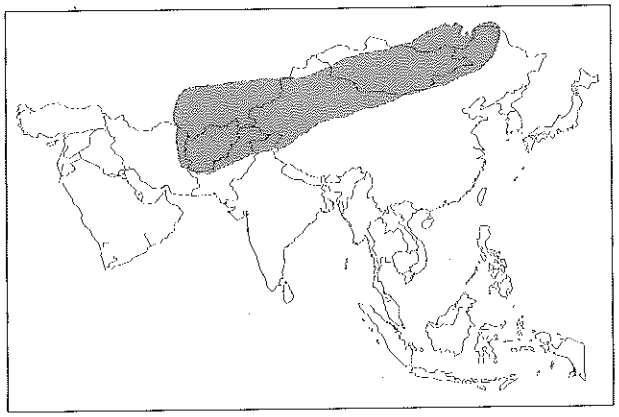
Source: Gottelli, D. & Sillero-Zubiri, C. 1992. The Ethiopian wolf – an endangered endemic canid. Oryx 26: 205–214. and Yalden, D.W., Largen, M. J. & Kock, D. 1980. Catalogue of the mammals of Ethiopia. 4. Carnivora. Monitore Zoologico Italiano NS Supplemento XIII(8):169–272.

Claudio Sillero-Zubiri

Code	Location	Area (km²)	Population estimate
1	Simien Mountains	680	35-90
2	Mount Guna	10	10-20
3	Mahal Meda/Menz	66	10-20
4	Gosh Meda/Ankober	46	10-15
5	Mount Chilalo/Ticho	318	30-50
6	Mount Kaka	10	15-20
7	Somkaro/Korduro Monntaios	155	25-35
8	Bale Mountains National Park	1209	205-270

Corsac fox (*Vulpes corsac*) appeal





Almost nothing is known about this fox in the wild, and so the CSG has nominated it for a special mapping effort. In the Canid Action Plan we classified it as *Insufficiently Known* and wrote: "nothing is known about the details of its distribution. It is said to be distributed throughout parts of Russia, Turkestan, Afghanistan, Mongolia, Transbaikalia and northern Manchuria. It has never been systematically studied in the wild, although it is rumoured to be rather sociable in that groups are reputedly seen". We appeal for any information on the distribution of this species. We would welcome correspondence from any museums, university department, government agencies etc. which have information on corsac foxes.

David Macdonald

Zambia Wild Dog Project

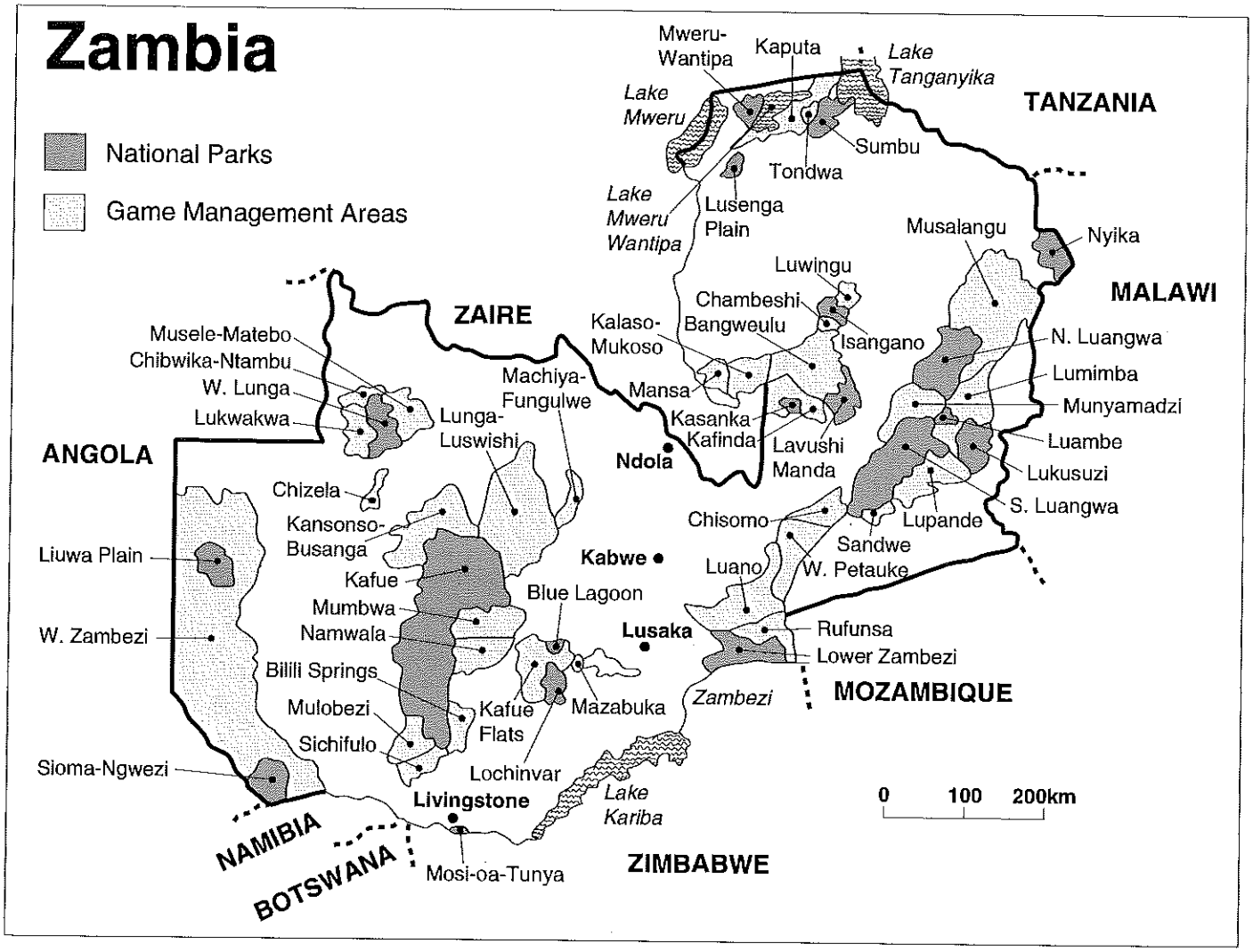
There are about 4,000 African wild dogs (*Lycaon pictus*) scattered through, perhaps, 15 countries on the continent. Studies of some of these populations have shown that the ecology of the species and the behaviour of humans are very highly responsive to differences between habitats. Thus successful conservation relies heavily on both national and local data.

In Zambia wild dogs figure prominently in folklore and public consciousness. Colonial "vermin control units" killed more than 5,000 wild dogs, while a bounty system added to the toll. Although commercial and traditional livestock owners undoubtedly still kill dogs illegally, there are also more positive attitudes. Some praise the dogs for chasing away lions, thus protecting man and livestock. The skin of a wild dog born on the back is said to protect people against lions. Others follow the dogs to snatch what they kill for their own pot. A new project has now begun which aims to promote appreciation of the animal and of its place in Zambia's fauna (see map of Zambia below).

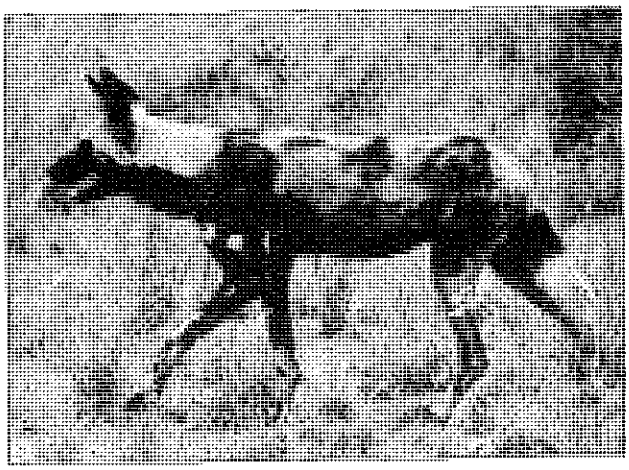
The Zambia Wild Dog Project (ZWDP) was initiated in August 1993 in response to the IUCN Action Plan for the Conservation of Canids (Ginsberg & Macdonald, 1990) and other reports of the alarming rate of population decline in the wild dog. In Zambia no wild dog research or conservation action had taken place, except for a survey carried out in connection with the 1992 Lycaon PVA in Tanzania, which gave only an indication of a potentially viable population in Zambia (Canid News No. 1, pp. 2-6). The fact that Zambian populations form a link between the Eastern and Southern subspecies of *Lycaon* enhances the interest of this project.

The objective of the ZWDP is to formulate recommendations for the conservation of wild dogs in Zambia, based on relevant data, and to stimulate the implementation of these recommendations. The project will achieve this through a nation-wide survey, an ecological and behavioural study, and conservation extension work.

The nation-wide survey is based on questionnaires and/or interviews at



all National Parks and Wildlife Service camps throughout protected and unprotected areas of Zambia, interviews with local residents and veterinary authorities and reports of sightings from tour guides, tourists, the Forest Department and others. The emphasis is on distribution, but data on trends in wild dog sighting frequency, pack sizes, sighting frequency of potential disease vectors and competing carnivores, occurrence of diseases, causes of wild dog mortality, livestock losses and public attitudes will also be collected from reliable sources.



The ecological and behavioural study will focus on the populations which the survey indicates are the most important. For these populations photos and videos taken by visitors and project staff can, because of the individually unique coat patterns in this species, yield data on population size, pack sizes, home range and migration. While observations of any pack will be made where and when conditions permit, a few packs will be radio-collared, under veterinary guidance, to allow extended periods and areas of study. Radio-collaring will provide data on mortality and fecundity, reproductive phenology, hunting success and strategies, species, age and condition of prey, interaction with potential disease vectors and competitors, plus aspects of social behaviour. In addition, immobilization will give an opportunity to collect morphological data as well as samples of parasites and blood for collaborative research on diseases and genetics.

The conservation extension work has two aims. Firstly, to encourage co-existence with wild dogs in the affected local public and advise people how best to reduce conflicts. Secondly, to implement conservation actions through the enlightenment of decision-makers and the general public on the conservation and biology of wild dogs. Use will be made of personal discussions, audio-visual presentations, pamphlets, posters and popular articles. Participation in a video co-production between wild dog researchers and a film company is under negotiation. Future continuation of wild dog monitoring by the National Parks and Wildlife Service is being mutually facilitated through participation, knowledge transfer and encouragement.

The first data from the survey suggest that wild dogs are more widely distributed in Zambia than indicated by the PVA survey, but that two of the major populations are facing an uncertain future. In the Kafue population the rate of sighting and pack size is apparently dropping, and the Luangwa population has reached a critical low after being affected by anthrax. In addition there are unconfirmed reports of rabies in the West Zambezi population.

The future of the Zambia Wild Dog Project is also uncertain. While initial funding from the FFPS and the PTES/CSG has made it possible to carry out the survey, we do not yet have adequate funding to commence the ecological and behavioural study and the conservation extension work.

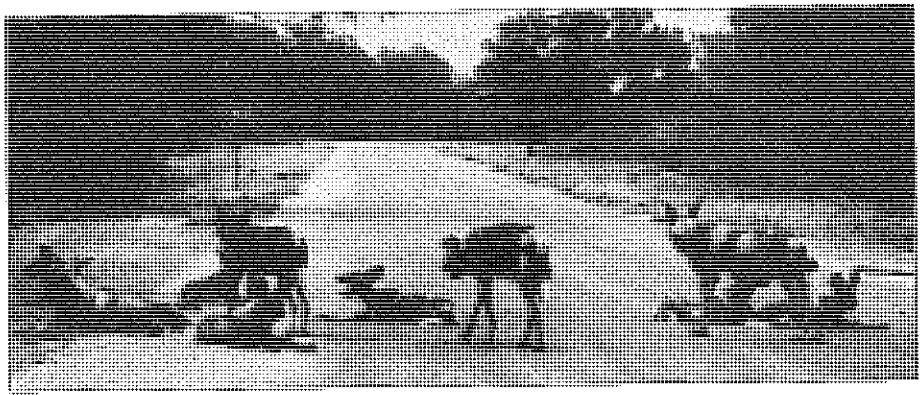
Kenneth Buk
NWPS-SC
PO Box 60086
Livingstone
Zimbabwe

Licaone Fund: New Hopes for Endangered Wild Dogs

Licaone Fund was created in 1992 by a small group of Italian biologists concerned about the rapid disappearance of the African wild dog (*Lycaon pictus*). No more than 5000 wild dogs are left in the wild, scattered in isolated populations between southern and Eastern Africa, making this species one of the most in danger of extinction in the short term.

Massive hunting in the past, partly due to ill-founded prejudices, and the recent outbreak of diseases such as rabies coupled with the continuous reduction of suitable habitats have severely hampered the chances for the species' survival.

Although scientists engaged in the study and protection of this unique species in the field have raised numerous alarms about its status, the larger conservation associations have



long overlooked the tragic situation facing wild dogs. Projects on wild dogs in Africa are also often in danger of extinction!

The founder members of Lycaone Fund felt that it was time to take prompt action in order effectively to contribute to the continuation of these projects, before the situation deteriorated still further. Lycaone Fund is a small but agile non profit-making organization, and the money received by subscribers is almost solely used to finance scientific projects in the field. Only a small proportion is used for educational purposes, such as the publication of the quarterly newsletter.

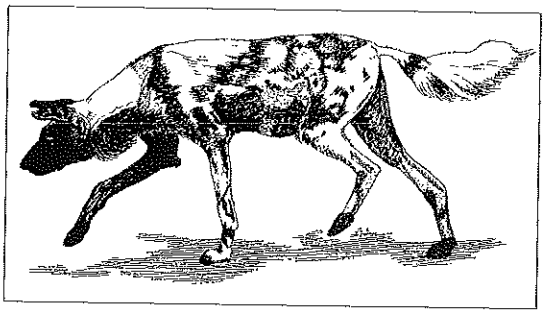
Thanks to the voluntary work of its founder members, and the help of an ever-growing number of concerned associates, Lycaone Fund promotes educational programmes aimed at making the plight of the species known to the public at large, throngh talks, film and slide shows and publications. More recently a comprehensive documentary film on the current situation of the species has been initiated in five African countries with the supervision and coordination of Licaone Fund.

In little more than one year of its existence, Licaone Fund has already succeeded in financing ongoing wild dog projects in Kenya, Zimbabwe and South Africa. The hope is to be able, in the short term, to give financial aid to other projects in need of assistance, and to begin a completely new project in Ruaha National Park, Tanzania.

Thanks to the help of well known researchers, like Scott Creel, Joshua Ginsberg and Gus Mills to name but a few (who enthusiastically joined the association), Licaone Fund is confident of increasing its membership and being able to accomplish the difficult task it has undertaken: i.e. to contribute effectively to the survival of the wild dog and its unique African habitat.

For further information contact the Licaone Fund at:

Via Manzoni 64
19121 La Spezia
Italy
Tel. 39 187 2552224
Fax. 39 187 24487



News from the Lycaon Working Party

The *Lycaon* Working Party was set up recently by the Chairman of the Canid Specialist Group as an informal communication group for people directly involved with research on the African wild dog (*Lycaon pictus*). Its function is to facilitate the exchange of information and discussion of matters arising for the benefit of *Lycaon* conservation. I was asked to coordinate the group, together with Scott Creel, who was asked to be the Secretary.

In recent years there has been an escalation in research projects on the wild dog. This is in no small way due to the attention that was drawn to its endangered status in the Canid Action Plan. At present there are six active field studies being condncted in different parts of Africa on various aspects of wild dog ecology and behaviour. Scott Creel in the Selous Game Reserve (Tanzania), Josh Ginsberg in Hwange National Park (Zimbabwe), Tico McNutt in the Okavango, and myself in the Kruger National Park (South Africa) are all managing projects that have been running for at least three years. More recently Gunther Andreka has started a project on a small popnlation of dogs in the Hluhluwe Umfolozi Park in Natal (South Africa) and Kenneth Buk is setting up a project in Zambia. In addition Marienne de Villiers is investigating physiological aspects of wild dog behaviour in captivity and Kathy Alexander has been investigating wild dog diseases in Kenya. These studies will be used to improve the conservation status of these animals and ensure their long term survival. At the same time much fascinating behaviour is being observed which is of considerable biological interest.

A novel idea was recently proposed by Josh Ginsberg to the Italian wildlife television company Paneikon. Josh suggested that they equip several researchers with high quality video cameras and ask them to film their wild dogs. This material will form the basis of a television documentary on wild dogs. At the end of the projects the researchers will be

able to keep the cameras, or be paid US$2000. Josh, Scott and Nancy Creel, Gunther and myself are the four to be given cameras. Hopefully this film will further improve the image of these maligned creatures and make a positive contribution to wild dog conservation.

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Report from the Lycaon Population Viability Assessment

Following the ***"Lycaon* Population Viability Assessment"** meeting in Arusha, Tanzania (March 1992) a draft ***Lycaon* Action Plan** has now been completed and will soon be distributed to participants at the Workshop and other interested parties.

The largest populations of *Lycaon*, with the greatest potential for long term conservation occur in Eastern and Southern Africa. For this reason both the PVA and the Action Plan focus on *Lycaon* in these regions. The status of the species is most critical in western and central Africa (Canid News No. 1, pp. 2-6), yet so little is known about *Lycaon's* status in these parts of Africa that further survey work is required before Action Planning can be effected.

The *Lycaon* Action Plan is organized into four main sections:

1) Population biology and modelling of *Lycaon* populations
2) Current status and distribution
3) Research and veterinary studies
4) Management strategies and action plans.

Appendices include a complete bibliography of the *Lycaon* literature and a section on the discussion which has developed concerning mortality of *Lycaon* in the Serengeti-Mara ecosystem. Patterns of distribution and abundance were reviewed in the previous issue of Canid News.

It can be seen from data collected at the PVA, and from the literature, that *Lycaon* populations exhibit extreme variation in all important demographic variables. Because variation is so extensive, the modelling section of the LAP investigated how altering single variables affected the probability of population/meta-population survival. The results clearly show that the most critical variables affecting long term survival are population size and, perhaps of even greater importance, the integration of multiple populations into a single metapopulation. Wild dogs are able to disperse widely, so multiple subpopulations can ensure that local extinction need not lead to population extinction.

Lycaon research is an active field, with scientists working in Kenya, Tanzania, Zambia, Zimbabwe, Botswana, Namibia and South Africa. In the research section, current research programmes are reviewed and research needs discussed. The integration of veterinary and ecological concerns is of great importance and forms a significant part of this section of the report.

Action plans for *Lycaon* are extensive, including plans for a continent-wide monitoring system, proposals for cross-border cooperation, and plans for the further co-ordination of veterinary and ecological research.

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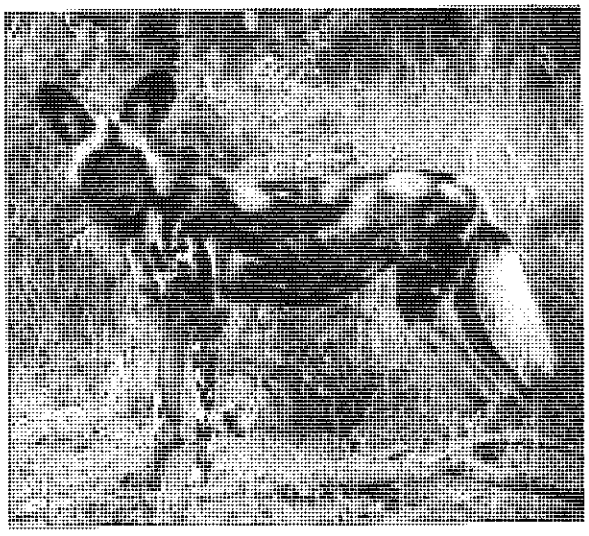
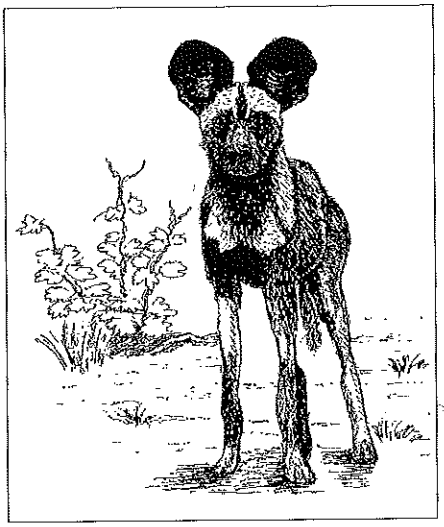




(Photos of *Lycaon pictus* by Gus Mills)

Conservation of the Wolf in Poland

For centuries the wolf was persecuted in Poland, as it was in most areas of Europe. It was declared a game species for the first time in 1927, but was simultaneously declared a pest, and in 1955 the government launched a programme of wolf control (over 400 wolves were killed annually). It wasn't until 1975 that the wolf was declared a game species with seasonal protection, and in 1981 it was allocated an annual 4-month period of protection (1st April to 31st July).

A licence must be obtained in order to hunt wolves, and only rifles or shotguns may be used; trapping is banned. Hunters use two main methods: shooting from hunting towers, and the use of "fladry". Wolves are hunted for their skulls and pelts which are considered as trophies.

Wolf hunting towers (see Figure 1, from Okarma, 1993) are built on the edge of a forest or bordering clearings inside the forest. Constructed from wood, they are 5-10 m high with a small hide at the top. The walls of the hide are sufficiently thick to allow hunters to remain there throughout the night, regardless of weather. The hide has a small door and 1 or 2 small windows for shooting through. Bait (cow or horse carcass) is laid out 20-30 m away, and the hunter waits inside the tower for the wolves to appear.

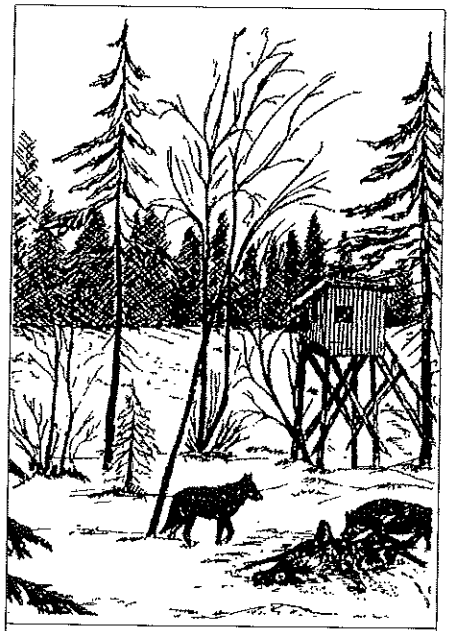


Figure 1. A hunting tower.

Figure 2. Wolf hunting using fladry.

The second and more effective way of hunting wolves involves the use of a device called "fladry". Fladry consists of long ropes with strips of red material (40-50 cm long and about 10 cm wide) attached every 35-40 cm (see Figure 2, from Okarma, 1993). After locating a resting pack of wolves hunters surround the area with fladry. This is done in complete silence (as wolves are easily disturbed) and the ropes are hung on trees, bushes and sticks so that the ends of the material strips do not touch the ground. Once the whole area is surrounded, several metres of rope are removed at a suitable place, and the hunters gather there. 2-3 people then enter the surrounded area making only a slight noise. Disturbed wolves try to escape to a safe place, but they seem unable to cross the fladry. There are some speculations as to why wolves are so afraid of fladry, but the behavioural mechanism involved has yet to be explained. The wolves walk along the fladry until they find the opening, where they are shot by the waiting hunters. Entire wolf packs are often killed this way.

The official wolf population size in Poland is in excess of 800 individuals, but the actual number is probably much smaller. Hunters in recent years have been killing between 100-200 wolves per year, and there is also considerable pressure from unlicensed poachers.

Wolves inhabit the eastern part of Poland, with two core areas in the southeastern and northeastern parts of the country (see Figure 3). There is also a small population in the western part of Poland, although the size of this population is not known. About 40 wolves were killed annually from this area in the hunting season between 1980-1991. Some individuals migrate from this area into eastern Germany across the Odra River. This occurs nearly every year, but few survived there until the wolf was declared a protected species in Germany last year.

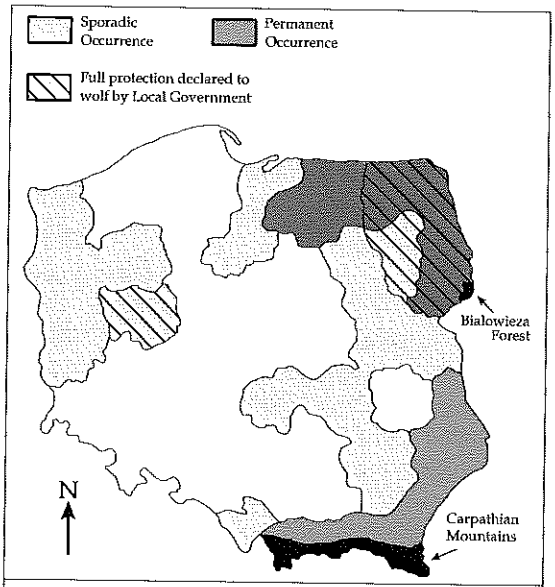
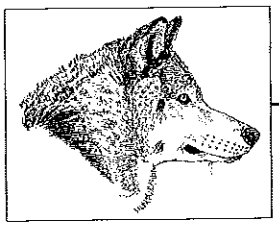


Figure 3. Distribution of wolves in Poland, and regions where they receive protection.

There are probably no significant movements of individuals from the eastern to the western population, and no migration from west to east. Migrations do occur from the northwestern population to western Poland, usually after hunters have



wiped out the latter population (which has happened several times this century). The western area is slowly re-colonized by wolves migrating westwards through small forested areas in north central Poland.

Systematic research into wolves really only began in Poland in the late 1980's, in the Carpathian Mountains and in the Bialowieza Primeval Forest. Early studies focused mainly on diet composition and selection of prey species (faecal analyses, snow-tracking, recording and examining of prey carcasses). The results showed that wolves preyed primarily on red deer, followed by wild boar and roe deer. Within the red deer population calves and females were most at risk from wolves, whilst piglets were preferred to adult wild boar.

More detailed research on wolves in the Bialowieza Forest has encountered bureaucratic difficulties. A project involving radio-telemetry was initiated, but the local authorities developed an unfavourable attitude to leg-hold traps, and the use of these traps was eventually banned by the Ministry of Environmental Protection.

Despite such setbacks, conservationists are making continuous efforts to protect the wolf in Poland, with some notable success. In 1992 some local governments declared full protection to wolves in their administrative units. Moreover, a new hunting law for the whole of Poland has been proposed to Parliament which would give full protection to wolves in the western part of the country, and extend the closed season to 8 months over the remainder of Poland. However, the Polish Parliament is currently occupied in discussing many more important laws, so it is unlikely that the above proposal will be considered for some months.

Henryk Okarma

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Second North American Wolf Symposium

The grey wolf (*Canis lupus*), perceived by many as a symbol of wilderness, is the most studied carnivore, challenged only by the closely related coyote (*C. latrans*). The wolf generates intense interest and has a wide distribution over three continents, justifying a thorough discussion of the species' current status, biology and management. Dr. Ludwig Carbyn of the Canadian Wildlife Service (CWS) and the Canadian Circumpolar Institute (CCI) therefore convened the Second North

American Symposium on Wolves: their Status, Biology and Management, which took place from 25-27th August 1992, at the University of Alberta in Edmonton.

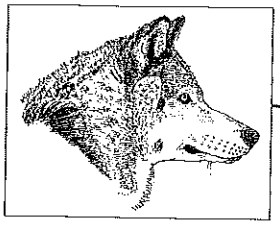
Although the conference was dominated by wolf research originating in North America, Carbyn encouraged reports from abroad and actively sought a global perspective on issues relating to wolves. Speakers from Italy, the Netherlands, Germany and Russia delivered presentations, and poster presentations were given concerning the behaviour or status and management of wolves in China, Finland, Germany, Greenland, India, Poland, Romania, Spain, and the former USSR. The international representation was aided by the meeting of the Wolf Specialists' Group of the IUCN held during the Symposium.

Three main issues concerning wolves were highlighted at the Symposium:

1) The grey wolf reintroduction programme currently under review in Yellowstone National Park
2) The taxonomy of wolves and related canids, specifically the distinction between grey wolves and red wolves (*C. rufus* as currently classified)
3 The evaluation of methods to achieve wolf population control.

The return of the wolf to Yellowstone has long been a contentious issue. Diametrically opposed views exist between ranchers concerned about the inevitable depredation by wolves and traditionalists who argue that only the wolf now remains absent in an ecosystem gone awry without its presence. An interesting debate at the Symposium concerned the historical abundance of both ungulates and wolves in Yellowstone, an important topic pertinent to current and future reintroduction plans. Later, Steven H. Fritts (USFWS) summarized the status of wolf recovery programmes in the northwestern Rockies of the US, identifying Yellowstone as the most controversial. Together with USFWS and US Parks Service colleagues, Fritts acknowledged the exceedingly delicate issues their agencies must face in implementing the recovery of species listed in the Endangered Species Act of which the wolf is but one species, albeit a highly emotive one. Whether the grey wolf can be removed from the threatened and endangered species lists for the lower 48 states remains to be seen. Certainly, efforts of many researchers such as the simulations used by Mark S. Boyce to project the consequences of wolf recovery to ungulate populations will draw close scrutiny.

Taxonomy was another major



theme of the symposium.

Robert K. Wayne, currently at the Zoological Society of London, began the discussions with a review of the molecular-genetic analyses of grey wolves and related canids. Compelling evidence from mitochondrial DNA suggests at least 7 hybridization events have occurred between wolf and coyote in Minnesota and eastern Canada. Wayne and his coauthors argued that a more ancient hybrid zone between grey wolves and coyotes may have occurred in the American south and southeast and that this hybridization may have influenced the phenotype of the red wolf.

Ronald M. Nowak, of the United States Fish and Wildlife Service then presented morphometric data that he and his co-authors had analyzed. Whilst they did not deny that hybridization had occurred betweeu wolves and coyotes they argued, based on new fossil evidence, that the red wolf is indeed a distinct species from the coyote and grey wolf. Furthermore, Nowak *et al.* believe that the red wolf is an ancestor to all wolves, including the grey wolf and the extinct dire wolf (*C. dirus*). These two presentations stimulated much discussion, not only on the repercussions of endangered species recovery programmes but on the traditional and genetic approach to taxonomy.

The third major area of contention in wolf biology and management highlighted at the Symposium was the intentional removal and control of wolves by wildlife managers. Such programmes are generally implemented to reduce depredations on livestock and to reduce declines in, or otherwise augment, ungulate populations (primarily to benefit hunters). This part of the Symposium began with discussions of three non-lethal control methods.

Firstly Boertje summarized ADF&G experiments which provided supplemental food to wolves, grizzly bears (*Ursus arctos*) and black bears (*U. americanus*) during calving periods for moose (*Alces alces*) and caribou (*Rangifer tarandus*). Such diversiouary feeding to reduce predation on these ungulates showed some promise as a non-lethal method of controlling wolves but its effectiveness is heavily dependent upon scale of effort and overall cost-effectiveness.

Next, Coppinger eloquently presented his 15 years of work using guard dogs as a preventative measure in livestock depredation by wolves, but stressed that the method is not an immediate response to wolf-livestock problem because guard dogs must be properly socialized to the animals they are to protect.

Asa outliued contraceptive approaches as a way to reduce or eliminate wolf conflicts. Techniques such as steroid hormones, immunocontraceptives, chemical sterilization and castration will influence physiological and behavioural processes in individuals. Whether the integrity of the wolf pack as a social unit is preserved remains largely unknown. The uncertainty arises from the potential breakdown in the maintenance of a dominance hierarchy by the alpha pair towards its pack mates. The social repercussions associated with the absence of a litter in the pack are also unknown.

Several other talks concerning wolf control issues highlighted the importance of public acceptance in shaping the development and use of particular techniques. Further talks included evidence of wolves as interspecific competitors in a size-based hierarchy of predators, the presence of humans as contributing to the outcome of interference competition, and a suggestion that humans may function as a keystone species, thereby facilitating the survival of small canids that might otherwise be excluded by the larger species.

L. David Mech (USFWS), perhaps the world's foremost authority on wolves today, outlined gaps in our knowledge concerning wolves and the ways and means with which we might go about acquiring such information. Mech discussed issues relating to the wolf's biology, behaviour, and the yet-to-be-resolved controversy surrounding the impact of wolves on their prey. Mech encouraged a long-term approach to wolf research, partly because of the longevity of wolves aud most of their prey and the changes that ensue in long-lived species.

As Mech and others have pointed out, we have made significant inroads in understanding the wolf since our blatant attempts to totally eradicate the species throughout much of human history. Nevertheless, we still have a long way to go. Mech's analysis, together with the other 88 papers submitted to the Symposium's proceedings will focus research activity for the years ahead. Perhaps when the third North American Symposium on Wolves convenes a decade or so from now, we may finally comé to understand a species so dear to some and so deeply hated by others.

H. Dean Cluff

A more detailed report of this Symposium can be found in *Canadian Field-Naturalist*, 106(4): 531-533, who kindly allowed us to use the above material.

Hybridization: An Emergency for the Ethiopian Wolf

Hybridization and habitat fragmentation greatly complicate plans to conserve the genetic diversity of wild canids (Wayne, 1993). Among the 34 Canid species, grey wolves and coyotes are known to hybridize, both with each other and with their close relative, the domestic dog. The Ethiopian wolf (*Canis simensis*) is a phylogenetically distinct canid but is closely related to grey wolves and coyotes (Gottelli *et al.*, in press), making the species a potential target for hybridization with domestic dogs (a recent derivative of the grey wolf).

This canid, endemic to Ethiopia, has become finely adapted to life at high altitudes in Afroalpine habitat, where it preys exclusively on rodents. Today, perhaps less than 500 individuals survive, living at altitudes between 3,000 and 4,400 meters in six or seven isolated mountain pockets (Gottelli & Sillero-Zubiri, 1992; Sillero-Zubiri & Gottelli, in press).

To the already known threats to the species, namely small isolated populations, high altitude grazing, subsistence agriculture and direct persecution by humans, the increasing presence of domestic dogs in Ethiopian wolf habitat has brought a new and more critical problem. Dogs are kept by pastoralists to protect their herds from hyaenas, but they are not fed regularly and roam the highlands freely. Dogs potentially pose a three-pronged threat to the wolves: competition for food resources, as vectors of canid-related diseases such as rabies, and hybridization with their wild relatives (Gottelli and Sillero-Zubiri, 1992; Macdonald, in press).

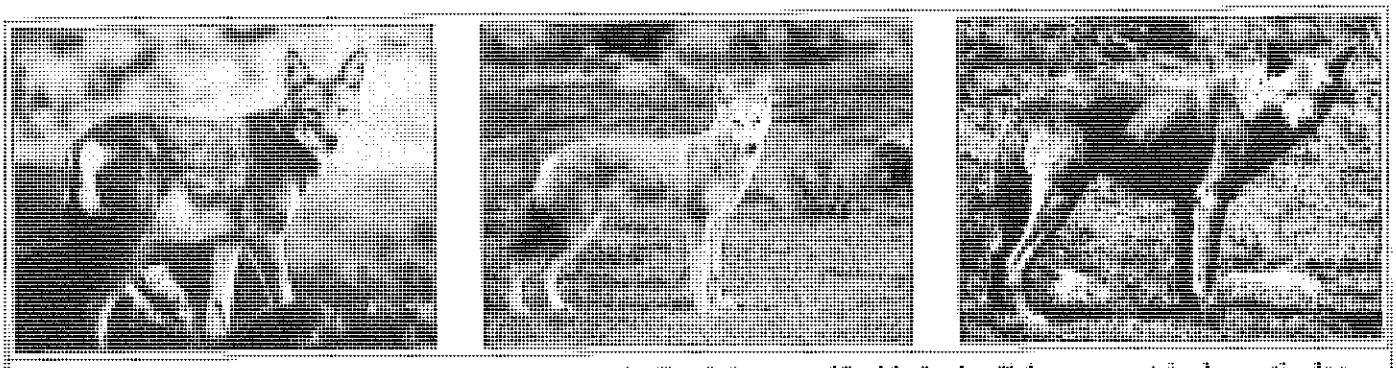
The first suggestion that hybridization does occur was the presence in the western parts of the Bale Mountains of phenotypically atypical individuals, noted in 1988. Of 156 animals individually identified and observed during a four year study in the Bale Mountains National Park, 8% had an apparently aberrant coat colour, and some had kinky tails (Sillero-Zubiri and Gottelli, 1991).

Using molecular techniques applied to blood samples taken in Bale we addressed the question of whether Ethiopian wolves hybridized with dogs. We examined this possibility through mitochondrial DNA restriction fragment analysis and the analysis of nine microsatellite alleles (nuclear DNA) in populations of Ethiopian wolves. This research was carried out at the Department of Biology, University of California Los Angeles, and at the Institute of Zoology, Zoological Society of London. Detailed results are presented elsewhere (Gottelli *et al.*, in press).

For the first analysis, restriction fragment patterns from 23 Ethiopian wolves were compared with those found in three phenotypically aberrant individuals, in seven sympatric domestic dogs and in a panel of 32 different dog breeds. All typical Ethiopian wolves and abnormal individuals analyzed had identical restriction fragment patterns, and they differed from the pattern identified in dogs for 14 of the 17 restriction enzymes used. Because the mtDNA is inherited by maternal line only, this analysis suggested that interbreeding of female domestic dogs and male Ethiopian wolves was not common. Although the mtDNA sequence analysis suggests that domestic dogs are close relatives of Ethiopian wolves (Gottelli *et al.*, in press), the two species differ considerably in microsatellite allele frequencies. Consequently, it was possible to define a set of marker alleles to determine whether Ethiopian wolves that were phenotypically aberrant had alleles otherwise found only in domestic dogs.

From the second analysis, the presence of dogs' alleles in all of eight phenotypically abnormal Ethiopian wolves (and their absence in 41 phenotypically normal individuals) suggested that hybridization between dogs and Ethiopian wolves had occurred. The earlier results from the mtDNA analysis and the microsatellite analysis were consistent with field observations indicating that female domestic dogs do not attempt to mate with male Ethiopian wolves (Sillero-Zubiri & Gottelli 1991).

The probable occurrence of hybridization of the Ethiopian wolf was first reported to the Ethiopian authorities and conservation bodies in 1989 (Sillero-Zubiri & Gottelli, 1991). No action was taken in 1989, due to the need for genetic evidence. Now the latest molecular genetic tools have given us that evidence. Actiou in two fronts is required urgently. Efforts should be made to control dog



From left to right: typical Ethiopian wolf; phenotypically aberrant wolf with dog's alleles; sympatric domestic dog.

populations within the Ethiopian wolf's range, in particular within the Bale and Simien Mountains National Parks. Secondly, a captive breeding programme with pure-bred founders should be initiated without further delay. Unless genetic introgression (cross-breeding) is stopped, the top predator of the Ethiopian highlands might soon become the next large mammal candidate for extinction.

Dada Gottelli, Claudio Sillero-Zubiri & Robert K. Wayne

Acknowledgements: This work was partly supported by the People's Trust for Endangered Species and NYZS – The Wildlife Conservation Society, under the auspices of the Canid Specialist Group.

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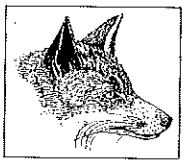
Canids in Moldova: changes in the latter half of this century

The Republic of Moldova is situated in the far south west of the ex-USSR. The last four decades have been characterized by an extreme modification of its natural landscapes. The dense human population has undergone rapid growth (from 73.3/km² in 1940 to 129.4/km² in 1990), whilst the area of cultivated land has expanded, at the expense of the development of natural biotopes, and presently accounts for 86.26% of the Republic.

These changes have been most noticeable in the valleys of the Lower Pruth and Lower Dniester, the steppes of the southern and northern parts of the republic, and in the forest biotopes. The influence on indigenous fauna, including representatives of the Canidae, has been predominantly negative.

Early in the latter half of this century the Moldavian fauna included two indigenous canid species – the common red fox (*Vulpes vulpes* L.) and the grey wolf (*Canis lupus* L.), and one introduced species – the raccoon dog. All canid species are currently unprotected in Moldova.



The red fox is widespread throughout the whole of the Republic, inhabiting all natural habitats, and also urban areas. Over the last decade its numbers have fluctuated between 11,000-19,000 individuals, and its density varies between different natural biotopes: 0.8-13/100 ha in the forests of the central part of Moldova ("Codru"), 0.2-0.7/100 ha in the agricultural lands, 0.05-0.3/100 ha in the southern steppes of the Republic, and 6-12/100 ha in the swamps of the Lower Pruth.

The diet of red foxes varies considerably between habitats. The species has now become adapted to rural regions, where its numbers are limited by factors such as availability of den sites, human persecution and competition with dogs (Vasiliev & Konovalov, 1992). In these areas they feed mainly on small rodents and juicy fruits of cultivated and wild plants, with domestic and wild birds playing a more minor role, along with refuse and wild and domestic carrion. In the winter months the importance of refuse and carrion increases.

The grey wolf has disappeared from Moldova's resident fauna. Numbers were high until the beginning of the 1960's; Uspensky (1972) reported numbers approaching 300 individuals, but by the end of the 1970's only single specimens could be found. Wolves were last noticed entering the republic from Ukraine during the 1988-1989 winter. The wolf's basic diet consisted of domestic carrion (Gursky, 1969; Upensky, 1972). The main causes of its decliue are human persecution and habitat destruction.

The raccoon dog was introduced into Moldova over the period from 1949-1954 in order to enrich the local fur-bearing, predatory fauna. Raccoon dogs can now be found in the forests, swamps and river valleys of the lower Pruth, and lower Dniester. Densities are variable: not exceeding 0.2/100 ha in the forests, but reaching 4/100 ha in the swamps and marshes.

In the forest biotopes the raccoon dog's diet consists of small rodents, birds and their eggs, and juicy fruits such as hawthorn, wild rose hips, apples, cherries and plums; in the valleys of the lower Pruth they take birds, their eggs and hatchlings, and also rodents – water voles and muskrats. The raccoon dog's main enemies are free-roaming, herdsman's and feral dogs.

The free-roaming and feral dogs cause a great deal of damage: they kill and disturb wild animals, and are carriers of many dangerous diseases, such as rabies and echinococcosis infections. They eat mainly food refuse and domestic carrion. These dogs live in natural biotopes on both a temporary and permanent basis, and there are estimated to be 30,000 of them outside populated areas. Their density can reach 34/100 ha.

The rapid growth in feral dog numbers has been provoked by lack of control upon the maintenance of dogs, wolf persecution, availability of a great number of open rubbish heaps, and unburied cattle corpses.

In summary, there have been a number of important changes in the status of canid species in the Republic of Moldova over the last few decades, the most notable being the adaptation of the red fox to urban biotopes, the disappearance of the grey wolf as a resident of the Republic, the introduction

of raccoon dogs, and the rapid growth of the feral dog population.

Andrew Vasiliev

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The New Guinea Singing Dog

Initially considered to be a new species of wild canid when first discovered by scientists in the mid-1950's, the New Guinea Singing Dog, also known as Hallstrom's Dog, is more properly considered as a member of the complex of animals – including the grey wolf, domestic dog, Australian dingo and other canids – whose precise taxonomic status and phylogenetic relationships are matters of current controversy that may require considerable reconstruction of traditional assumptions. Virtually all biological information for the New Guinea Singing Dog has resulted from studies of captive animals. Captive populations are extremely limited however and currently consist of only a few hundred individuals world-wide, all having been derived from eight wild-caught fouuders.

Althongh wild populations of these dogs have occasionally been noted by field researchers working at the higher altitudes of the Central Highlands, they have invariably beeu overlooked as subjects of careful research in favour of other more well-known Papuan fauna. This neglect has at least partially been the result of a failure to appreciate the unusual features of this canid and to understand its position as a truly primitive form of domestic dog. The possibility that this canid may also exert significant predator pressure upon populations of smaller native fauna further increases the need for careful field studies of these animals in the Central Highlauds where they are the only form of large mammalian predator other than man.

Foremost among this canid's unique features is its vocal behaviour, which gives rise to the common name of Singing Dog. The animals exhibit a form of howling marked by an extraordinary degree of highly variable frequency modulation, and also contain within their vocal repertoires a number of signals, e.g. a high-pitch rapid trill, which have not been reported for other canids. However the structural complexity and functional significauce of these vocal patterns are not yet well understood. Other features include an annual reproductive cycle, with short-term recycling of oestrus in the females which fail to become pregnant, as well as social behaviour which, on the basis of studies of captive animals, suggests a monogamous non-pack social organization in the wild.

Interests in undertaking field studies of these animals are being hindered by what may be a recent decline in their numbers and distribution on the wild. Of particular concern has been the increasingly limited number of sites where conditions assure their protection from hybridization with domestic dogs which have accompanied recent non-native cultural iutrusions into the Central Highlands. This is probably the most significant conservation concern facing wild populations of this canid today. There is hope, however, that non-hybridized Singing Dog populations may still exist at higher altitudes on Mounts Giluwe and Wilhelm in Papua New Guinea, and in highlands to the south of the Lakes-Plains region of the Idenburg and Rouffaer Rivers in Irian Jaya. A particularly important population for study, due to the degree of its isolation, has recently been found in the Mount Mekil region in northwest Papua New Guinea.

Lehr Brisbin, Raymond Coppinger, Mark Feinstein, Steven Austad & John Mayer

Appeal for Information.

We plan to publish a review article by Lehr Brisbin, covering all the primitive breeds of domestic dog, including the New Guinea Singing Dog, North Carolina Dog, etc. If anyone has any information they think would represent a useful contribution towards this article (due to appear in issue 4 of Canid News), please send it to:

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Mapping the Dhole Update

In the first issue of Canid News (pages 18-21) I reported on an initial CSG survey on the status of the dhole *Cuon alpinus* in India and South East Asia. In response to requests for further reports of the dhole, several correspondents very kindly sent new information and sightings. As a result, parks in Thailand and Laos are added to the current range on the basis of recent dhole sightings. Dhole tracks have beeu reported in Indonesia and Vietnam, and the case for relic populations of dhole in Russia and China seems stronger. There is still no news from Burma or Cambodia.

Most of the recent direct sightings of dhole have come from the deciduous and evergreeu forests of the Huai Kha Khaeng Wildlife Sanctuary, near the Burmese border of Thailand (Rabinowitz & Walker, 1991). Reports include

sightings of a pack killing a Sambar deer, and dhole moving singly and in packs (Susan Walker, Hans Kruuk, Rob Atkinson, Kevin Morgan, pers. com.) The dholes coexist in the park with a diverse assembly of feline predators which are gaining the park well- deserved attention and protection.

In Laos Michael Woodford and Roger Cox recently saw a dhole in the dry mixed deciduous forest of the Houei Kaliang Plains in Southern Champassak Province on the Cambodian border (M. Woodford, pers. com., and Cox, Laurie & Woodford, 1992). Dhole were also reported from tracks in the Yok Don Nature Reserve in Southwest Vietnam by Laurie *et al.*, 1989. Both of these records were made during efforts to locate the Kouprey, *Novibos sauveli*. The position of these sightings perhaps points to a dhole population in the remote terrain of North East Cambodia. Dhole are also recorded from the Vu Quange Nature Reserve in Vietnam, site of the recent spectacular discovery of the Vu Quange Ox *Pseudoryx nghetinhensis* (Vu Van Dung, MacKinnon *et al.*, 1993).

In China Peter Jackson reports that dhole are frequently seen in Chinese zoos. In Hangzhou a notice on the cage said the animal was a pest and must be exterminated. The dhole may still be present in the Sikhote-Alim of the Russian far East, but it is at best very rare. These reports are currently being followed up by communication with Chinese and Russian biologists. A report of the dhole from the Gobi desert is also being investigated, (Rosie Woodroffe, pers. com.).

I received no further reports from Malaysia. John Seidensticker brought my attention to his 1976 observations of dhole tracks in the Meru Betiri reserve in South East Java. His report concluded that the dhole was thinly distributed in the Park (Seidensticker, 1980). He also remarks on the problem of mistaking feral dog tracks for those of dhole.

Overall a picture of the dhole's range outside India is slowly developing. They appear to survive as small populations in the most remote parks of the region, scattered across a truly vast range from Russia to Indonesia. The pattern is a familiar one for large carnivores such as African wild dog and tiger. It reflects the situation where a continuous wide range of a once highly successful species has been fragmented into small remnant populations by increasing human pressures.

Paul Stewart

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Book Review

"Wild dogs: the natural history of the nondomestic Canidae"

By Jennifer W. Sheldon
San Diego: Academic Press (1992). 249 pp.

This book is dedicated to the whole canid family. It represents an extensive revision and synthesis of the major literature published on all species within the Canidae up to 1990. A great deal of dispersed information on the natural history of 35 species in 15 genera has been brought together for the first time, resulting in an extremely useful compilation for the general reader, and a valuable convenient source for the specialist.

The information is presented in sections for each species. This facilitates ease of reference, and includes a brief description which, for species at risk, contains the IUCN classification and/or the CITES Appendix listing. Unfortunately, however, the latter information is not consistently found here, but sometimes appears in the section on distribution and habitat.

A morphological description is given with dental formula, measurements, and comments on the function of distinctive attributes. For example, it is suggested that the colour patterns of the African wild dog (*Lycaon pictus*) enable them to differentiate between conspecifics and prey during hunting, or act as a unifying camouflage for the pack.

The sections concerning diet, activity, reproduction, and social organization and behaviour clearly reflect the state of knowledge for each group. Species like the grey wolf (*Canis lupus*) and red fox (*Vulpes vulpes*) have been the subject of numerous studies over the majority of their ranges; for these an extensive synthesis has been necessary. For the Tibetan sand fox (*V. ferrilata*) and many others for which virtually no information has been produced, data from captive animals or none is provided.

This book provides a useful tool for decision makers, shedding light on where resources and effort for research should be allocated. Much information is still needed in order to determine soundly-based conservation policies for nearly half of the Canidae species, many of which are at risk.

Each of the fifteen genera is illustrated by a picture, but I would have appreciated the additional effort to include also pictures of the twenty remaining species.

Rurik List

The Raccoon Dog: a Successful Canid

by Kaarina Kauhala

This article addresses possible reasons for the spread of the raccoon dog across much of the northern hemisphere, and attempts to account for its current distribution patterns in northern Europe.

Natural Distribution and Introductions

The raccoon dog originated in the Far East and is a native of southeastern Siberia, China, North Vietnam, Korea and Japan (Figure 1). At least three different subspecies have been distinguished: *Nyctereutes procyonoides procyonoides* and *N. p. ussuriensis* in continental Asia and *N. p. viverrinus* in Japan.

The Japanese subspecies differs in three respects from the two mainland subspecies. Chromosome numbers are different (2n = 38 in Japan, 2n = 54 in the two mainland subspecies) (Mäkinen *et al.*, 1986; Ward *et al.*, 1987). The fur of the Japanese subspecies provides much poorer insulation than does that of *ussuriensis* and the energy intake of the Japanese raccoon dog in summer and early autumn (and consequently the seasonal change in weight) is lower than that of *N. p. ussuriensis* (examined on a fur farm in Finland) (Korhonen *et al.*, 1991). Some differences in behaviour may also exist between the Japanese and continental Asian subspecies.

The large difference in chromosome numbers suggests that a process of speciation is under way and that the Japanese raccoon dog should probably be considered a separate species by now. The raccoon dog entered Japan from Korea or via Sakhalin 18,000-12,000 years ago, and it has adapted to the mild marine climate and a more or less constant supply of food throughout the year. In many of the areas inhabited by the raccoon dog on the Asian mainland the climate is much harsher and little food is available in winter.

The raccoon dog (subspecies *ussuriensis*) was introduced into the former Soviet Union, mainly the European part, in 1929-55 because it was considered a valuable fur animal (Lavrov, 1971). Altogether 9100 animals were released, some of them not far from Finland (Figure 1). Many of the introductions were successful, and populations increased. It was not long before the raccoon dog began to colonize neighbouring countries, including Finland. The raccoon dog expanded its range at an average annual rate of 40 km, and by the mid-1970's its distribution included southern and central Finland, where the population density is now higher than that of the red fox (Helle & Kauhala, 1991). The species is very common in the Baltic states and many parts of eastern Europe, and is also found in Germany and Sweden. Some specimens have even been seen as far away as Norway, France, the Netherlands, Switzerland and Austria, and the species is still spreading westwards and southwards (see Helle & Kauhala, 1991).

Kaarina Kauhala completed her doctorate on raccoon dogs in 1992 at the University of Helsinki in Finland. Now she is organizing the II North-European symposium on the ecology of small and medium-sized carnivores for 1994. She still continues her research work on the raccoon dog and other small carnivores.

The Successful Raccoon Dog

The raccoon dog's colonization of Europe has been very rapid. In Finland, the growth rate of the population was highest in the south of the country, and the population reached its peak in the mid-1980's, according to game enquiries. Thereafter, the numbers first declined slightly in some areas, but have since stabilized and seem now to vary in a density-dependent manner (Kauhala, 1992). The raccoon dog would thus seem to have reached the carrying capacity of the environment in Finland. The annual catch has increased sharply in Finland during the past two decades, reflecting the rapid increase in population density. Only 818 raccoon dogs were killed during the 1970-71 hunting season but 75,000 were killed twenty years later. Although the annual tally does not always give

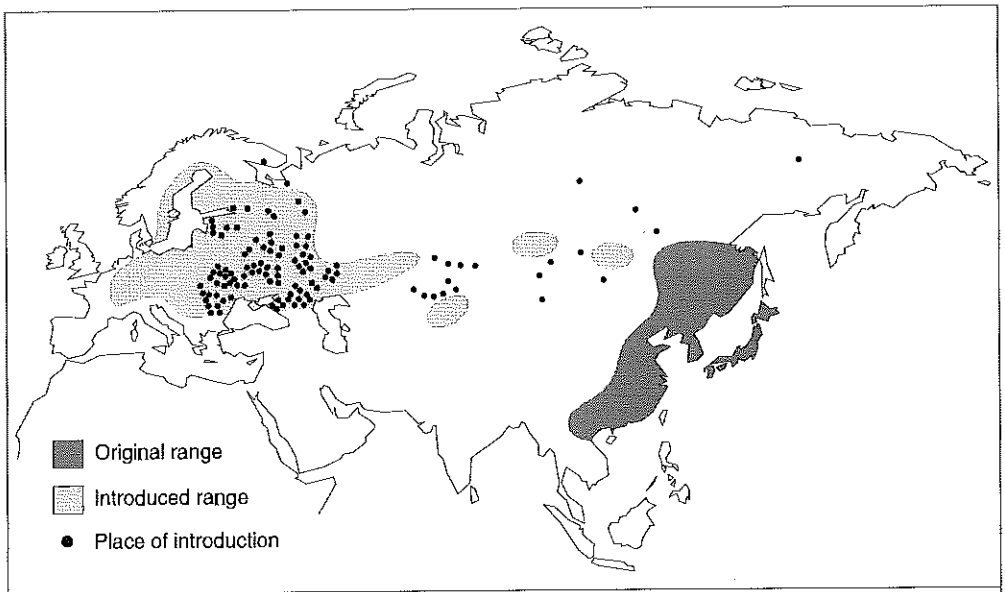
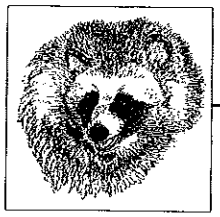


Figure 1. Distribution and places of introduction of the raccoon dog.



a true picture of population density, an increase of this magnitude certainly reflects the rapid increase in numbers.

Thus, the raccoon dog can be considered a very successful species. It has many features in common with other mammals that have quickly invaded new areas: it is rather small, omnivorous, capable of living near human settlements and of utilizing man-made food resources, it has a very high rate of reproduction and is generally very adaptable. Moreover, the raccoon dog sleeps through the winter, which is a great advantage in areas where winters are harsh and food availability low. With short legs and small paws the raccoon dog is not able to move around in deep snow, so lethargy offers the best means of surviving the winter.

"the raccoon dog sleeps through the winter, which is a great advantage in areas where winters are harsh and food availability low"

High Reproductive Potential

A comprehensive study of the ecology of the raccoon dog, directed by Dr. Eero Helle, began in 1986 in the Finnish Game and Fisheries Research Institute. This research included the collection and examination of thousands of raccoon dog carcasses, but radio-telemetry work was also carried out in the field. The following results are mainly based on this work.

Oue of the most important factors affecting the growth rate of any population is the species' rate of reproduction. The reproductive potential of the raccoon dog is amazingly high in most areas studied: in southern Finland the mean litter size is 9 cubs (in some 'good' years it may even reach 10) and the maximum litter size is 16 (Kauhala, 1992; Figure 2). Equally high figures have been reported from the Danube delta, Lithuania and the Russian Far East. The reproductive potential seems to be lower, however, in the eastern part of European Russia and in eastern Finland (North Karelia) (see Helle & Kauhala, in press).

The raccoon dog has one of the highest litter sizes to be found in the Family Canidae. Only the arctic fox (*Alopex lagopus*) and the African wild dog (*Lycaon pictus*) may have larger litters, and the arctic fox has very large litters only in years wheu small mammals are very abundant. The mean litter size of most canids is between four and six. Reproductive investment among canids can also be measured by comparing relative litter weights (litter weight/female weight). The relative litter weight of the raccoon dog is the highest of all canids, the mean weight of the litter being 24% of the weight of the female (Kauhala, 1992). The relative litter weight of most canids the size of the raccoon dog is around 11%.

Reasons for High Reproductive Potential

Why is the raccoon dog able to invest so much in reproduction? One would expect the cost of reproduction to be too high for a female with nine or ten cubs year after year. However, there are several features of the raccoon dog's ecology which may explain the high reproductive potential of the species (Kauhala, 1992).

Firstly, it is strictly monogamous (with the possible exception of the Japanese raccoon dog) and the male helps to rear the young. During the first week after parturition, both the male and female remain in the den with the cubs. Thereafter it is usually the female that forages for food because she needs a great deal of energy for lactation, while the male stays in the den with the cubs, guarding and keeping them warm. If the male did not participate in rearing the cubs, the female would not be able to obtain enough food to produce milk for such a large litter. The raccoon dog eats small food items and does not usually carry food into the den. On the contrary, the female prefers to eat as much as she can herself and feed the cubs entirely with her own milk during the first

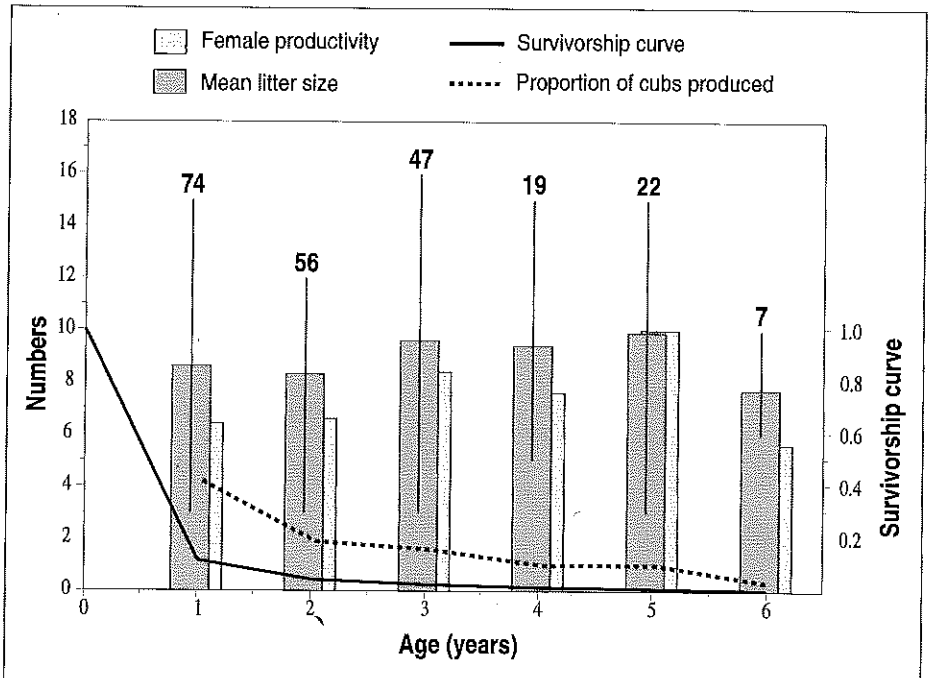
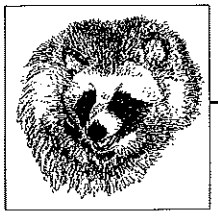


Figure 2. The litter size (mean, range, n) and survivorship curve (probability of being alive at a certain age, solid line) of the raccoon dog in southern Finland. The dotted line gives the relative investment of each age-class in reproduction (survivorship x female cubs/female).



month.

Secondly, the raccoon dog is truly omnivorous, which means that some food is always available (Kauhala *et al.*, 1993). It also utilizes man-made supplies of food, such as rubbish heaps, and so is rather insensitive to fluctuations in other food resources, e.g. voles, especially in areas near human settlements.

Thirdly, the raccoon dog sleeps during harsh winters. Winter is the critical season for many mammals in northern latitudes, because moving about in deep snow requires much energy and there is often a shortage of food. Adult raccoon dogs are always very plump in late autumn and are able to survive the winter in good condition, regardless of the weather and food supply. Thus, in March (when females come on heat) they still have ample extra fat, and can afford to invest heavily in reproduction.

Distribution Limits

Although the raccoon dog is very successful, it appears unable to colonize Lapland. The animal's northern distribution limit lies between 65°N and the Arctic Circle, and so it is only rarely seen in Lapland. Distribution seems to be determined by climate, which is very similar near the northern limit in Finland and the northern limit in Russia: the mean annual temperature is just above 0°C, the snow cover about 80 cm, the duration of the snow cover 175 days and the length of the growing season 135 days.

The growth rate of the population and the present density are highest in southern Finland; both are explained rather well by the mean annual temperature. Thus, climate affects the distribution, regional abundance and growth rate of the raccoon dog population (Kauhala, 1992).

Climate also seems to have a marked effect on the productivity of the raccoon dog population, especially on the proportion of reproducing females (Figure 3). The time of the thaw (indicated by snow depth at the end of March) determines when the animal comes on heat and gives birth. Parturition, in turn, affects the length of the period during which the young can grow and accumulate fat reserves for the winter and, thus, their weight in late autumn. The weight of the females of the youngest age class largely determines how many of them will reproduce the following spring. This, in turn, determines the proportion of reproducing females in the population, because the youngest age class (individuals just under one year) constitutes more than 40% of the population in spring.

"the relative litter weight of the raccoon dog is the highest of all canids, the mean weight of the litter being 24% of the weight of the female"

In Lapland, winter is so long and summer so short that cubs do not have not enough time to grow and accumulate fat reserves for the winter, and small cubs are not able to survive the long winter. Accordingly, the raccoon dog is not able to colonize Lapland permanently. In southern Finland, winter lethargy is an advantage, because there is time enough to accumulate fat reserves and the winter is not too long, but in northern areas total inactivity during the winter is a disadvantage.

Climate is also a determinant of population density. In southern Finland primary production is higher than farther north, and this naturally affects the amount of food available for animals. As a result, the home ranges are smaller and the population density higher in the south than in areas where the climate is

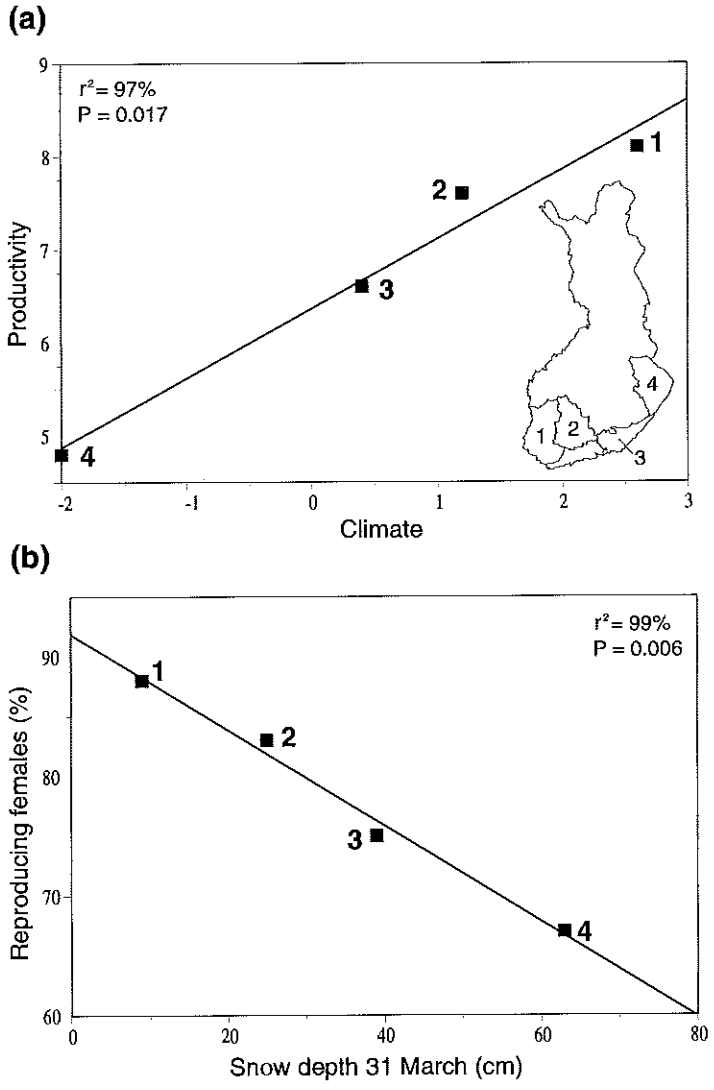
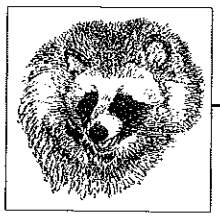


Figure 3. (a). Productivity (litter size x proportion of reproducing females) of the raccoon dog in four provinces in Finland. **(b).** The proportion of reproducing raccoon dog females and the depth of the snow cover at the end of March in four provinces in Finland.



more severe. For example, The mean home range size (calculated from population density) in the northwestern part of Russia (where climate is continental with long and very cold winters) is 10-20 km². In the Novgorod area (where winters are shorter and warmer) the mean home range size is about 1.5 km².

Fluctuating Abundances

The numbers of all natural populations always fluctuate to some extent. The abundance of food, in particular of berries (mainly bilberries and lingonberries) in autumn, is largely responsible for the annual variation in the raccoon dog numbers in Finland (Kauhala, 1992). The abundance of voles may also have some effect, especially near the northern distribution limit, possibly because vole numbers fluctuate more sharply in northern than in southern Finland.

The abundance of berries probably affects the accumulation of fat reserves in autumn, because berries are one of the raccoon dog's main sources of food. Juveniles in particular rely on them for building their fat reserves and surviving the autumn and winter. Juvenile mortality is indeed the most important mortality factor for the population (Figure 2), and seems to be directly dependent on the abundance of berries.

Climate can also affect the annual population density in the northern parts of the distribution area by causing heavy mortality, especially among juveniles, in severe winters.

A Vacant Niche ?

Serious competition between the raccoon dog and other carnivores of similar size (red fox and badger) has not been observed. In fact, badger and red fox population densities increased slightly in southern Finland in the first half of the 1980's, even though raccoon dog numbers were rapidly increasing in the same area.

The diet of the red fox, badger and raccoon dog overlap to some extent since all three carnivores feed on items such as small mammals, invertebrates and plants. But the red fox specializes more on small mammals (voles), the raccoon dog on plant material (e.g. berries) and the badger on invertebrates (Ivanova, 1962; Kauhala *et al.*, 1993). Thus, each species has a slightly different diet, which may help them to avoid competition.

Furthermore, at northern latitudes, competition for food is probably at its fiercest during the winter, when food is scarce. However, both badger and raccoon dog spend this season asleep, so there can be no food competition in winter.

The same three species may also compete for dens. The raccoon dog often uses old badger or fox dens, but both badger and fox tend to chase it away. Nonetheless, raccoon dogs are sometimes found in the same dens as badgers during the winter, possibly because the badger goes to the den earlier in autumn and wakes up later in spring, and so may not be aware that it is sharing the den with the raccoon dog.

In conclusion, the raccoon dog really does seem to have found a vacant ecological niche in its new range; there is enough food, no serious competition with other carnivores of similar size and predation on raccoon dogs is probably not very heavy.

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Conservation of the Maned Wolf:

Fruitful Relations in a Changing Environment *by Orin Courtenay*

The interrelationships between maned wolves, the "Lobeira" fruit, and leaf-cutting ants have possible implications for maned wolf conservation.

Introduction

The maned wolf, *Chrysocyon brachyurus*, is monotypic and endemic to central South America (Berta, 1987). Agricultural expansion and direct conflict with humans are reported to threaten the species in parts of its geographical range (Ginsberg & Macdonald, 1990). Nevertheless, observations indicate that the maned wolf is able to survive alterations to its preferred habitat (Dietz, 1984; R. Dias, pers. com.; pers. obs.), and that in the last 40 years the species' range, rather than diminishing in size, has altered in configuration (Dietz, 1985a). While reports that this vulnerable species is able to colonize potentially hostile environments are reassuring, without a reasonable understanding of the behavioural mechanisms behind such range expansions and delimitations, the efficiency of conservation strategies will be limited.

As a member of WildCRU, **Orin Courtenay** has worked on rabies ecology of carnivores in Saudi Arabia and the role of the crab-eating fox, *Cerdocyon thous*, in visceral leishmaniasis in Amazonian Brazil. He is presently employed at the London School of Hygiene and Tropical Medicine to continue studies on canine leishmaniasis in Brazil.

Here I summarise the results, to be reported in full elsewhere (Courtenay *et al.*, in prep), of studies conducted in the Central Brazilian plateau, where the scrub forests and savanna, collectively called cerrado *sensu lato* (Eiten, 1972), is the threatened native habitat of the wolf in this part of its range. Field experiments focussed on the fruiting species *Solanum lypocarpum*, locally known as "Lobeira" or "fruit of the wolf", at IBGE reserve (15°56'S, 47°53'W) and the wildlife sanctuary at Fazenda São Miguel (SM) (15°50'S, 46°30'W) in Brazil.

Lobeira in the Maned Wolf's Diet

Dietz (1984) was the first to report the high frequency of lobeira seeds in maned wolf faeces collected in the Serra da Canastra (19°30'S, 46°30'W), which accounted for more than half (58%) of the total scat volume. We found that an average 85% (± SD 18.3) of scats collected per month at IBGE contained lobeira, and Gomes da Silva (1988) working further north still, in Chapada dos Guimarães (13°30'S, 47°45'W), concluded that the fruit comprised 38% of the wolf's diet. These locations represent the equivalent of an 800 km northwest-southeast transect across the central north-south limits of the species' range (see map below), thus, we conclude that the wolf's prefereuce for this resource is not simply a local phenomenon.

Work on the phenology of lobeira at IBGE showed that, although fruits are produced all year round, availability to the wolf varies seasonally. In contrast, consumption by the wolf (measured by proportional faeces content) is constant throughout the year ($\chi^2_{11} = 13.1$, $p = 0.29$), showing no correlation with monthly fruit availability ($r^2_9 = 0.12$, $p = 0.3$). It has yet to be shown that the wolf seeks the fruit more actively during the less productive months, nevertheless, lobeira's year round predominance in the diet of an animal whose diet is otherwise dependent on food availability (Dietz, 1984) is indicative of the fruit's substantial value to the wolf. We propose that the wolf's dependence on lobeira makes this fruit a potential indicator of suitable maned wolf habitats.

The Lobeira Plant

Lobeira is a fast growing woody shrub which reaches heights of 4-5 m, and produces hermaphroditic blue flowers pollinated by bee species of the families Andrenidae, Anthophoridae, Apidae and Halictidae (Oliveira-Filho & Oliveira, 1988). Full-size ripening fruits, weighing 300-750 g, emerge in December, coinciding with the first rains, and reach peak production in February/March. Thereafter, during the dry months, production tails off to a minimum.

We found that the germination success of seeds which had passed through the wolf's digestive tract (faeces derived), was significantly higher ($\chi^2_2 = 40.2$, $p < 0.001$) than for equivalent untreated seeds (fruit derived), when experimentally planted in local cerrado soil types. Indeed, germinating lobeira seeds were frequently seen in wolf faeces deposited along dirt roads in IBGE and SM.

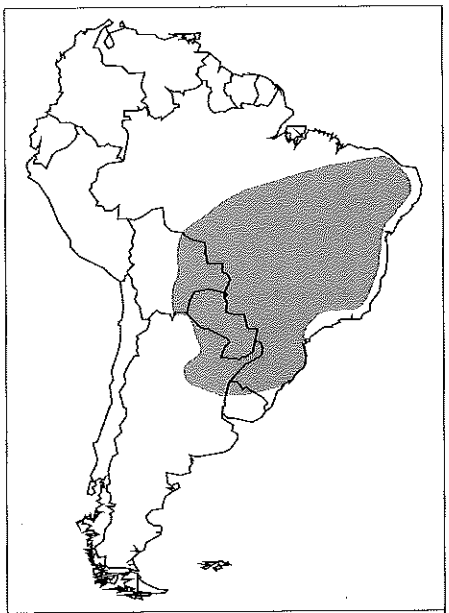


Figure 1. Distribution of the maned wolf in the wild (taken from the Canid Action Plan).

Ant Interactions

In a 24 ha sample plot of undisturbed cerrado *sensu stricto* in the SM sanctuary, we discovered an entirely unexpected component in the wolf-lobeira relationship. Each of the 34 lobeira plants located in the plot, without exception, was situated on top of an individual ant mound belonging to one of two species of Attine leaf-cutter ants, *Atta sexdens* and *A. laevigatus*. These mounds measured up to a metre high, many of which had been cleared of all other existing vegetation by worker ants.

Observations revealed that foraging ants took both fruit and wolf faeces containing seeds into the nest, and that over a period of a week, at least 40% of the seeds marked for identification purposes, were ejected from the mound via specific exit holes, along with other refuse. The germination success of lobeira seeds was significantly greater when planted in this refuse matrix (the composite of fresh ant diggings, seeds and uuidentified faecal pellets), than in cerrado soil types ($\chi^2_2 = 56.5$, $p \leq 0.001$). Moreover, in the ant substrate, faeces-derived and fruit-derived seeds germinated equally well.

Mutually Beneficial Relationships

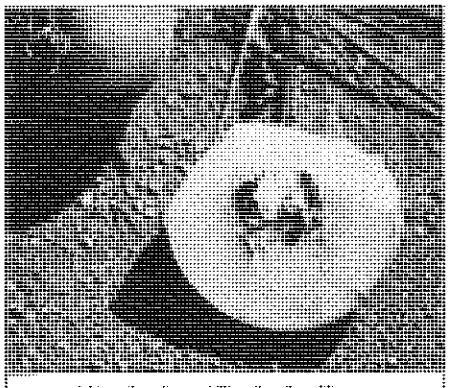
The processes behind Lobeira dispersal and establishment in undisturbed cerrado *s. s.* thus seem to involve a number of mutually beneficial relationships between the ant, the wolf and the lobeira. The anomalous large size of the fruit would seem to restrict potential dispersal agents to larger frugivorous vertebrate species: consumption by the wolf is constant throughout the year, the germination success of these seeds is enhanced, and the seeds are dispersed over relatively large distances. Faeces were identified on termite and ant mounds where the topography obviously suits the wolf's habit of depositing odorous territorial markers on high ground (Dietz, 1984). However, leaf-cutter ants also appear to facilitate seed location, either from a fruit or faeces source, and provide a suitable substrate for seed germination. Whether they further aid in plant establish-ment, by literally cutting down vegeta-tive competition, has yet to be confirmed. The reciprocal benefit to the ant is, we presume, that wolf faeces and fruit are suitable fertilizers for the cultivation of their fungus gardens (Weber, 1972; 1982). For the maned wolf, apart from its nutritional reward, lobeira may prove to be of further benefit if its secondary compounds (Motidome *et al.*, 1970) are shown to be an anthelmintic.

"the germination success of seeds which had passed through the wolf's digestive tract (faeces derived), was significantly higher than for equivalent untreated seeds (fruit derived)"

Implications for Conservation

So how does human disturbance to the cerrado affect lobeira availability to the wolf? The SM wildlife sanctuary is only 20% of the 47,000 ha commercial concern, owned by the Tocantin Cement Company, for the large scale production of fuel wood. Eucalyptus plantations are established by mechanically uprooting and burning the cerrado; the fazenda therefore comprises a mosaic of plots in various stages of development.

The abundance and distribution of lobeira was compared between the 24 ha sample plot of undisturbed cerrado *s. s.* (mentioned above), and a 23 ha plot of disturbed cerrado s. s., outside the sanctuary, which had been cleared nine months earlier prior to future planting. Regeneration of cerrado species in this plot was limited. In the undisturbed plot, lobeiras were randomly distributed (compared with a random Poisson distribution, $\chi^2_3 = 1.98$, $p = 0.6$), but not with respect to the ant mounds. In contrast, lobeira in the disturbed cerrado were not distributed at random ($\chi^2_9 = 303.7$, $p < 0.01$), rather, they formed aggregations along the plot edges (dispersion index [following Krebs, 1989] = 2.48). Our results were consistent with the known ecology of the plant as a fast-growing invasive species on disturbed ground (Oliveira-Filho & Oliveira, 1988): the distribution pattern in the latter area was the direct result of undamaged underground rhizomes giving rise to a number of new plants in the vicinity where old plants had once existed. Consequently, there was a greater density of lobeira in the cleared area than in the undisturbed cerrado, 6.7 /ha and 0.6 /ha, respectively. Vegetative regeneration was noticeably infrequent in the latter plot.



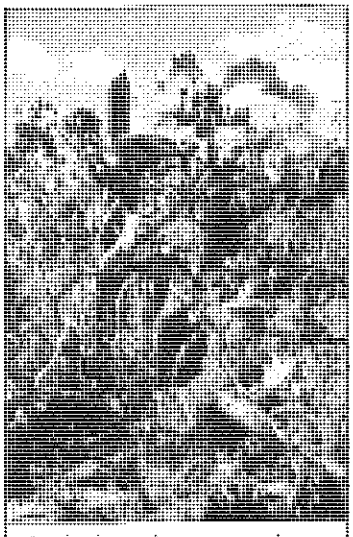
Wolf's fruit - "Lobeira".

Therefore, in the immediate post-clearance phase, lobeira regeneration is relatively fast and the primary result of vegetative propagation. In the longer term we can only be reassured by the fact that lobeiras commonly occurred along the plantation access roads and on even the smallest patches of waste ground, and that maned wolves were frequently sighted in these same areas. Thus, we suspect that the wolf, and probably the typically invasive Attine ants, can continue their role in lobeira dispersal even in this degraded environment.

An optimistic conclusion is that small scale alterations to the cerrado *s. l.* (eg. dirt roads, patchily distributed pastures) have little effect on the wolf's livelihood. The recent predominance of hooded livestock in cerrado regions may indeed aid in seed dispersal: casual observations indicate a preponderance of lobeira plants in cow pastures and corrals; cowboys have even been reported to produce the plant to fatten swine on the fruit (Correa, 1962). Larger scale operations may encourage net fruit production under certain circumstances, as it appears in the case of Fazenda SM where cleared cerrado plots are sometimes allowed to fallow prior to planting.

"we suspect that the wolf, and probably the typically invasive Attine ants, can continue their role in lobeira dispersal even in this degraded environment"

The extent of geographical sympatry of the maned wolf and the plant is not well documented. In Brazil at least, *S. lypocarpum* is reported to occur in the states of Minas Gerais, Goias, Matto Grosso and São Paolo (Correa, 1962; 1984; refs above), an area which includes much of the 0.5 million km² ex-forested zone, where the maned wolf has extended its range in recent years (Dietz, 1985a; b). Whether lobeira invasion following deforestation is a prerequisite for the colonization of previously unsuitable areas by the maned wolf remains to be shown.



Lobeira plant growing on disturbed land.

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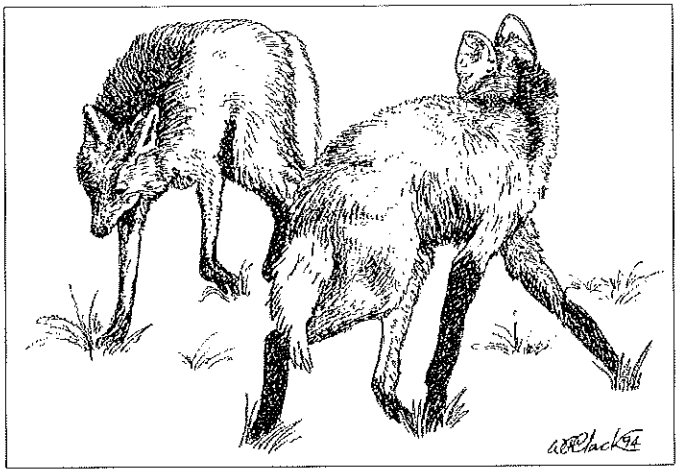

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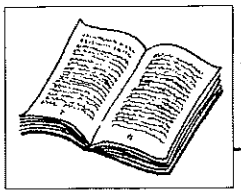

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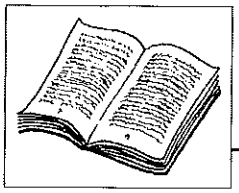

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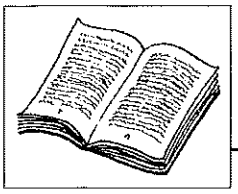

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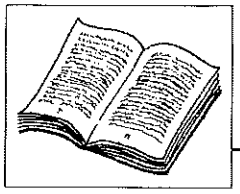

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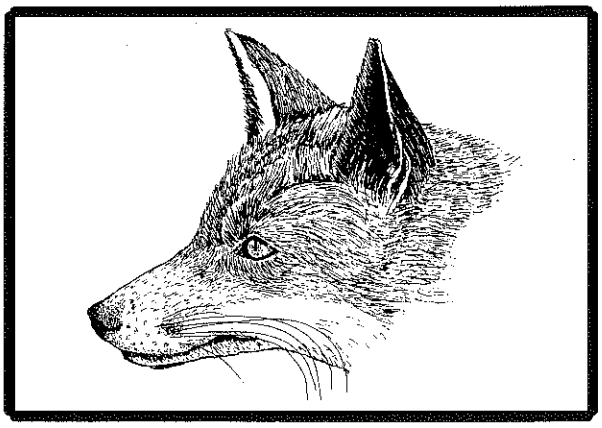

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