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Abstracts

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Estimated Diet of the Dhole or Asiatic Wild Dog (*Cuon alpinus*) in Kanha Tiger Reserve, Central India

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A field study was carried out on the ecology of dholes in the Kanha Tiger Reserve, central India, from June 1998 to June 2000. One of the objectives was to estimate the diet of dholes from their scats and kills and also to estimate prey abundance. Scats of the dhole and other predators from Kanha were analysed for the occurrence of prey remains. Kills of dholes were located and kill characteristics were recorded. The Line Transect Method was used from March to June 2000 for estimating prey species abundance. Vehicle counts were used to measure prey encounter rates along forest tracks. *Ad hoc* sightings of dholes and their prey species were recorded with respect to numbers, age/sex class, sighting location, and activity. Detailed findings and their inferences are discussed.

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Faecal DNA Sampling to Detect the Presence of Coyotes and Hybrids in the Red Wolf Recovery Zone

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Genetic and morphological analyses have documented hybridization between re-introduced red wolves (*Canis rufus*) and immigrating coyotes (*Canis latrans*) in north-eastern North Carolina. To address this problem, the U.S. Fish and Wildlife Service has developed an adaptive management plan that includes creating and maintaining a coyote and hybrid free zone on the Alligator River National Wildlife Refuge (ARNWR). We have developed and imple-mented a non-invasive genetic sampling method to screen for the presence of coyotes or hybrids across the 250,000 acre ARNWR. To obtain samples, faeces were collected along all refuge roads and GPS coordinates were taken. Faecal samples were identified to species (dog, coyote, red fox, gray fox, bobcat, red wolf) using restriction enzyme analysis of cytochrome b and sequencing of the control region segment of mitochondrial DNA. In 2000, over 400 faeces were collected and 72% were successfully assigned to species. Four different carnivore species were repre-sented in the samples, but no coyotes or hybrids were detected. In 2001, over 500 faecal samples were collected and are currently being analysed to species. This method has tremendous potential in the ARNWR and other study areas for species identification and individual identification of canids.

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Detecting Coyote Introgression into the Wild Red Wolf Population

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Genetic analyses have established that some released red wolves (*Canis rufus*) are hybridizing with a recently established coyote (*Canis latrans*) population in north-eastern North Carolina. One immediate USFWS red wolf recovery objective is to conserve the red wolf gene pool and effectively manage coyote introgression. In order to accomplish this, field personnel need to distinguish between the two canid species and their hybrids. We developed a genetic diagnostic test by screening the fourteen red wolf founders, a subset of the captive population and south-eastern coyotes at 24 microsatellite loci. Genotyping the founders allowed us to determine possible alleles in the current red wolf population while the captive subset helped established allele frequency distributions of individuals released into the wild. We combined this data with the known genealogies of red wolves released into the wild to simulate possible microsatellite genotypes and allele frequency distributions of wild red wolves. We then simulated genotypes for hybrid and back-crossed individuals by combining our wild red wolf and coyotes genotype databases. This allowed us to assign captured individuals of unknown origin to different categories. This technique will help implement the adaptive management plan and play a key role in efforts to recover the red wolf.

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Genetic Characterization of Himalayan Wolf, an Endangered Canid from India, Using DNA Markers

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Himalayan wolves (HW), numbering about 350 individuals in the wild, are probably among the world's most endangered canids found in the upper Trans-Himalayan ranges. Although regarded as an extremely endangered species, there has been a complete lack of systematic effort to understand their population biology and genetics. Moreover, as per the available information, these represent an isolated population of the same species, *Canis lupus* (Grey wolf) found in plains of peninsular India. Recently, we have initiated molecular characterization studies on these endan-gered animals to understand their genetic structure and taxonomic status relative to the Indian Grey wolf from the plains and other wolf-like canids from India and the rest of the world. As a first step in this direction, we have analysed the genetic variability in few representative samples of HW, Indian Grey wolf, wild dogs and jackals, using three different DNA typing approaches i.e., haplotypic variation specific to the 'mtDNA cytochrome B region', and RAPD and Microsatellite markers. Our preliminary results reveal reasonably significant genetic variation in the Himalayan wolf samples indicating that their present day small population is genetically vibrant and that these are genetically well differentiated from the gray wolf and other Indian canids from the plains.

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Transboundary Movements of Wolves in Latvia and Estonia: Results of a Pilot Study

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In two winter seasons of 1999-2000, wolf movements through the Latvian – Estonian, Latvian – Russian and Estonian – Russian borders were studied. The study was financed by the Regional Environmental Centre and carried out by the Estonian and Latvian Funds for Nature in close co-operation with the national border guard authorities. Border guards had to fill out special questionnaires when on patrol along the border, recording the tracks of large carnivores observed (including the number of individuals and direction of their movement). In Latvia, 93 crossings of wolves (about 145 animals) were recorded with a slight positive balance toward immigration (+35 individuals). Most of the crossings were recorded at the border with Russia, which can be explained by lower hunting pressure and consequently higher wolf density in Russia. In Estonia, movements of 17 wolves were recorded at the borders, giving a balance of +11 animals. However, due to irregular patrolling the data obtained are very rough and cannot serve for precise estimation of immigration rate. Without marking the animals it is impossible to distinguish between true immigrants and territorial individuals moving within their home range in the border area. The method is useful for obtaining background information on wolf movements in inac-cessible and vast areas and for distin-guishing the areas of further conservation interest (ecological corridors).

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Demographic Structure of the Latvian Wolf Population

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In 1998-2000, 84 wolves (19% of those legally hunted in Latvia in that period) were examined – sexed and aged (by the annuli in the canine root), reproductive status determined (in females, by placental scars in uterus). The ratio of males to females was 1:1.3. Predominance of females was most pronounced in pups up to one year old (1:2.4) and in the forth year (1:2.7). Predominance of females can be a result of a heavy hunting pressure or it could be a collection bias as well. There are indications in the total annual hunting bag, however, that the ratio of females increased in the last few years – possibly as a mechanism to compensate losses due to over-hunting. 83% adult females were capable of having pups. Embryo number ranged from 4 to 10, on average constituting 6 (n = 10, SD = 1.89). The ratio of subadult individuals was less than expected from the number of adult reproducing females - only 20% of the sample versus 70% of the expected. Obviously, some other pre- and post-natal mortality factors exist, including elimination of pregnant and lactating females by hunters because currently wolves are allowed to shoot all year round. Low ratio of old animals is another indication to the strong hunting pressure (the oldest individual was 13 years old).

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Dhole Depredation and its Consequences for the Carnivore Community in Arunachal Pradesh, North East India

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An assessment of the problem of livestock-depredation was carried out in some settlements in and around Sagaali, Arunachal Pradesh, Northeast India by examining evidence of carnivores on livestock kills and on animals that had been attacked. A questionnaire survey was also used to ascertain the nature and extent of the problem in the area. In this poster we present results from this survey suggesting that dholes (*Cuon alpinus*) were responsible for most of the predation followed by leopards (*Panthera pardus*), clouded leopards (*Neofelis nebulosa*) and tigers (*Panthera tigris*). It appears that frequent predation on *Mithun* (*Bos frontalis*) (a semi-domesticated bovid which is an important economic asset within the region), creates antagonism among owners of livestock which results in retaliatory hunting. This was substantiated by the discovery of a number of pelts and remains of dholes and other carnivores within houses of surveyed settlements. This result also indicates a hitherto lesser known, though serious threat to the dhole. It further demonstrates the negative effect of dhole livestock predation on the carnivore community in the area. In addition we summarize the attitudes of affected people and by examining changes in human population and land use in the region, we speculate on possible causes for an increase in carnivore-human conflict within the area. We also present a set of recommendations for mitigating this conflict.

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Gray Wolf Restoration in the North-western United States

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Gray wolf (*Canis lupus*) populations were eliminated from the western United States by 1930. Dispersing wolves from Canada lacked legal protection until passage of the federal Endangered Species Act (ESA) of 1973. By 1986 packs formed in north-western Montana. In 1995 and 1996 wolves from western Canada were reintroduced to remote public lands in Idaho and Yellowstone National Park, Wyoming and were specially designated to increase management flexibility. Wolf population growth has occurred rapidly. Over 400 adults were present in December 2000 and nearly 200 pups were born in April 2001. The wolf population in the north-western U.S. should be recovered and removed from ESA protection by 2003. Wolf restoration has proceeded more quickly and with more benefits (public viewing) and fewer problems (livestock depredations), than predicted. Because over 80% of adult wolf mortality is human-caused, the interagency recovery program focuses its efforts on addressing the concerns of people who live near wolves to increase human tolerance. Wolves restored important ecological processes to several large wild areas in Montana, Idaho, and Wyoming. The program has been widely and internationally publicized and is generally viewed as highly successful.

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On Biometry and Sexual Dimorphism in Wolf

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There is little information on sexual dimorphism in wolf (*Canis lupus* L.), especially in Western Europe. We present basic data on external and cranial wolf biometry emphasizing the difference between both males and females. We measured a sample of 35 specimens, 14 females and 21 males, which are two or more years old. All the wolves were collected in Galicia (NW Iberian Peninsula). The results show that there is a large individual variation in size, which is more marked in males than females. Mean body weight is 38 kg (29-46) in males and 30 kg (27-34) in females. On average, male linear parameters were 7% larger than females, although all the measurements show some overlapping. A discriminant analysis was carried out using six external and 13 cranial measurements, and we noticed that body weight and zygomatic breadth showed the most important difference between both males and females. We provide some averages and ranges, in centimetres, for males and females, respectively: Head and body, 114 (105-127) and 106 (95-113); Tail, 40 (36-45) and 37 (32-41); Shoulder height, 77 (72-86) and 73 (68-78); Greatest length of skull, 25.66 (23.97-27.14) and 23.87 (22.01-25.96); Zygomatic breadth, 14.58 (13.38-15.42) and 13.59 (12.50-14.13).

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Selection of High Sites for Placing Scats by Wolf

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Scats placed on high sites play an important role in the territorial marking of wolf (*Canis lupus*). A study carried out during two consecutive years (1998-2000) in Montes do Invernadeiro (NW Spain) has revealed that prominent plants and terrain features accumulated a substantial proportion of faeces. Reproductive individuals deposited significantly more scats on top sites, and selected for higher points, than non-reproductive individuals. Top placed faeces, mainly from the reproductive pair, were more common along the roads and tracks. While establishing in a territory or during the breeding period the reproductive pair top placed their scats from at trail intersections in mountain ridges near the rendezvous site. In contrast, during this time scats lying directly in the soil were randomly spread over the whole territory, independent of altitude. Spatial distribution of scratchings is alike to the top placed scats. In the rendezvous site many scats were observed, all of them at ground level. So here, scats ought not be considered as territorial marks but only as the result of an intensive use of the area.

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Plant Selection for Scat Marking by Wolf

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It is well documented that wolves (*Canis lupus*), like other carnivores, deposit scats on conspicuous places. Faeces seem to play an important function as scent and visual marks for these animals. A wolf population in Northern Spain has been studied during two consecutive years (1998 May – 2000 May) by surveying lineal transects that included roads and firebreaks. Results reveal that conspicuous sites are not equally selected for placing scats, with particularly plant species preferred. Woody species were chosen in preference to grasses, with Espartos (*Pterospartum tridentatum*) and heaters (*Erica sp.*) being especially targeted. Therefore it can be concluded that wolves mark mainly the vegetal substrata that guarantee a great duration and efficacy of scats as signals.

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High Placed Urination in Wolves (*Canis lupus*) in Captivity

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Urination is considered to be the main method used by canids for marking. At Madrid Zoo, four wolves (two reproductive pairs) were studied for one year, and all the marking episodes were registered. Notably, the marking postures used by wolves influenced the proportion of urinations emitted onto elevated substrata. During raised leg urination (a posture characteristic of males) conspicuous and prominent points were selected, while squat urination (a posture characteristic of females and young individuals) was carried out directly on the ground. The length of urination acts showed significant intersexual differences, with a shorter mean urination time in males. The mean length of urnaition episodes was also less in individuals that urinated more frequently. In wolves, the posture adopted during urination, the urination length, its frequency and the urine volume voided in each episode can be employed as criteria for true scent marking from simple elimination. Our results show that urine marking is almost exclusively a male activity, while in the majority of cases female urination can be viewed as mere excretion.

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Use of a Natural Emetic in *Lycaon pictus*

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Zoopharma-cognosy is a field that has recently attracted much interest and attention. Here we describe a possible case in an Africa wild dog (*Lycaon pictus)*, from the Kruger National Park, South Africa. The ingestion of grassblades (*Graminae* spp.) is well known in carnivores and acts as a means of stimulating the regurgitation of fur (trichobezoars in *Felis* spp.), and other undigested material. It also may function to remove and purge intestinal parasites. The action is certainly mechanical and is possibly mediated by some toxic com-pounds. We observed an instance of a helminthemesis (*Dipylidium caninum*) by an old female *Lycaon pictus* following ingestion of grass.

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Evidence for Induced Ovulation in Channel Island Gray Foxes (*Urocyon littoralis*)

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Faecal hormone analysis of samples collected from captive Channel Island gray foxes on San Miguel Island during the 2000 and 2001 breeding seasons was used to delineate their reproductive pattern. Based on sustained increases in faecal progesterone as an indicator of ovulation, results suggest that female Channel Island gray foxes are induced ovulators. Ovulation occurred in 8 of 9 females housed with males, in 0 of 6 females housed singly, and in 1 of 6 females housed in female/female pairs. The single case of failure to ovulate in a female housed with a male occurred in 2000, and may be attributable to stress since this was her first year in captivity. She did ovulate in 2001, while still housed with the same male. However, cortisol levels were not related to the occurrence of ovulation. The absence of a difference in faecal oestradiol between ovulating and non-ovulating females indicates that oestrus is spontaneous. These results are significant because all canids studied to date have been shown to ovulate spontaneously. However, because endocrine data are available for only a fraction of canid species, induced ovulation may not be unique to Channel Island gray foxes.

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Exhibit Space Availability in North American Zoos: a Limiting Factor in Success of Programs for Canid and Hyaenid Species

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Captive animal managers rely on field biologists for vital information such as a species conservation status or behavioural ecology. Recently, the American Zoo and Aquarium Association's (AZA) advisory group for canid and hyaenid species met to evaluate recommendations for North American zoos. During this evaluation, the number of exhibit spaces for each species was tabulated since space availability impacts breeding program success. One of the notable results was that most species are being housed in groups of 1 to 3 individuals, in contrast to the larger group sizes sometimes seen in the wild. An increase in group size would increase available space, while also contributing to animal welfare by providing a more enriched environment and by adding value to the educational aspect of the exhibits. However, group size cannot be increased without considering the species' natural social structure using input from field biologists. Examples of other results include: space flexibility, composition of animals within groups and effectiveness of the breeding programs in utilizing the spaces available. In order to strengthen existing programs, collaboration between field biologists and captive managers is essential to integrate the behavioural ecology of a species with the need to manage viable populations in limited exhibit space.

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Aspects of Canid Systematics Revealed Through Supertree Analysis

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Many different data sources have been used historically to estimate the phylogenetic relationships of canids, both within the family and in relation to other groups of Carnivora. Although certain sets of relationships for the family are widely agreed upon, it remains that no phylogeny for all extant species exists that is based on all available data and derived using a rigorous methodology. I use supertree construction to provide the first such estimate and to summarize the current state of canid systematics. The supertree confirms canids as the sister group to the remaining caniform carnivores, the Arctoidea. Within canids, the supertree was based on 35 studies published between 1967 and 1995 inclusive, with times of divergence estimated from 17 studies. Two major clades exist within canids, comprising the dog-like and fox-like forms. Several problematic taxa were inferred to cluster basally within either the dog-like (*Nyctereutes procyonoides*) or fox-like clade (*Otocyon megalotis* and *Urocyon* spp.), although support for these placements was comparatively weak. Several monotypic genera (e.g., *Atelocynus*, *Cerdocyon*, *Chrysocyon*, *Cuon*, *Lycaon*, and *Speothos*) were included in the dog-like clade, but of uncertain placement due to highly conflicting opinion. Further analysis showed that estimates of canid phylogeny differed significantly according to all the factors that I investigated: age of the study, the data source used, the number of species examined, and the tree construction method employed. This indicates more historical disagreement about canid phylogeny than in the remaining carnivore families, which showed fewer or no significant differences for the same factors.

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Effects of Removing Breeding Coyotes on Coyote Spatial Organization

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Territorial, breeding coyotes are responsible for most predation on domestic sheep. Selective removal of depredating breeding coyotes is effective at reducing predation losses, but has the potential to disrupt both the social and spatial organization of a coyote population. We used radiotelemetry to investigate the effects of high breeder mortality on coyote spatial organization in north coastal California, USA. To examine stability of breeding territories through time, we compared the size, overlap and configuration of 90% adaptive kernel (ADK) home ranges and 65% ADK core areas of successive pairs. Four turnovers involved only 1 member of the breeding pair, 7 involved both members, and no information was available on the uncollared mate of 2 other pairs. Four home ranges contracted, 5 expanded, and 4 remained unchanged; average size of original and replacement ranges was similar. Home ranges decreased on average for 2 member turnovers and increased for 1member turnovers. No pairs with 1 new member contracted their home range and only 1 pair with 2 new members occupied a larger range than the original pair. Average overlap of replacement on original home ranges was <75% for both 1 and 2 member turnovers. Nine of 13 turnovers involved exchange of some core area among neighbouring territories, including all turnovers involving both members of the pair. We assessed home range fidelity of 11 coyotes that lost their mates by measuring the overlap of monthly 90% ADK post-removal home ranges on the pre-removal range for 1-3 months after the death of their mates. One breeder was displaced from her home range and 3 other breeders shifted their home ranges. Seven breeders remained within their pre-removal home ranges, but the number of forays >.5km from the home range boundaries increased slightly during the post-removal period. Finally, we examined whether neighbouring breeders responded to removals in adjacent territories by examining shifts in their 65% ADK core areas. Only 2 neighbours shifted their cores into the removal range during the first 2 months following a removal. Neighbours were equally likely to shift their cores toward or away from the removal range during the first month after a removal, but were more likely to shift toward the removal range during the second month. With one exception, the largest changes in space use involved neighbours who had also lost their mates. Breeder turnover was highest in territories that overlapped lambing pastures, and these territories were less stable than those that did not overlap lambs. The effects of breeder mortality on coyote spatial organization appear to be localized.

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Wolf Habituation: Friend or Foe to Wolf Recovery?

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Fear of wolves *(Canis lupus)* and severe persecution by humans caused the extirpation of wolves from much of their former range in Europe and the U.S. However, emerging pro-predator sentiments have softened these fears and the pendulum has continued to swing to the pro-wolf side until present perceptions of wolves are often naively unrealistic. The increasing tolerance of humans toward wolves, and vice versa, has occurred concurrently with increasing habitat fragmentation and human occupation of landscapes suitable for wolves. Wolves have significant behavioral plasticity, fecundity, and resiliency, and wolves often become habituated to humans and human activities. This adaptability has allowed wolf populations to expand worldwide, with a concurrent increase in the frequency and intensity of wolf-human encounters. Thus two important issues are 1) the extent habituation is occurring in wolf populations, and 2) the implications of habituation upon the coexistence of wolves and humans in human-dominated landscapes. I will discuss the causes of wolf habituation, specifics of recent "wolf attacks", and the consequences habituation may have on wolf conservation and restoration efforts worldwide. Increasing levels of wolf-human conflict will require innovative solutions to conserve this dynamic carnivore.

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Personality Assessment as a Predictor of Survival Rates of Captive-Bred Swift Fox

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Successful captive breeding and re-introduction programmes rely on a variety of factors. Availability of suitable habitat, finance, genetic diversity, pre-release training, and physical health are just a few of the components that must be considered. Several studies have covered the ability to learn necessary survival skills through training, and the need for maximum genetic diversity, however, one aspect that is often overlooked is the animals personality/ timidity. This may be important in survival after release. This is examined in a release programme of the endangered swift fox (*Vulpes velox*). Behavioural responses to four novel stimuli presented twice during a 3-month period prior to release were recorded, and individuals were given boldness scores depending on responses. Survivorship of 15 radio-collared individuals were investigated 6 months following release, to determine whether there was a relationship between behavioural attributes and survival rates. Five of the 15 released foxes died during the first 6 months following release. Analysis of boldness scores and survival showed a significant correlation ($df = 13$, $t\text{-value} = 3.058$, $P<0.01$) implying that bolder foxes have lower survival rates.

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The Use of Molecular Tools in Management Procedures of Existing Canid Captive Breeding Programmes

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Endangered swift fox (*Vulpes velox*) are captive bred at a facility in Canada for reintroduction onto Blackfeet Tribal Lands in Montana. Previous management procedures have consisted of compiling a studbook using empirical data, however, this provides a margin for error, leading to the risk of an increase in inbreeding. Genotyping all existing foxes within the colony tested the accuracy of the studbook records, and commenced a molecular database for future reference. From 1998-2000 83 blood/tissue samples were collected from all foxes in the colony over a three-year period. This provided a sample set containing several generations of parents and offspring to be used as a test of the studbook accuracy, thereby providing an indicator for inbreeding potential. DNA from all samples were amplified using PCR techniques for 7 microsatellite loci, taken from the Dog Genome Project and previous publications. Results were analysed using parentage assignment software developed for this purpose. Whilst the analysis confirmed studbook registrations for a high proportion of offspring, several discre-pancies were highlighted, illustrating the usefulness of this test.

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The New Guinea Singing (Wild) Dog

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The New Guinea Singing Dog [NGSD] is a wild dog indigenous to the mountains of New Guinea. The NGSD was first described by E. Troughton in 1957 and named *Canis hallstromi*. Subsequently, other authors have designated the NGSD *Canis familiaris hallstromi*, *Canis familiaris dingo*, *Canis dingo*, *Canis dingo hallstromi*, or *Canis lupus dingo*. This canid has never been studied in the wild and virtually nothing is known concerning its behaviour, social organization or general natural history under free-ranging conditions. From the few sightings reported, the NGSD appears to be rare in its native habitat and to range from about 2,500 m up to 4,300 m. There are < 50 specimens (all highly inbred) currently in the documented captive breeding population. V. Simonsen (1976) reported that NGSDs had 17 of 18 blood enzymes that matched coyote (*Canis latrans*) rather than domestic dog (*Canis familiaris*) or wolf (*Canis lupus*). Observations of captive specimens in the North American population have revealed that NGSDs posses several unusual and some unique characteristics compared to domestic dogs and wolves. It now seems likely that the NGSD is not, as commonly assumed, merely a feral domestic dog. It may be a unique and highly endangered taxon.

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The Wolf in Turkey: Its Status and the Conservation Challenges

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The grey wolf (*Canis lupus*) is the third largest predator in Turkey after brown bear (*Ursus arctos*) and Anatolian leopard (*Panthera pardus tulliana*). The other members of the family Canidae that occur are golden jackal (*Canis aureus*) and red fox (*Vulpes vulpes*). The wolf was once common in Turkey but since the 1980s the population has been in decline. Nevertheless, the country still holds the largest wolf population in Europe with viable populations in Northern, Central and Eastern Anatolia. The wolf has disappeared from large parts of western, north-western and southern Turkey and, where it is not extinct the populations are highly fragmented and isolated. The local people in Turkey generally tolerate the wolf's presence despite the damage it does to livestock. It is difficult to estimate the scale of this and, equally, the total number of wolves killed in a year, since the authorities keep no records. The wolf has no legal protection status in Turkey and the terrestrial hunting law of 1937 allows wolf hunts throughout the year without any quotas. The official view on the wolf is that "it exists everywhere" but this view has to change since hunting is rampant and habitat fragmentation and loss are increasing. Studies of wolf distribution, potential habitat and prey availability are needed to develop a national conservation strategy to secure the future of the wolf in Turkey.

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Feeding Success of African Wild Dogs in Relation to Group Size and Kleptoparasitism: The Emergence of an Allee Effect?

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Ecosystem level dynamics are often neglected in conservation studies involving single species. Here we investigate the effects of interspecific interactions between a subordinate member of a carnivore guild, African wild dogs, and a key competitor, spotted hyaena, using records of over 700 dog kills in the Serengeti between 1964-1987. Changes in the level of interaction between these species were monitored over a period when hyena numbers approximately doubled. Using foraging data collated for this study and a foraging model, we estimate feeding performance on a kg/dog/kill basis for different dog group sizes, prey size and numbers of hyenas attending kills. We find that hyaena attendance substantially influences the amount of time that dogs have access to the carcass. Singletons performed best when carcasses were completely consumed and no hyenas were present. Groups of three or more fed on all prey sizes and performed best with hyenas present. Optimal hunting group size increased with increasing levels of hyena attendance because the benefits of increased carcass defence outweighed the costs of having to share the carcass with more dogs. However, typically the impact of kleptoparasitism on medium to large groups may be limited because 2/3 of the available meat is consumed within 10 minutes. Our results show that there was an increase in hyena attendance at dog kills corresponding with an increase in hyena density. There was also a decline in dog group size in the

1970s and 1980s. Dogs in the 1980s appeared to compensate for the increased effects of competitive interactions by consuming more of the carcass (typically 20% more), however, these remains are largely made up of skin, sinew and bone, which probably is of lower nutritional value. Dogs in the 1980s appear to have a lower kill rate (measured as kg/dog/day) and the finding that they ate more of the carcass is consistent with the idea that these dogs were energetically stressed.

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Topographic Barriers to Gene Flow in Wolves (*Canis lupus*) of the Canadian Northwest

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This study characterizes population genetic structure among grey wolves (*Canis lupus*) in North-western Canada and investigates potential physical and biological deter-minants of this structure. 491 grey wolves, from nine regions in the Yukon, Northwest Territories, and British Columbia, were genotyped using nine microsatellite loci. Nei's standard genetic distance, F-statistics, the genotype assignment test, and the Mantel test were then use to identify and test patterns of gene flow between wolves in different regions. Results indicate that wolf gene flow is significantly reduced across the Mackenzie River, most likely due to the north-south migration patterns of the barren-ground caribou herds that flank it. Furthermore, while Banks and Victoria Island wolves are genetically similar, gene flow between island and mainland wolves (across the Amundsen Gulf) is limited. However, low-level island-mainland wolf migration may occur in conjunction with the movements of the Dolphin-Union caribou herd. While previous authors have examined isolation by distance in wolves, the present study is the first to demonstrate correlations between the genetic structure of wolf popu-lations and the presence of topographical barriers between them. Perhaps most interesting is the possibility that these barriers may reflect prey-specialization by wolves in different regions.

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Group Size and Allee Effect in the African Wild Dog (*Lycaon pictus*): New Insights Through Stage-structured Population Models

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Recent research based on literature review and logistic models suggests that pack size is critical to African wild dog (*Lycaon pictus*) population persistence by generating an Allee effect at the pack and population level. We built deterministic and stochastic stage structured models to simulate the complex social structure of an African wild dog population. Our approach takes Allee effect into account by (i) including a critical pack size and a critical cohort size under which pack and cohort would split, (ii) decreasing pup and adult sized individual survivals at low pack size and (iii) increasing dispersal probability at low pack size. Our simulations explore the influence on extinction probability of these previous factors, in situations of poaching, prey depletion, habitat fragmentation and disease outbreaks. Our results provide new insights on critical pack size and Allee effect for the conservation of the African wild dog.

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Ecological Economics of Wolf - Livestock Conflict in the French Alps

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Wolves returned in France from Italy in 1992 and have inflicted damages to cattle farming activities for a global cost of 0.95 millions Euros (1,185 attacks / 5,529 dead sheep). The French government proposed management plans for designing non-wolf and wolf zones and for allowing wolf removals if attacks occur repeatedly on a farm. We build a wolf stage structured population model connected to economic data to explore what would be the cheapest solution to solve the wolf-sheep farming conflict, while minimizing both the numbers of predated sheep and the numbers of wolf killed to address public concern. A manager could decide to do nothing, to protect farms with enclosures and guard dogs or to kill wolves in surplus of the population considered as viable. Each of these actions has a cost that was incorporated into the model. Our results show that killing surplus wolves may not be the best long-term solution. Protection measure efficiency and cost of legally killing wolves are the parameters to which the space of solution is the most sensitive.

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Managing the Wolf (*Canis lupus*) Expansion in Western Europe: Conservation and Control Strategies

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Securing the long-term acceptance of large carnivores such as the wolf (*Canis lupus*) in Europe and North America raises a difficult challenge to conservation biologists: planning removals to reduce depredations on livestock while ensuring population viability. We developed stochastic stage structured population models to understand what drives wolf population dynamics and to predict the effect of zoning and adaptive management strategies. Our results show that a wolf population can have high growth rate but can show dramatic decline once more than one third of the population dies every year. Pack breeder survival has a critical impact on population growth. Among the various management strategies advocated by agencies, zoning that involves eliminating wolves outside a restricted area should be designed with caution because probabilities of extinction are extremely sensitive to the maximum number of packs an area can support and to slight change in survivals of wolves. In a zoned population, viability is enhanced more by decreasing mortality rates of all wolves rather than increasing wolf zone size. An alternative to strict zoning is adaptive management, where there is no limit on pack number but population control is operated whenever some predefined demographic conditions are met. We model a strategy where managers are assumed to remove a given number of wolves or percentage of the population when growth rate from the previous year exceeds a given threshold. An adaptive management strategy that removes a moderate percentage (10%) of the population when it shows a median increase (> 5 %) would provide visible actions addressing public concerns while keeping extinction probability at low levels. Our analysis emphasizes the need to better estimate wolf life history parameters before decisions on management strategies are made for small populations.

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Ecology of a Wolf pack in a Semi-agricultural Landscape in Tuscany, Central Italy

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Following range expansion throughout Italy, the wolf has recently reached semi-agricultural areas of intense livestock production, where local farmers lack ex-perience and willingness to deal with large wild predators. One of such areas, in the Province of Siena, has been re-colonised by wolves since the early '90s when, in few years, livestock depredations raised to the highest levels reported for the entire Region. For this area, featured by gently rolling hills interspersed with deep ravines, we hereby report on demography, feeding ecology, home-range, movements and habitat use by the local pack of wolves. The study (1993-94) was carried out by means of radio-tracking, wolf-howling, direct observations and scat analysis. Two pack members were fitted with radio-collars and located from the ground at least once a day, and monitored continuously (1 location/10 min.) during nocturnal movements. The local pack produced pups in both summers, with minimum litter sizes at first sight of 5 and 6 pups. Minimum pack size in winter ranged 3 to 5 wolves, corresponding to territorial densities of 1.4 – 2.3 wolves/100 km2. The territory (100% MCP = 220 km2) was centred in areas of high sheep production but low human density. Paved road density within the territory (0.42 km/km2) decreased significantly in areas of concentrated use by wolves (i.e., kernel £ 50%). Roe deer composed most (51%, frequency) of the diet, followed by sheep (21%) and wild boar (6%). Both high densities of roe deer and easy accessibility of sheep, coupled with low human densities and local topography (i.e., ravines), appeared to represent critical conditions for the local persistence of the species. Our results represent a first contribution to fill the gap in our knowledge of the ecology of wolves in agricultural and semi-agricultural landscapes, and they contribute to a more comprehensive definition of what has been traditionally perceived as suitable habitat for wolves in Italy.

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Relations Between Sechuran Fox (*Pseudalopex sechurae*) and Man in Peru: Threats and Uses

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Interviews were conducted with 32 shamans, 11 salesmen of crafts and witchcraft items, 28 individuals who possessed handcrafts or amulets made with parts of the Sechuran fox, and 120 rural residents. The purpose of the interviews was to obtain data regarding the use of and attitudes towards the species, as well as to search for examples of captive breeding of this species. The Sechuran fox seems to have played an important role in the religions of the pre-inca cultures of Northern Peru. This role is evidenced by the presence of fox bones in human tombs, as well as by the pictorial and sculptural representations of these animals and of zoomorphic characters by the Mochica and Chimu cultures. Today, rural residents pursue this species (68.3%) or view it with indifference (31.70%). In just one particular case (Santa Catalina de Chongoyape, in Lambayeque), residents have recently started protecting the animal for its value in touristic endeavors and for seed dispersal. Rural residents hunt the Sechuran fox due to the fact that it eats chickens and guinea pigs (95% of those surveyed) as well as vegetables and stored foods (13.3%). Some respondents also noted the suspected (but not proven) role of the Sechuran fox as a predator of goats (10%). Occasional sport hunting of the animal by illegal poachers was also reported. The common uses of the Sechuran fox are: the selling of the animal as a pet, which occurs infrequently, and the fabrication of witchcraft items (used by shamans), amulets (called *seguros*) and other crafts, all of which are prohibited by law. The species is used by shamans to call upon spirits and give stronger prophesy powers (100% of the surveyed), and to treat respiratory and stomach ailments with its fat (15.6%).

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The Implications Of The Allee Effect for the Conservation of Painted Hunting Dogs

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Despite current legal protection, the decline of painted hunting dogs, *Lycaon pictus*, continues. *Lycaon* suffers from many threats, including habitat fragmentation, human persecution and heavy pressure by natural enemies (predators, competitors, parasites). Here we focus on a potential further threat, arising from the specific features of *Lycaon*'s social system and life history traits. Obligate cooperative breeders could suffer inverse density dependence, because of their need for helpers for survival and/or reproduction. This could in some cases be accompanied by the existence of a critical group size below which the capacity of the group to maintain itself becomes increasingly small, creating an Allee effect, which would increase the risk of group extinction. In *Lycaon*, such an Allee effect could be generated by their need for helpers for cooperative hunting, defense of kills from kleptoparasites, pup feeding and baby-sitting. We present recent results, coming both from empirical and theoretical studies that suggest that such a threshold could exist, around 5-6 adults, in this species. Because they push them below this critical pack size, anthropogenic causes of mortality would be experienced differently in this species. This can have significant implications for the conservation of this species, as well as that of other cooperative breeding canids.

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The Significance of Canids in the Epidemiology of Human Leishmaniasis

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Domestic dogs are the principal mammalian reservoir host of human and canine leishmaniasis resulting from infection with a number of different protozoan *Leishmania* parasite species. Wild canids show high infection rates similar to domestic dogs which has led to the suggestion that they may amplify transmission rates, or (re)-introduce infection into parasite free areas following successful intervention. Results from extensive field investigations into the epidemiological role of the crab-eating fox *Cerdocyon thous* are presented, answering two fundamental questions (i) what is the transmission potential of a naturally infected wildlife host population, and (ii) can such a population maintain a transmission cycle independent of infectious domestic dogs. The results are discussed in the context of other canid species involvement in the epidemiologies of Leishmaniases worldwide.

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Current Conservation Efforts For San Joaquin Kit Foxes

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The San Joaquin kit fox (*Vulpes macrotis mutica*) is classified as Endangered in the USA and Threatened in the state of California. A recovery plan has been completed for this taxon, and this plan recommends a dual recovery strategy comprising habitat conservation and essential information gathering. Ongoing habitat conservation efforts consist of land protection through acquisition, conservation agreements, "Habitat Conservation Plans," "Safe Harbour" programs, retirement and restoration of agricultural lands, and mitigation measures required for develop-ment projects. Current research efforts include a number of field investigations such as the demography and ecology of urban kit foxes, use of agricultural landscapes, interspecific interactions with non-native red foxes (*Vulpes vulpes*), use of artificial dens, use of canals as movement corridors, effects of roads on demography and ecology, response to cattle grazing, response to military training activities, population gene-tic structure, effects of rodenticide exposure, and efficacy of dogs in locating kit foxes or their sign. Other research efforts include GIS-based analyses and modelling of range-wide habitat quality, habitat acquisition strategies, optimal reserve design, and population viability. A more comprehensive population monitoring program would benefit the conservation and recovery of San Joaquin kit foxes.

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Is the Endangered Fennoscandian Arctic Fox Population Genetically Isolated?

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The arctic fox population in Fennoscandia is on the verge of going extinct after not being able to recover from a severe bottleneck at the end of the 19th century. The Siberian arctic fox population, on the other hand, is large and unthreatened. In order to resolve questions regarding gene flow between, and genetic variation within the populations, a 294 bp long part of the mitochondrial hypervariable region I was sequenced. This was done for 17 Swedish, 15 Siberian and two farmed foxes. 12 variable nucleotide sites were observed, which resulted in ten different haplotypes. Three haplotypes were found in Sweden and seven haplotypes were found in Siberia. An analysis of molecular variance showed a weak, but significant, differentiation between the populations. No difference in haplotype diversity was found between the populations. A phylogenetic analysis revealed that the three Swedish haplotypes were not monophyletic compared to the Siberian haplotypes. These results indicate a certain amount of gene flow between the two populations, both before and after the bottleneck. Restocking the Fennoscandian population with arctic foxes from Siberia might therefore be a viable option.

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The Skull Morphology of the Ethiopian Wolf (*Canis simensis*)

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The most endangered canid in the world is the Ethiopian wolf (*Canis simensis)*. This species is endemic to the highlands of Ethiopia and is threatened by increasing human activity in this unique ecosystem – namely through loss of habitat to agriculture and the presence of domestic dogs. In addition to acting as vectors of canine disease, domestic dogs have been recorded as hybridising with Ethiopian wolves in the Bale Mountains National Park. A collection of 39 *C. simensis* and 12 domestic dog (*C. familiaris*) skulls formed the basis of an investigation into morphological characteristics using multivariate tech-niques. In addition, a range of other canid species was examined to address issues of phylogeny using a cluster analysis. Results indicate that there is no evidence of sexual dimorphism in *C. simensis citernii,* but that it is differentiable from the subspecies *C. simensis simensis* by components of snout shape. A discriminant function based on two linear measures can be used as an indicator of domestic dog hybrids in the field. Phylogenetic analyses concluded that despite grey wolf (*Canis lupus*) ancestry, convergent evolution has produced Ethiopian wolf skull characteristics resem-bling those of the jackals and the South American maned wolf (*Chrysocyon brachyurus*).

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Swift Fox Vocalizations: Their Possible Application to Population Censuses

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The vocal repertoire of the swift fox *Vulpes velox* includes a long-range call sequence produced regularly by male and female foxes during the mating season. Each sequence consists of a series of three or more bark and bark-like elements. Quantitative analyses of swift fox barking sequences obtained from 20 captive individuals, indicate that the calls exhibit a high degree of difference between individuals and between the sexes. Using a combination of temporal and frequency parameters in a discriminant function analysis (DFA), we were able to reclassify 98.97% of calls to the correct individual and 97.42% of calls to the correct sex. Distinguishing between different age groups does not seem reliable with the measurements used (only 61.86% correct reclassification). The results of this study and of pilot playback experiments where barking sequence responses have been elicited from wild foxes, suggest that there is potential for using this call to conduct swift fox population censuses.

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Wild Dog Population Dynamics in Kruger National Park, South Africa

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The African wild dog, *Lycaon pictus*, is the most endangered large carnivore species in South Africa. The only viable population in South Africa occurs in the Kruger National Park where three successful wild dog photographic surveys were carried out in 1989, 1995 and 2000. The surveys involved identification of individuals by their unique coat patterns and centred on a photographic competition open to the public. In 1989 the wild dog population comprised a minimum of 357 animals living in 30 different packs. By 1995 this had increased to at least 434 wild dogs living in 36 packs. In 2000 numbers had dropped to 203 wild dogs living in 26 packs. Densities were 16.7 dogs/1,000 km², 20.3 dogs/1,000 km² and 9.5 wild dogs/1,000 km² in 1989, 1995 and 2000, respectively. Fluctuations in pack size and distribution were observed in the central and northern regions of the park but numbers in the southern district remained relatively stable. In 2000 only 27% of the population were less than one year old, compared to 45% in 1989 and 1995. This suggests that the observed decline in overall numbers was due to decreased reproductive success. The most likely reason for this was higher than usual rainfall. Records from section rangers corresponded closely to the results of all the photographic surveys. This presents an opportunity to develop a new technique by which to assess wild dog density without photo-graphic material. This method could be used to supplement, rather than replace, future photographic surveys.

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Developing a Technique for Attracting Bush Dogs (*Speothos venaticus*) in the Wild

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The bush dog (*Speothos venaticus*) is a small unique canid whose distribution, ecology and general habitat requirements are poorly understood. The uncertain conservation status of the bush dog (threatened or en-dangered), the continued degradation of their habitat and our limited knowledge of their basic requirements and socioecology all necessitate in-depth field research in order to develop a long-term conservation strategy for this species. Studies conducted in the Mbaracayú Reserve, Paraguay used conspecific urine and/or vocalizations to lure bush dogs to a specific location. Evidence in the form of tracks, response vocalizations, urine, and feces suggest that the techniques used in these studies have the potential to serve as an important tool in gaining an understanding of this secretive, small-bodied canid within its natural habitat. The ability to attract bush dogs to a potential capture site would prove inva-luable for current and future researchers to complete the critical first step of an ecological study: locating and marking research subjects. In addition, it could serve as a source of genetic material to investigate a range of questions from bush dog systematics to inter/intra group social composition and population size. All of this information is critical to forming an accurate and much needed conservation strategy for this potentially endangered canid.

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A National Network to Monitor Natural Wolf Recovery in France: Patterns and Rate

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The survey of wolf natural recovery in France benefits from a European LIFE program, and aims to: (1) monitor the wolf colonisation patterns in a conservative perspective, and (2) manage wolf-livestock conflicts through damage compensation and improved herding techniques. The large area to cover (the whole alpine range) requires an original monitoring system: the French wolf network. This system involves 415 trained wildlife managers equally distributed among the French Alps. They report every wolf signs (tracks, faeces, prey remains, sightings) on standardized forms during their current working activities. Winter track surveys show a stabilizing minimum population size of 26 wolves, but the most parcimonious model of wolf pack settlement among 3 competitive curves (from exponential to generalized logistic model) still is exponential with a constant rate of increase r = 0.33. We empirically recorded nine areas with permanent wolf presence. The trend of the proportion of districts with recorded wolf signs varied with regions. The wolf network system seems adequate to monitor large areas for a national conservative purpose but fails in controlling sampling effort. To investigate home ranges or pack structure, it should be associated with telemetric or genetic studies.

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Forest Dwelling African Wild Dogs in the Bale Mountains, Ethiopia

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African wild dogs *Lycaon pictus* are threatened throughout their sub-Saharan range. While Ethiopia harbours several relict dog populations, most data is anecdotal and surveys are needed to assess status and conservation outlook. The only protected dog population in Ethiopia is found in the Bale Mountains National Park, where it atypically inhabits montane wet forest. A questionnaire-survey of the Harenna Forest of Bale investigated the knowledge and attitudes to wild dogs of the local people, by interviewing 90 residents of 20 kebeles (parishes) and drivers regularly crossing Harenna. Wild dog sightings were reported throughout the Harenna Forest, between the lower forest boundary at about 1,400 m and an upper altitudinal limit of 2,000-2,400 m, although dogs have been reported as high as 4,000m in afroalpine grassland. The dogs were reported to be in decline, and results suggest that presently there may be only one large pack of 30 wild dogs in this area. The maximum extent of suitable forest habitat in and outside the National Park is about 1,500 km, and several mid-size mammalian species preyed on by wild dogs were present at reasonable density. Harenna dogs are threatened by disease (rabies was reported in domestic dogs and jackals); encroachment and loss of suitable forest habitat; decline in prey species through competition with livestock; persecution by pastoralists; and occasional road casualties. Conservation action is needed to increase awareness, reduce the rate at which habitat is being loss and protect the prey base.

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Fluctuating Asymmetry and Inbreeding in the Painted Hunting Dog, *Lycaon Pictus*

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Dramatic decline of the painted hunting dog (*Lycaon pictus*) throughout Africa in the last century has made it vulnerable to associated reductions in genetic variation and inbreeding depression. The hypothesised positive relationship between developmental stability and heterozygosity was therefore used to assess whether the painted hunting dog population of southern Africa is likely to be suffering from the deleterious effects of inbreeding. Eighteen measurements were taken from bilaterally symmetrical traits of 106 *L. pictus* skulls collected throughout southern Africa, the asymmetry detected providing an indication of developmental instability. The black-backed jackal (*Canis mesomelas*) was selected as a control due to its large population size and sympatric distribution with *L. pictus* in southern Africa. This comparison showed *L. pictus* to exhibit reduced levels of developmental stability. The correlation between asymmetry and small population size in *L. pictus* suggests that stresses associated with its population decline have had deleterious consequences for the population. However, developmental instability can result from stresses of both a genetic and environmental origin. In the face of similar levels of habitat deterioration, *C. mesomelas* is unlikely to have experienced nutritional stress to the same extent as *L. pictus*, due to its ecological adaptability. This differential response to similar environmental pressures suggests that a non-genetic component may have contributed to the difference in develop-mental stability observed between the two species. The confounding influence of the environment therefore made it impossible to conclude that the painted hunting dog population is suffering from inbreeding depression, although such a possibility could not be discounted. Nevertheless this investigation provides support for the use of estimates of developmental stability in the future monitoring of stress in painted hunting dog populations, both captive and wild.

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Home Range and Spatial Organisation of Arctic Foxes – Responses to Spatio-Temporal Distributions of Prey

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The influence of spatial and temporal distributions of prey to arctic fox, *Alopex lagopus*, home range sizes and territoriality was studied on Spitsbergen, Norway. Home ranges of 15 reproducing foxes were mapped using VHF telemetry. The distribution of reindeer, seabirds and geese, the arctic fox's main prey species, were recorded annually to a 2 x 2 km grid database for 3 years. Long-time monitoring series 19, 10 and 3 years for the respective species were also available. Based on these data-sets estimates of spatial distribution, availability and predictability of prey resources were calculated. Arctic fox home range sizes and degree of home range overlap between neighbouring reproducing pairs varied largely: (4-60 km^2) in size and (17–74 %) in overlap. Home range size co-varied with prey spatial distribution, prey density (R^2=0.41, p=0.01), predictability of prey abundance (R^2=0.76, p<0.001) and predictability of prey spatial distribution (R^2=0.86, p<0.01). Home range overlap, increased with availability of prey (R^2=0.68, p=0.044), and with predictability of prey spatial distribution (R^2=0.41, p=0.17). This study revealed that both spatial and temporal patterns in prey distribution are important explaining the arctic fox flexible spatial organisation, having large influence of arctic fox local density and reproduction.

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Intraguild Competition Between Arctic and Red Foxes

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The distribution limit of the Arctic fox may be determined by interspecific competition with the larger red fox. The endangered Scandinavian Arctic fox population has not recovered despite 70 years of protection. The role of an expanding red fox population in this conservation problem has been debated. The Arctic fox has retreated to dens at higher altitudes, while red foxes occupy former Arctic fox dens at lower altitudes. Arctic foxes consume more lemmings, but less field voles and birds than red foxes do. However, the fox species respond similarly to changes in prey availability. Thus, the dietary differences probably reflect prey availability at different altitudes, while Arctic and red foxes have the same fundamental food niches. The spatio-temporal pattern of den use reveals that Arctic foxes avoid using dens in the vicinity of reproducing red foxes. Furthermore, red foxes can kill adult Arctic foxes and they are predators on their cubs. We conclude that low altitude habitat in itself still should be suitable for Arctic foxes. However, interference competition with red foxes might have caused a decrease in the realized niche of the Arctic fox, thus becoming a factor of importance for the non-recovery of the Arctic fox population.

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Vocal Tract Anatomy and Vocal Behaviour in the New Guinea Singing Dog

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We report on several anatomical and behavioral observations of the New Guinea Singing Dog (*Canis lupus hallstromi*), which point to some significant differences between this rare wild canid and related animals. Radiographic and ultrasound examination of the vocal tract of eight individuals suggest the presence of a rudimentary two-lobed uvula at the free border of the soft palate. A prominent uvula is noted only for *Homo sapiens*; a rudimentary uvula is reported for the pig, ox and sheep; and this structure has otherwise not to our knowledge been found in the Canidae. We also observed and describe here a high-pitched, intense trilling vocalization in the NGSD that is emitted under high arousal. This call is not reported for other canids. We suggest that this trill may be produced by a rapid vibration of the uvula.

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Energy Cost of Running in Arctic Fox, *Alopex lagopus*, on Svalbard

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This work was conducted to determine effect of season and starvation on metabolic rate during running in the arctic fox (*Alopex lagopus*) on Svalbard (78°55'N, 11°56'E), Norway. Indirect calorimetry was used to measure metabolic rate of foxes running on a treadmill and heart rate was monitored using implanted radio transmitters. The relationship between heart rate and metabolic rate was also examined. Metabolic rate increased with running speed. In July the metabolic rate while running almost fitted general equations predicted for mammals, while it was up to 20% lower in January, indicating seasonal variation in metabolic rate. There was a significant positive linear relationship between HR and weight specific metabolic rates, suggesting that HR can be used as an indicator of metabolic rate. Starvation for 11 days decreased the net cost of running by 13% in January and 17% in July, suggesting that a starved fox runs more energetically efficient than when fed. Heart rate measured in July, decreased by 27% during starvation. Re-feeding reversed the starvation-induced reduction in metabolic rate and heart rate during running almost up to post-absorptive levels. The present results are from one fox, and must be considered as preliminary data until further studies are conducted.

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Gray Fox Distribution in Southern California: Effects of Carnivore Competitors and Suburbanization

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From 1996 to 1999 we captured, radio-marked, and monitored 24 foxes (*Urocyon cinereoargenteus*), 101 coyotes (*Canis latrans*) and 64 bobcats (*Felis rufus*), and also identified food remains in 347 fox, 761 coyote, and 660 bobcat scats, in a mixed landscape of southern California. Camera and trapping surveys indicated that in suburbanized/developed areas where coyotes were most common, gray foxes were nearly absent; telemetry data confirmed that foxes preferred chaparral habitat in non-suburbanized areas, whereas coyotes and bobcats spent more time in open, developed habitats. Although there were strong interspecific differences in carnivore food habits, average seasonal diet overlap was high, even where species were locally sympatric. Gray foxes were mainly crepuscular and nocturnal, while coyotes and bobcats were more diurnal (except in developed areas). Interference competition was evident; most (11/12) of fox mortalities were due to coyotes or bobcats, and these often occurred outside or on the edge of a fox's home range. Survival rates of foxes did not suggest that the local population was declining, and surviving gray foxes appear to avoid times, habitats, and locations of high predation risk. In southern California, these include areas with poor or unfamiliar escape habitats, especially suburbanizing habitats with anthropogenic food sources.

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Consequences Of Demographic Bottlenecks And Genetic Drift On Population And Phylogeographic Structure Of Fragmented Wolf Populations In West Eurasia

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Human activities have led to the continuous population decline, fragmentation and local extermination of the once widespread wolf *Canis lupus*. We characterised genetic differentiation between ten European and two Near Eastern sampling areas using eleven microsatellite markers. The demo-graphically bottlenecked Italian and the Scandinavian captive populations possess significantly lower genetic variability and the highest levels of genetic differentiation compared to all other populations. Compa-rison of estimators of genetic differentiation (FST, RST) and simulation experiments using Nei's standard genetic distance indicate that these large values can be explained by recent genetic drift alone. Therefore, even highly significant allele frequency dif-ferences may not be suitable to identify management units sensu Moritz (1994) in bottlenecked populations. Samples from northern and south-eastern Europe and the Near East also showed significant allele frequency differences but genetic distances were generally low and gene flow follows a pattern of isolation-by-distance. Despite different subspecies status (Europe: *lupus*, Israel: *pallipes*, Saudi-Arabia: *arabs*) popula-tions were not genetically isolated. The significantly reduced genetic variability in Italy and the likely future loss of variability in north European populations where data indicate recent population bottlenecks, emphasise that the prevention of further loss of genetic diversity should be given priority by allowing population growth and re-establishing migration between isolated populations.

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The Relationships between Humans and Wolves in the Montesinho Natural Park (North-east of Portugal): From Destruction to Conservation

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The majority of the earth's ecosystems today are considerably impoverished. This situation can be traced to activities structurally linked with most human societies, which eroded the ecosystems till minimal biodiversity states. Nevertheless some societies still coexist with high or total biodiversity eco-systems, which normally include large carnivores and large wild herbivores. The Montesinho Natural Park region is one of these last examples of coexistence between humans and wolves in Western Europe. Throughout the centuries, like all over Europe, humans persecuted the wolves and wildlife, causing the extinction of several species and biodiversity erosion. However, due to a combination of ecological, technical, social, cultural and political factors, wolves still live in the region and the local rural societies are developing a more balanced relationship with them. This is a new situation in the history of Portugal and of the European rural world. The description and analysis of the several factors that determine the relationships between these societies and the wolf and wildlife allows to conceive possible solutions to ameliorate them, and to define local and international strategies for the conservation, expansion and restoration of wolves and biodiversity, and to explore the conditions by which the integration in synergy of human societies with total biodiversity is possible.

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A Test of Survey Methods for Swift Foxes (*Vulpes velox*)

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Swift foxes (*Vulpes velox*) were historically distributed across the short and mixed grass prairie regions of North America. Today, the swift fox is found in small, isolated populations in the southern and western margins of its historic range. Although methods for censusing wild canids exist, an evaluation of survey techniques for swift foxes has not been conducted. We initiated a 2-year study to examine whether relative abundance indices from 5 survey methods were correlated with swift fox density estimates. The study was conducted on the Pinon Canyon Maneuver Site, south-eastern Colorado, from January 1997 to December 1998. We evaluated catch-per-unit effort or trapping surveys, scent station surveys, spotlight counts, scat deposition rate surveys, and an activity index. All surveys were conducted along 5 10-km transects during 3 seasons annually. All methods, except spotlight counts, were reliable and consistent detectors of swift fox presence across 5 survey areas. Overall visitation/ capture rates were highest with the activity index (0.25 visits/station) followed by scent station surveys (0.19 visits/station) and trapping (0.09 foxes caught/trap night). For the entire study, foxes observed during spotlight sessions averaged 0.1 foxes/km and daily scat deposition rates averaged 0.1 fox scats/km. Regression analysis showed that the degree to which survey indices correlated with swift fox densities varied widely among methods and seasons. Stepwise regression analysis of all surveys conducted in 1998 showed that scat deposition rate and scent station indices combined explained 79% of the variation observed in swift fox densities. The combination of these 2 surveys would be economically viable for predicting swift fox densities more reliably than the other methods tested.

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Science, Policy and the Conservation of Canids

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Scientific studies of canids have, for the most part, fallen into one of two categories: those which have addressed questions related to behaviour and ecology with little direct (or often indirect) reference to conservation issues; those which address issues related to canids as pests or resources (disease, predation, and management of extremely common species, usually fur bearers). Too few studies actually address core threats to the Family. While there are exceptions (wolves, African wild dog, Ethiopian wolves), canid biologists need to change the way in which they do science if, in the long term, our work is relevant to the conservation of the rarer and threatened members of the Family.

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North American Canid Taxon Advisory Group Regional Collection Plan

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The North American Canid Taxon Advisory Group was developed in 1990 to assist zoos in North America with their development of Regional Collection Plans for the long-term management of various Canid species. The goal of the Regional Collection Plan is to identify species in need of conservation work, both *in situ* and *ex situ*, and assist in promoting their conservation needs. This may be done through support of field conservation programs as well as developing captive populations of these species to assist with conservation, educational and research priorities. In April 2001 a revised Regional Collection Plan was developed for zoos in North America looking at the conservation needs of the species, viable captive populations, support of wild populations, fund raising, taxonomic uniqueness and veterinary research. The goal of this plan is linking with the IUCN Canid Specialist Group to support field conservation efforts and use of the managed populations to promote these efforts. This paper will discuss the methodology of this process and the goals for the future conservation work.

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Wolf Vocal Communication: Sources of Variation among Individuals in the Squeak

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Goldman *et al.* (1995, *JASA 97*:1970-1973) showed that two adult female wolves (*Canis lupus*) differed individually in their squeak (whimper) calls. The pattern of variation they observed suggested several alternative hypotheses to us: 1) a female emits lower pitched calls when she becomes socially dominant; 2) a female uses lower pitched calls with her own pups, but not those of other females; and 3) a female's call features are not affected by change in her social or maternal status, but do show long term stability. We tested these hypotheses using archival videotape of three females recorded in their dens. Individual females' calls were sampled over periods of up to 7 years, during which females changed in social and/or maternal status. Results supported neither of the first two hypo-theses. Rather, individual females showed long-term consistency in call parameters, regardless of social or maternal status. However, a new hypothesis emerged from the analysis. The female with the deepest-pitched voice, once she gained dominant status, held that position significantly longer than the other two females studied, suggesting that some parameters of an individual's calls may have predictive value concerning the acquisition and main-tenance of social status.

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The Influence of Social Factors on Reproduction in Red Foxes

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In red foxes, the proportion of non-breeding females seems to vary between populations in relation to density. It could be assumed that occurrence of barren vixens is linked to female body condition or social factors like social inhibition of reproduction between females or sexual preference of the breeding male. Our aim is to study the influence of these social factors. We therefore follow since a few months ago several foxes trapped within the same area, in the Ardennes, North-eastern France. Fox density on the study area is estimated by Kilometric Index, using spotlight transect surveys. Proportion of barren vixens is estimated through autopsy of foxes killed in the area. Social and spatial organisation is determined by radio-tracking through spatial overlap between adjacent home ranges and spatio-temporal proximity between individuals. These data are completed by field observations of social interactions. Capture-recapture provides information on reproductive status and body condition of vixens. Kin-relation between individuals is determined through genetic analysis of collected tissue samples. Although data are still insufficient, we are waiting for the first results to draw preliminary conclusions.

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Cranial Development in Wolf between Four and Ten Months of Age

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In wolves (*Canis lupus*), the principal changes in both size and shape occur between the 4th and 10th months of their life and during this time they also develop a series of characteristics that qualify them to adult life. We studied 36 wolf skulls of this stage from different regions of Iberian Peninsula to identify the principal changes in cranial development. Twenty three-dimensional landmarks of each skull were digitized, and increase in size was analysed by regressing centroid size (CS) on age. We used Procustes distances to measure the amount of shape change between successive months. It was noticed that CS increases by 50% during this stage, with it then becoming stable at the end of this stage. For all the age groups studied the size and growth rate of skull was higher for males than females. Shape changes, summarized by Procustes distances, were reduced in about a 70% throughout this stage. A two-dimensional relative warps analysis was carried out to identify the principal axes of variation, and results are shown by the projection of the relative warps on consensus.

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Density Dependence in the Icelandic Arctic Fox Population

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The Icelandic Arctic fox population has undergone large-scale fluctuations in population size during the last 50 years, from a high in the 1950's to a low in the 1970's and approaching a high again at the end of the 20th century. The fluctuation has been more pronounced in the western part of the country which has a higher proportion of productive, coastal habitat, and a higher average population density of Arctic foxes. While density dependence can be detected in recent years in western Iceland, this is not so in eastern Iceland. However, the density dependent response so far observed is weaker than would be expected in comparison with the situation 50 years ago, during the last population maximum. Thus the proportion of non-breeders has increased while the fertility of breeding foxes remains high by Icelandic standards and mortality of cubs is low. It is argued that food availability has increased during the last 50 years, due to population size increase and nesting range expansion of the fulmar (*Fulmarus glacialis*) in Iceland and that this has resulted in an elevation of the overall carrying capacity for Arctic Foxes in both western and eastern Iceland.

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Juvenile Dispersal in the Icelandic Arctic Fox Population

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Both sexes of the Icelandic Arctic Fox strive to breed as yearlings. In order to do so they have to disperse away from their natal range and compete for territories and/or mates. Competitive ability of juveniles will be determined by factors such as timing of dispersal, body size and physical condition. The results of dissections of juvenile Arctic Foxes in Iceland suggest that fat accumulation in autumn may act as a trigger for dispersal and that this happens earlier in males than in females. While mean dispersal distances between the two sexes are not significantly different, evidence is accumulating that long-distance dispersers tend to be males while females are more likely than males to delay dispersal. It is suggested that yearling non-breeding females staying on in their parents' territories have in most cases tried and failed to find a mate and territory prior to the breeding season. The dispersal pattern of a juvenile female tracked with a satellite transmitter suggests that it maintained frequent contact with its parents' territory for more than two months after dispersing and settling down 30 km away. Such frequent contact is presumably necessary, due to the constantly changing scent of a maturing female, if it is to keep the option open to delay dispersal in case of failure to hold on to the new territory and mate.

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Development of Genetic Markers to Address Conservation Issues for the Dhole

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The Dhole (*Cuon alpinus*) is an endangered canid found through much of Asia. The species is listed as 'Vulnerable' in the IUCN Red List and is thought to be at high risk of extinction in many parts of its once extensive range. The species has been little studied to date. In this recently established collabo-rative project, we are developing molecular genetic tools to address issues for dhole conservation and research. We have identified a number of novel *Cuon alpinus* microsatellite loci using a RAPD (Random Amplified Polymorphic DNA)-based method and an enriched library-based method. Using novel *Cuon* and existing *Canis* microsatellite loci, we will carry out popula-tion genetic studies in two geographical regions – East Java (Indonesia) and Southern India. In Southern India, our genetic study will be concurrent with an ongoing ecological study, which will also provide relevant field observations. We will obtain information on levels of genetic diversity, gene flow, effective population size and population structure. By developing assays for sexing individual dholes, we will also obtain information on adult sex ratio and dispersal within these groups. We are optimising primers for mitochondrial control region DNA amplification from dhole scat samples. We will carry out DNA sequencing on samples to be obtained from across Asia representing all or most of the 11 putative subspecies and will determine whether there is clinal variation across the mainland of Asia. This will help us to define conservation units in the region in order to appropriately focus conservation efforts.

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Morphogenesis and Evolution of the Canid Auditory Bulla

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Morphology of the auditory bulla, a bony receptacle for the middle ear, is basic to the systematics of higher-level carnivoran taxa. The bullae in several families show the different patterns of their ossification and/or growth, presumably reflecting the different evolutionary pathways throughout the order. Canidae are unique in having a ventral entotympanic sinus, a particular subdivision of the hypotympanic cavity, which is partially or completely circum-scribed by the low septum on the bulla wall. The sinus develops in ontogeny from the ventral, ossifying first and growing most intensively, region of the 'caudal ento-tympanic' portion of the bulla. Comparative morphology of the canid intrabullar septum, which is merely a by-product of the expansion of ventral entotympanic sinus, indicates that the presence of this sinus is a synapomorphy for the family including the extinct subfamilies Hesperocyoninae and Borophaginae. Distribution of various intrabullar patterns within each of the canid subfamilies is promising for further arranging the taxa. For instance, the basic branching events in the phylogeny of Caninae, the best-studied canid group, can be convin-cingly deduced from the morphology of the ventral entotympanic sinus.

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Golden Jackals in Intensively Cultivated Areas of Bangladesh: Daring Dacoits or Rat Control Wallahs

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Golden jackals (*Canis aureus*) are the most common wild canid remaining in Bangla-desh. They are found throughout much of the country including areas with intensive cultivation and high human density. The objective of this study was to better understand the distribution and pest status of jackals in the two major agro-ecosystems. This study was conducted from 1987 to 1989 in two 4,800 ha sites; Mirzapur representing deep-water rice and wheat and Ishurdi transplanted rice and wheat. Sampling scats indicated that jackals were more abundant at Ishurdi where sugarcane occurred and was preferred for daytime cover. Home ranges of seven radio-collared jackals based on daytime locations in cover averaged only 56 ha. at Ishurdi. Jackals are generally considered to be pests of poultry and livestock. But they are also a potential benefit in terms of reducing rat damage in pre-harvest rice and wheat which is the principal vertebrate pest problem through-out the subcontinent. Rodents were the most important food item by percent occurrence found in scats from both sites throughout the year. A model indicated that jackals can significantly reduce rat damage in wheat. This was supported by rat damage in wheat being greater at Mirzapur than Ishurdi.

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The Role of Predation by Wolves (*Canis lupus pallipes*) and Jackals (*Canis aureus*) on Blackbuck (*Antelope cervicapra*) in Velavadar National Park, India

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The blackbuck population of Velavadar National Park has been monitored for the past 12 years. The population is believed to have remained stable between 900 to 1100 individuals. Studies on Blackbuck nutrition suggest that this population is well below the park's nutritional carrying capacity. Annual population estimation, data on recruitment, and life-table demographic parameters for blackbuck are presented. Predation by wolves on blackbuck was estimated by scat analysis and continuous monitoring (several days) of radio-collared wolves. Predation rates, pack sizes, and consumption were estimated and their impact evaluated on the blackbuck population. Wolves subsisted almost exclusively on blackbuck and made kills at a frequency of one in 4 (se 0.9) days. Consumption by wolves was estimated at 1.3 (se 0.23) kg/wolf/day. Jackal population was estimated by responses to simulated howling and by sighting-re-sighting of radio-collared jackals. Jackal density was estimated at 1-2 jackals/km^2 within the National Park. Predation by jackals on blackbuck calves was considered to a major limiting factor for the blackbuck population. Data suggests that wolf and jackal predation was responsible for controlling the blackbuck population of Velavadar National Park.

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Ecology of the Endangered Darwin's Fox (*Pseudalopex fulvipes*) in a Fragmented Forest in Southern Chile

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The Darwin's fox (*Pseudalopex fulvipes*) is an endangered and little-known species restricted to the temperate forests of the island of Chiloé and a very small population occurring on one mainland site of southern Chile. This fox is of high conservation concern, because these forests are rapidly disappearing. We studied Darwin's fox habitat use, spatial ecology, activity patterns, and relative abundance on the edge of a fragmented landscape on Chiloé Island. Data from ten adult foxes indicate that males are larger (3322g) than females (2873g) and that island foxes are larger than those on the mainland. We radio-tracked six adults for various time periods between Oct 1999 and Feb 2001. Males and female foxes were active mostly at night and the sizes of their home ranges were 162 and 148ha, respectively. However, ranges overlap subs-tantially (79% on average) within and between genders, rendering an ecological density of 1.4 foxes/km^2. Darwin´s foxes were found in all habitat types on the study site, ranging from old-growth forest to highly disturbed pastures, but used forest the most. On average, foxes used secondary forest more often than available and old-growth forest less often than available. Thus, unlike generally assumed, the Darwin's fox appears not to be a forest obligate species. These foxes seem to be locally abundant when they are not exposed to disturbances by dogs.

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Energy Requirements and Local Distribution of Sympatric Chilla (*Pseudalopex griseus*) and Culpeo (*P. culpaeus*) Foxes in South America

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Culpeo fox (*Pseudalopex culpaeus*) and chilla fox (*P. griseus*) have similar ranges in southern South America, but the factors determining both their local and geographic distributions are unknown. We hypothesize that when sympatric, their distributions are determined by energy requirements. Alternative hypotheses include the effects of (1) environmental constraints, (2) dietary requirements, (3) habitat requirements, and (4) predation or extirpation by humans. To meet their daily energy requirements, as calculated by theoretical basal metabolic rates, the chilla in the Chilean Patagonia need 0.04-0.09 European hares (*Lepus europaeus*) or 3-7 rodents compared with 0.1-0.4 European hares or 11-30 rodents needed to maintain the culpeo. In north-central Chile, where foxes are smaller, the chilla need 0.08-0.16 hares or European rabbits (*Oryctolagus cuniculus*) or 1.2-2.3 rodents, compared with 0.2-0.4 hares or rabbits, or 3-6 rodents for the culpeo. These estimates are consistent with our research at these two dissimilar sites, separated by 3,000 km, where the larger and behaviourally dominant culpeo monopolyses prey-rich habitat patches, whereas the smaller chilla appear to use those prey-poor patches in which culpeo cannot be sustained. Based on the evidence, we discarded the alternative hypotheses and conclude that the local and regional distribution of chilla and culpeo appear to be determined at least in part by the behaviourally dominant culpeo and the abundance of its main prey. In southern Chile this is dictated in part by the distribution and density of the European hare and in north-central Chile by the densities of lagomorphs or rodents such as *Octodon degus* and *Abrocoma bennetti*. Because the current distribution of these two foxes may be dependent on European rabbit, European hare, and domestic sheep, all non-native species, other prey species had to have been more influential in the past. If this is true, we predict changes in carnivore communities, as smaller native prey are replaced by larger exotic prey.

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Spatial Ecology of the Culpeo Fox (*Pseudalopex culpaeus*) in the Highland Desert of Northern Chile

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From Oct 1996 to May 2001 we studied a culpeo (*Pseudalopex culpaeus*) population in the highland desert of northern Chile (24°35'S, 68°58' W) at an elevation between 3,000 and 4,500 m a.s.l. The study site included ca. 200 km^2 of a flat salt lake (Salar de Punta Negra) and rugged highlands cut by deep ravines (Llullaillaco National Park). Out of 19 culpeos caught, we analysed the telemetric information of the individuals with >12 fixes (n = 8, weights 4.6-8.7 kg). Of the habitat types distinguished, foxes preferred them in the following decreasing order: ravines, water bodies, salt flats, and other uplands. Ravine bottoms and water bodies are the most productive habitat types and culpeos used them mainly to forage and rest. Adaptive Kernel (95%) home range varied greatly among individuals (113-210 km^2), males having larger ranges than females (mean 896 and 814 km^2, respectively). Foxes living on the saltflat had larger range sizes and overlaps than those living in ravines. According to capture times and telemetry data, culpeos are active mainly at night. Although this desert environment looks barren and seems little productive, it has productive point sources that maintain a culpeo population.

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DLA-DRB1, DQA1 and DQB1 Alleles in Alaskan Grey Wolves

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The Major Histocompatibility Complex in the dog (DLA) contains highly polymorphic genes, which are critical in regulating the immune response. Since the Grey Wolf, (*Canis lupus*) is ancestral to the domestic dog, it would be anticipated that some of the DLA class II alleles identified in dogs should be present in wolves. Sequence based typing was used to characterize a series of 24 Alaskan Grey Wolves for their DLA class II alleles. DLA data from a panel of 568 dogs from 60 different breeds were available for comparison. Within these wolves, 16 new class II alleles were identified: 7 DRB1, 4 DQA1 and 5 DQB1. Three alleles were found in single animals, but the other 13 were found in at least two wolves. Five alleles found in wolves had previously been identified in dogs. This wolf population had few DLA alleles previously found in dogs, and contained several new DLA alleles. These wolves may represent a remnant population, descended from Asian wolves, whereas most of the dogs tested had a European origin. A single European wolf was typed and carried a haplotype found in many of the dogs tested. One DQB1 allele found in wolves, has been found in Shih Tzu, a breed of Asian origin. These data suggest that the original wolf ancestors of Asian and European dogs may have had different gene pools, which may be reflected in the DLA alleles present in dog breeds.

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Red Fox and Grouse Populations in Finland: is the Fox Threatening Grouse Populations?

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Red fox (*Vulpes vulpes*) is generally consi-dered a pest in Finland because predation on grouse broods is thought to be one reason behind the decline of grouse populations. This year hunters' organizations started a campaign in Finland to increase hunting pressure towards small carnivores - including the fox. I present the results of two studies concerning the impact of fox on grouse breeding success and grouse numbers in Finland and try to answer the question whether fox control is good game management or a waste of money and effort. The impact of the red fox on grouse populations was studied both experimen-tally and using the wildlife monitoring data ('wildlife triangles'). The predator removal experiment was done in southern and northern Finland between 1993 and 1998. The breeding success of grouse (young/ adult ratio in August counts) decreased in predator protection areas and increased in predator removal areas. Also the mean brood size was higher in predator removal areas than in the predator protection areas. Predator removal/ protection did not, however, affect adult grouse density. The wildlife triangle data (125 448 km of transect line, data collected between 1989 and 1999) also indicated that fox numbers had some effect on grouse breeding success, while the effect of fox numbers on grouse density was not evident. The growth rate of grouse populations was largely dependent on the survival rate of grouse during autumn and winter. The survival rate showed clear density-dependency; when grouse density was high in August, survival rate was low and *vice versa*. These results suggest that although foxes affect grouse breeding success, other factors than fox numbers regulate or limit adult grouse population. These density-dependent factors may include abundance of food, disease or parasites, dispersal or functional respond of predators, including avian predators and man. Fox control may thus be an ineffective solution to the problems of grouse populations in Finland.

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Wolf and Jackal in Semi-arid Zone of Georgia

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A study was carried out on the canid community (*Canis lupus, C. aureus, Vulpes vulpes*) in the arid and semi-arid zone of Georgia (extreme southeast of the country). The basic aim of the research was to study the conservation of the predator community in Georgia's Arid Ecosystem, and to create a monitoring system for these canids. The data gathered during counts clearly indicates that seasonal changes of wolf and jackal numbers in the region are caused by sheep migration patterns, as sheep are the basic prey item for the canids inhabiting this area. There is also seasonal redistribution of territory between wolves and jackals, which in turn influnces the numbers of these two species. This redistribution of territory is most likely to occur as a means of avoiding food cometition, and was monitored by the observed movements of wolves and jackals movement on common paths over the study period. On the other hand fox numbers are stable throughout the year. Foxes are not competitors to other canids in terms of food, as the basic diet of the fox is comprised of small mammals, while wolf and jackal mainly subsist on sheep during winter. The results of human impact on biodiversity of the study area are also shown.

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Modelling of Wolf-Livestock Interactions in Spain: Proposed Methodology for Development of Policy Guidelines

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The success of canid conservation pro-grammes may lead to conflicts with human interests, especially in extensive livestock systems. This is the case in the Basque region of Spain, where livestock farmers are affected by wolf predation without receiving adequate financial recompense. In this situation, the perse-cution of wolf populations by farmers cannot be effectively prevented, and additionally, the continuation of extensive livestock farming and improvement of livestock quality may be compromised. This project aims to build a decision support system to provide policy guidelines for the management of wolf and livestock populations in the Basque region at both farm and landscape levels. The work will take an interdisciplinary approach, including farmer-participatory techniques and eco-regional economic-ecological modelling. The project will use three different techniques: 1) predictive modelling of wolf movements, 2) economic optimisation of livestock production and 3) GIS-based models of wolf-livestock interactions. Integrating techniques 1) and 2) within a GIS framework will allow area-specific predictions to be made of changes in wolf populations and/or livestock management practices on the economic impact of wolf predation on livestock farming. The output from this decision support system will be used to make policy recommendations for the future manage-ment of wolf-livestock interactions.

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Genetic Relatedness and Spatial Ecology of the Swift Fox

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We studied the spatial and social ecology of swift fox (*Vulpes velox*) in south-eastern Colorado. We used genetic analyses of relatedness between the foxes, in addition to field observations, to assess space use patterns, inter- and intra- social group interactions, and breeding structure and kinship. We radiotracked over 180 foxes from January 1997 to December 2000 to assess space use of the foxes, as well as their movements relative to those of other members of their own social group and their neighbours. We collected blood and tissue samples and used microsatellite analysis to assess the relatedness of the foxes. Microsatellite loci are effective in relatedness analyses because the high rate of mutation at these loci means that individuals are likely to have unique alleles at a sufficient number of loci to elucidate relatedness levels between individuals. Specific questions to be addressed include whether paired swift foxes are unrelated, whether 'helper' foxes (i.e., non-breeding adults in the social group) are closely related to the breeding pair, and whether extra-pair paternity occurs in swift fox family groups. We will also examine whether the absorption of a home range area of one fox social unit by another fox or social unit occurs more often when the foxes are related than when unrelated, and whether the overlap of home ranges is higher between neighbouring related social groups.

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The Home Range of Raccoon Dog in Relation to Other Carnivores

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Home ranges of raccoon dog (*Nyctereutes procyonoides*), red fox (*Vulpes vulpes*) and European badger (*Meles meles*) were studied in Finland in 2000-2001. The study area is situated in south-east Finland, near the border to Russia. From preliminary results the home ranges of the female and male of a pair overlapped almost entirely. The home ranges of raccoon dog and red fox overlapped during autumn 2000. Also contacts between individuals of different species were observed.

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Oral Rabies Vaccination in African Wild Dogs (*Lycaon pictus*)

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The objective of the study was to develop a bait and baiting system capable of delivering one effective dose of oral rabies vaccine to each member of a free-ranging African wild dog (*Lycaon pictus*) pack. Trials were conducted between June and October 2000. The results of cafeteria-style bait preference trials testing seven candidate baits in captive wild dogs revealed a significant preference for chicken heads (June trials: $p=0.023$, September trials: $p=0.021$). Trials using a topical biomarker (Rhodamine B) showed that chicken head baits are sufficiently chewed 71.4% (n=7) of the time to rupture the vaccine container. Free-ranging wild dogs and young puppies (10 weeks) successfully ingested chicken head baits. Significant dominance of bait intake by a single individual was seen in four of six study packs, and in the three packs in which an alpha pair could be distinguished it was noted that the dominant feeder was an alpha animal. Pattern of bait distribution and degree of satiation had no effect on pack coverage (proportion of pack ingesting at least one bait). Pack coverage was significantly related to trial number ($r=0.71$, $p<0.001$), with pack coverage increasing with increased exposure of the pack to the baits. During 45.9 hours of diurnal observations only two baits were lost to non-target species. The results of the bait/ vaccine combination trial are presented. A proposed baiting system for the oral vaccination of captive and free-ranging wild dogs is given.

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History and Status of the Red Wolf (*Canis rufus*) in North America

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Red wolves (*Canis rufus*) are medium-sized canids that once inhabited most of the south-eastern United States. They are larger than coyotes (*C. latrans*) and comparable in size to smaller subspecies of gray wolf *(C. lupus*). In the 1960's, an analysis of skull characteristics suggested hybridization among coyotes and red wolves may have resulted in a "hybrid swarm" that gradually encompassed the geographic range of the red wolf, with genetically pure red wolves seemingly extinct. In the late 1960's, remnant populations of red wolves were located. To preclude loss of the genotype through hybridization, 14 "founders" were recovered from the wild and placed in captive breeding programs. Offspring from these programs were eventually reintroduced to native habitats. One population became established in and around the Alligator River National Wildlife Refuge in North Carolina. Two issues of interest have arisen recently. There is a resurgence of hybridization with coyotes, which have now colonized eastern North Carolina. The other is a suggestion by several Canadian biologists, based on DNA analyses, that wolves in Algonquin Park, Canada, are more similar to red wolves than to nearby populations of gray wolves and that red wolves and coyotes are genetically more similar than either are to the gray wolves. Management issues related to red wolves are discussed.

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Genetic Study on the Anatolian Shepherd Dog Based on 100 Microsatellite Loci

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In this study, 100 canine microsatellite loci were employed to examine the genetic differentiation of Anatolian Shepherd Dog (n=29) from the central Anatolian feral dogs (n=51). Within populations, genetic variation was estimated by unbiased average heterozygosity values and the number of observed alleles, which were nearly the same in both populations. Populations differed in the frequency and distribution of alleles across loci. Private alleles were detected in both populations though it was much higher in feral dogs. The allelic frequency data were used to assess the probability of effective size reduction. Both of the populations exhibited a recent bottleneck effect as expected from the domestic populations. Slight but significant genetic difference between the populations was observed (F_{st} =0.021). Individuals were assigned to one of the two populations by using the software Geneclass. Few incorrect assignments (8 for ASD and 1 for feral dogs) were observed. Results of the present study indicated that ASD is different from the feral dogs studied. As similar data are obtained from other breeds, the question whether ASD is genetically as distinct as any other dog breed will be answered.

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Wolf Population Dynamics in Eastern Fennoscandia: Does Human Exploitation Mask the Effects of Prey Density?

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Wolves (*Canis lupus*) may respond numerically to the population changes of their main prey while in exploited wolf populations wolf-prey interactions are often masked by human influence. We examined how changes in moose density and hunting pressure on wolves influenced changes in wolf density during 35 years in Russian Karelia by use of partial autoregressive models. In a model without time lag in independent variables, wolf density changes depended only on changes in moose density while in models with time lag (up to 5 years), only the effect of human harvest rate was significant. Although the number of wolves in Karelia has decreased steadily since the early 1980s, from ca. 600-700 to the present 300-350, wolves have recently recolonized the neighbouring area, eastern Finland, as a reproducing popula-tion that comprises 8-10 packs. Prey densities are much higher in Finland than Karelia, and the major factor influencing wolf population trends in Finland is the exploitation rate by humans. Both changes in moose density and hunting pressure on wolves can explain wolf population trends in Karelia; the decreasing moose density may entail lower reproductive output by wolves which may increase the vulnerability of wolf population to human exploitation.

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Some Unusual Behaviors of the New Guinea Singing Dog (*Canis hallstromi*)

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This presentation illustrates some unusual behaviours of captive New Guinea Singing (Wild) Dogs (*Canis hallstromi*) [NGSDs]. The NGSD is a distinctive form of wild dog indigenous to the mountains of New Guinea. The behaviour of NGSDs has never been studied in their native habitat. The authors directly observed 21 adult NGSDs and 60 puppies for about 7,000 hours total over a ten-year period and developed an ethogram of 251 NGSD behaviours. The behaviour inclusion criterion was observation of the behaviour on more than one occasion, in at least two subjects. NGSDs exhibit nearly all types of behaviour noted by other researchers for *Canis*. However, NGSD behaviours often differ from domestic dogs (*Canis familiaris)* and wolves (*Canis lupus*) in frequency, threshold, or age at appearance. In addition, NGSDs show eighteen behaviours that may be unique to any canid. Among these behaviours are: the Head Toss solicitation gesture; Cheek Rub; Copulation Contractions; Copulation Scream; genitally-oriented biting; Tooth Gnashing during controlled aggression; several vocalizations. The NGSD also appears to lack the play-bow solicitation posture common in other *Canis*. This high number of novel behaviours suggests a possible taxonomic uniqueness for this canid, a conclusion now also being supported by non-behavioural data.

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Some Data on Seasonal Variation in Wolf Pelage

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It is known that wolf (*Canis lupus*) pelage density varies with latitude, and we also know that wolves moult twice a year. However, few studys have been conducted on these topics. Here we show our results about some aspects of the changes that wolf fur undergoes through the year, in a region with a humid and temperate climate. We analysed a sample of 81 skins from Galicia (NW Spain), which were put in chronological order according to their death date. Four 0.11 cm^2 skin samples with hair were taken from each specimen: a sample each from the neck mane, flank, groin and hindquarter. The number of hairs contained in each of these samples was counted and it was noticed that the average density of hairs on the four skin samples varies significantly with seasonal changes. The lowest mean values (hairs/cm^2) are found in summer (2.092) and the highest in autumn (5.589), with the winter (4.859) and spring (3.809) values are situated in between. The highest density of hair, with specimens whose mean values are higher than 10.000 hairs/cm^2, is found at the end of autumn (December). It was also noticed that the quotient between guard hairs and under hairs varies from 1:13 in autumn to 1:4 in summer. Finally, the mean number of guard hairs (375 hairs/ cm^2) remains con-stant throughout the year.

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Targeting Disease Control Programmes for Endangered Canids: Cost-effectiveness of Alternative Strategies for Ethiopian Wolves

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The threat disease poses to the conservation of endangered species has received increa-sing attention in recent years. Carnivores appear to be particularly vulnerable, with rabies and canine distemper virus posing the greatest threat. With domestic dogs the prime candidates for reservoirs for such pathogens in many ecosystems, control programmes have primarily entailed redu-cing disease incidence in the dog reservoir through dog vaccination. However, direct vaccination of the threatened species may be the most direct and cost-effective method of protecting a species of concern or may be the most feasible option where there is a wild reservoir. Rabies and other dog diseases are the most immediate threat to the critically endangered Ethiopian wolf. Recently, vaccination of sympatric dogs has successfully reduced this threat, but this programme is both expensive and logistica-lly difficult. In this paper we examine the potential relative effectiveness of alternative strategies to protect different-sized Ethiopian wolf populations from disease, using an individual-based mathematical model of a wolf population that incorporates disease as a dynamic process. In particular we compare reservoir dog versus wolf vaccination as well as different vaccination strategies within wolf populations. Results suggest that the persistence of small (<100 animals) wolf populations are improved when the incidence of rabies in dogs is reduced and that vaccination of less than 40% of wolves will have a similar effect. We also compare the cost of these strategies, with estimates suggesting that wolf vaccination is always cheaper than dog vaccination, and particularly so in small, linear of fragmented wolf populations. We suggest that further research investigating the feasibility of wolf vaccination should be pursued.

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Restricted or Widespread? Even or Patchy? Rare or Overlooked? The Distribution and Status of the Short-eared Dog *Atelocynus microtis*

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The short-eared dog could be considered the least known canid in the world. Varying distribution ranges have been presented by different authors, some considering its range to be restricted to the western Amazonian lowlands and some covering all Amazonia. In an attempt to clarify the species distri-bution we reviewed the data of all museum specimens around the world and inter-viewed biologists carrying out long-term research across the supposed range (the outcome of this will shortly be documented in a separate publication). The short-eared dog has an extent of occurrence (minimum area polygon created around the confirmed localities for the species) of approximately 1,600,000 km². Its home range size is not known but with such a large distribution it is possible that many tens of thousands exist (possibly enough to make it one of the most abundant canids). It therefore would appear incongruous that the species is so little known and considered to be so rare across its range. It is possible that the species is not evenly distributed across its extent of occurrence. However it is hard to conceive of factors that may limit the distribution or abundance of a widely distributed and apparently generalist species in what would appear to be the relatively homogeneous habitat of the western Amazon basin.

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Foraging Behaviour of Coyotes in Prairie Dog towns of Northwestern Mexico

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The aim of the work was to study coyote (*Canis latrans*) foraging behaviour and determine the influence of prairie dogs in their activity patterns. The study was conducted in north-western Mexico, in two contiguous properties, one occupied by prairie dogs, and the other where prairie dogs had been exterminated. Between February 1994 and June 1996 direct observations were made to determine coyote behaviour in the prairie dog town and adjacent grassland. Observations were conducted between dawn and dusk from a car or the top of hills. Behaviour was recorded using continuous focal obser-vations. Behaviours were grouped in: foraging, feeding, rest, stationary, travel, grooming, play and interaction. Animal observations totalled 51 hours. Activity peaked in the morning and afternoon, being lower at noon. Use of grassland was marginal. Coyotes invested more time foraging (40%). Most foraging time was spent walking (49%). In 63 capture attempts, coyotes succeeded 19 times, being prairie dogs the main prey and small rodents the next most frequent prey. Coyotes captured prairie dogs by chasing them, excavating their burrows, waiting at the burrow for prairie dogs to emerge, and by kleptoparasitism from raptors, this being the most successful method to obtain food. Most capture attempts were performed by a single coyote, regardless of if it was accompanied. Average coyote group size was 1.93. Seven interactions between coyotes and badgers (*Taxidea taxus*) were observed, 2 were aggressive, 1 passive and in 4, coyotes followed a foraging badger. High densities of diurnal prey (prairie dogs) favours diurnal activity of coyotes, even in areas where they are shoot. Foraging patterns coincide to those of an opportunistic species. Average group size and time invested foraging corresponds to the size of main prey. Activity patterns and foraging behaviour are strongly influenced by prairie dogs. Commensalism appears to be the most likely explanation for coyote-badger interactions.

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Using Ancient DNA Techniques to Address Questions in Canid Systematics

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Due to human influences over the last few centuries several canid species have dramatically changed their range and some have even gone extinct. Therefore, in some cases, the study of living populations provides a limited view of within-species diversity and gives a biased picture of the phylogeny of the group. Until recently, the relationship between extinct and extant taxa could only be assessed by morphological comparisons. Now, with recent developments in molecular genetic techniques, it is possible to extract and amplify DNA from some museum, archaeological and palaeonto-logical specimens. This opens a new, independent source of data which can be applied to canid systematic analyses involving extinct taxa. The limited amount of DNA that can be extracted from ancient specimens only allows for the study of short fragments of mitochondrial DNA (which is maternally inherited) with confidence. These studies may allow us to determine the origin of the red wolf, the systematic affinities of the Falkland Island wolf, and the relationships between late Pleistocene and modern canids in North America as well as the relationships between extinct and extant populations of African wild dogs.

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Non-invasive Molecular Tracking of Colonizing Wolf Packs in the Western Italian Alps

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The expanding Italian wolf (*Canis lupus*) population is currently recolonizing the Alps. Here we apply non-invasive methods to obtain genetic and demographic data on the colonizing wolf population. DNA samples, extracted from presumed wolf scats collected into two study areas in the western Italian Alps, were used to determine species and sex by sequencing parts of the mitochondrial DNA control region and sex-linked ZFX/ZFY genes. Individual genotypes were identified by multilocus microsatellite analyses. Performances of the laboratory methods were evaluated by taking into account the presumed age of the samples, and using multiple tube PCRs. The laboratory procedures allowed to amplify preferentially wolf and not prey DNA targets, and showed low rates of allelic dropout or occurrence of false alleles. Results indicate that: the quality of DNA samples may be improved by collecting fresh scats on snow in Winter; a preliminar mtDNA screening performed over all samples allows for species identification and is a good predictor of PCR performances; a panel of six to nine microsatellites allows the identification of individual wolf genotypes; location and distribution of wolf packs can be described by mapping the ranges of individual genotypes; microsatellite allow to infer genealogical relationships among geno-types.

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Ecological Niche of the Pampas Fox in a Mountain Grassland of Argentina

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We report the first results of a long-term project on the Pampas fox (*Pseudalopex gymnocercus*), one of the most widespread and least studied canids of Argentina, in the Tornquist Park (Pampas grasslands of Central Argentina). Foxes' diurnal activity is frequent, especially when compared to the second most common carnivore, the hog-nosed skunk (*Conepatus chinga*). Trapping and direct observation data suggest that the relative abundance of Pampas foxes is higher than those of the other carnivores of the area (the skunk, common grison, *Galictis cuja*, and Geoffroy's cat, *Oncifelis geoffroyi*) and that guild structure is affected by the presence of introduced large ungulates. The food niche of *P. gymnocercus* is wide. Invertebrates and fruits are the most frequent food items in its scats, but their contribution to the ingested biomass is probably smaller than those of large mammals (mainly carrion) and rodents. Our preliminary data suggest that the seasonal and local variations of this fox feeding habits are influenced by variations of food availability and that these are, in turn, affected by the presence of large ungulates. We recently started a radio-telemetry study, aiming to compare the ecological niche of the Pampas fox in this reserve and in a farming area.

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Dynamics of Wolf (*Canis lupus*) Population in Turkmenistan

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We can estimate the wolf population and its dynamics on the basis of quantity of pelts that local people brought to special places where they were paid for each killed wolf. And we also carried out several researches to calculate the number of the animals in small areas. According to the information of stock offices in 1930 s up to 816 pelts per year had been purchased, during the Second World War no more that 289, which indicates rather low level of hunting. In 1949 999 pelts were purchased. Sharp decline has been reported in period between 1967 and 1974 year (up to 413 pelts per year). Such level of the pelt purchase has remained up to now. It can be stressed that timing of the wolf number decline coincides with those of practically all large mammals and in the first place of wild ungulates, so that reduction of the wolf population might be a result of the food supply shortening, not of the direct extermination of the species. According to our estimations based on field data and on polls results total number of wolf in Turkmenistan is 1200-1400 animals. In some regions such as North-West Turkmenistan the steady decline takes place, but at the same time in the regions where stock raising is developed the wolf number has been increasing. The attitude to the wolf problem may be illustrated by the fact that its killing is permitted officially. In the other words the wolf in Turkmenistan has always been outlawed. And unfortunately it remains the same by now.

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Ecology and Conservation of the Mainland Population of the Zorro Chilote (*Pseudalopex fulvipes*)

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The endemic Darwin's fox or zorro chilote *(Pseudalopex fulvipes)* is one of Chile's most critically endangered mammals. The only known mainland population of zorro chilote is separated by 600 km from Chiloe Island, where the fox was formerly thought to be restricted. Two other species of the genus *Pseudalopex* are found in Chile: zorro chilla (*P. griseus*) and zorro culpeo (*P. culpaeus*). The mainland population of zorro chilote is within the geographical distribution of these two species. We have found that all three species of *Pseudalopex* are present in Parque Nacional Nahuelbuta. I am collecting basic natural history data on the zorro chilote and investigating inter- and intra- specific interactions among the three species to determine potential areas of ecological overlap and competition. From September 1998 to the present I have captured, radio-collared, and monitored 24 chilotes, 19 chillas, and 3 culpeos within the Park. Thus far, the results of the study indicate that the chilote and chilla have the greatest ecological overlap and therefore the highest potential for competition. I will discuss the results of initial analysis of home-range size and location, habitat content, activity patterns, survival, reproduction, morphology, and prey base of chilote and chilla and address immediate conservation concerns relating to the mainland popu-lation of the zorro chilote.

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Ecological Overlap Between Zorro Chilote (*Pseudalopex fulvipes*) And Zorro Chilla (*P. griseus*) In Mainland, Chile

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The endemic Darwin's fox or zorro chilote *(Pseudalopex fulvipes)* is one of Chile's most critically endangered mammals. The only known mainland population of zorro chilote is separated by 600 kilometres from Chiloe Island, where the fox was formerly thought to be restricted. Two other species of the genus *Pseudalopex* are found in Chile: zorro chilla (*P. griseus*) and zorro culpeo (*P. culpaeus*). The mainland population of zorro chilote is within the geographical distribution of these two species. We have found that all three species of *Pseudalopex* are present in Parque Nacional Nahuelbuta. I am collecting basic natural history data on the zorro chilote and investigating inter- and intra- specific interactions among the three species to determine potential areas of ecological overlap and competition. From September 1998 to the present I have captured, radio-collared, and monitored 24 chilotes, 19 chillas, and 3 culpeos within the Park. Thus far, the results of the study indicate that the chilote and chilla have the greatest ecological overlap and therefore the highest potential for competition. I will discuss the results of initial analysis of home-range size and location, habitat content, activity patterns, survival, reproduction, morphology, and prey base of chilote and chilla and address immediate conservation concerns relating to the mainland population of the zorro chilote.

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Greeting Behaviour in African Wild Dogs: Putting Behaviour Back Into Behavioural Ecology

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For the past 20 years canid behavioural ecologists have usually recorded the outcomes of behavioural interactions reflected in parameters such as group size, emigration rates and reproductive success. There has been little attention paid to the proximal behavioural interactions that un-derlie demographic outcomes. In contrast, primatologists such as Hinde (1983 'Primate Social Relationships') and de Waal (1988 'Chimpanzee Politics') have used social behaviour to study the more subtle costs and benefits of group living. Patterns of greeting behaviour among African wild dogs on the Serengeti were investigated to see if detailed study of social behaviour was useful in investigating social dynamics in the species. Greeting is a predominant interaction. In its typical form two or more dogs thrust their muzzles together with submissive facial expressions. In most greetings the behaviour of the dogs taking part appeared. Deviations from reciprocity were correlated with dominance with the subordinate dog showing the more intense posture. Rates of greeting were positively correlated with contributions to hunting. However, in each pack the details of greeting behaviour seemed to reflect the maintenance of particular cooperative relationships rather than follow fixed patterns of age or sex.

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Assessment of the Status and Threats to the Endangered Ethiopian Wolf

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Ethiopian wolves (C*anis simensis*) are afroalpine specialists, restricted to 'islands' of grasslands and heathlands above 3,000m asl surrounded by expanding subsistence agriculture. Despite the species' critical status, most populations were until recently unexplored or poorly known. Here we present results of expeditions conducted in 1998-2000 and a comparative assessment of the quality and extent of remaining Ethiopian wolf habitats and populations. Wolves were found in seven isolated ranges, two of them new to science. The populations south of the Rift valley were estimated at 300 in the Bale Mountains and 80 in Arsi. North of the Rift populations were relatively small, with Simien estimated at 40, North Wollo 35, South Wollo 25, Menz 25 and Mt. Guna 10. Wolves have become extinct in Mt. Choke and Gosh Meda. The total world population is thus estimated at 500 wolves. Suitable wolf habitats presented varying degrees of fragmentation, prey abundance and human use. Agriculture expansion is affecting population size and connectivity, resulting in an increasing degree of contact between wolves, people and domestic dogs. Rabies in dogs was reported in all areas visited, and is the main threat to wolf population persistence in the short-term. However, the persistence of wolves in very small 'islands' of habitat and in almost every available range of afroalpine ecosystem in Ethiopia highlights the species' resilience and adaptation to survival in fragmented habitats. However, small populations remain highly vulnerable to further habitat loss. These results greatly improve our previous knowledge of the Ethiopian wolf status, and provide crucial data for further analysis on metapopulation dynamics, habitat frag-mentation and consequent management practices specific to each population required to prevent further local extinctions.

Recovery of Ethiopian Wolf Packs after a Rabies Epizootic

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Infectious diseases pose a serious risk for several endangered carnivores that survive in small populations. The critically endangered Ethiopian wolf (*Canis simensis*), for instance, is susceptible to pathogens that 'spill over' from domestic dogs living in their close vicinity. In 1991 a rabies epizootic severely affected the largest surviving wolf population, located in the Bale Mountains of southern Ethiopia, where numbers dropped from an estimated 440 wolves in 1990 to 200-250 in 1992. Even though no signs of recovery had been detected until 1996, the population recovered to pre-epidemic levels by 2000. We analysed 14 years of demographic data and looked at the dynamics of population recovery, disclosing the crucial role of pack formation in the recovery process. Circumstances rapidly changed following the outbreak, from high density of wolves occupying all available habitat, to a situation of low density, fewer packs and extra resources available. However, the expected disintegration of social units into colonizing pairs or the occupation of 'vacant territories' by colonizing wolves did never occur. Instead, surviving packs retained their social structure and expanded their territories to cover all prime habitat available. The formation of new breeding units by fission of established packs was a newly observed phenomenon amongst Ethiopian wolves and the factor that most affected the population rate of increase. Benefits of group stability in defending a limited resource and the effect of group size on individual's decision to disperse seem to explain the observed dynamics.

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The Canidae Species in Uzbekistan

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Four species of Canidae occur in Uzbekistan: *Canis lupus campestris, Canis aureus, Vulpes vulpes karagan,* and *Vulpes corsac turkmenicus*. The physical characteristics, ecology, and status of each species is described. *Canis lupus campestris* Dwigubski. Weight is 20-35 kg. The colouring is gray-sand. Habitat: mountains, foothills, deserts. Food: rodents, wild sheep and goats, livestock, birds, reptiles, dead animals. Reproductive season: November-December. Gestation: 2 months. Litter size: 2-12. Nowadays because of development of many areas and direct destruction they have become scarce. *Canis aureus aureus* Linnaeus. Weight is 6-12 kg. There is a variation in colouring of animals from various areas of Uzbekistan. Habitat: riparian forests. Food: rodents, hairs, birds, reptiles, amphibians, insects, fruits of plants, dead animals. Reproductive season: February. Gestation: 60-62 days. Litter size: 2-9. In the middle of the 20th Century they were exterminated as harmful animals. Nowadays in many places they have disappeared. *Vulpes vulpes karagan* Erxleben. Weight is 2-3.5 kg. The colouring varies from ash-gray up to light-red colour. Habitat: mountains, foothills, deserts, riparian forests, cultivated grounds. Food: rodents, hairs, birds, reptiles, amphibians, dead fish, insects, fruits of plants, dead animals. Reproductive season: January-February. Gestation: 52-56 days. Litter size: 2-8. This species is the most common and widespread predator in Uzbekistan. *Vulpes corsac turkmenicus* Ognev. Habitat: deserts, semideserts, desert foothills. Food: small rodents, birds, reptiles, insects, dead animals. Reproductive season: January-February. Litter size: 2-11. In many areas has become rare.

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Diseases of Canidae Species in Central Asia

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The diseases (rabies, leishmaniasis, helmin-thosis) of Canidae species in Central Asia are a health hazard to people, domesti-cated dogs, and livestock. *Canis lupus*: these animals are often ill with rabies (*Virus fixe*). The fauna of internal parasites consists of seven species of helminths. *Canis aureus*: the blood protozoan parasite *Leishmania donovani* and the viruses of rabies and canine distemper (*Febris catarrhalis et Nevrosa canum*) are found in *Canis aureus*. Sixteen species of helminths can be found in this species, and a strong infection of *Canis aureus* with helminths and canine distemper will result in the disruption of a normal reproductive cycle. There is also a delay of spermatogenesis and approach of estrous, which is responsible for the large percentage of non-pregnant females in the population. There is also a delay of fall-off. In addition, twelve species of ticks (Ixodidae), four species of *Aphaniptera* and one species of *Mallophaga* are registered in *Canis aureus*. *Vulpes vulpes*: for this species thirteen species of helminths are registered. The fauna of external parasites consists of four kinds of ticks and one species of *Aphaniptera.* Rabies viruses are also found in *Vulpes vulpes*.

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Winter Habitat Selection of Wolves in the Western Alps

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Wolves (*Canis lupus)* were gradually exter-minated in the Alps at the beginning of the 20th century. Today, wolf recolonization in the Western Alps is occurring from populations in Central Italy. Landscape features in the mountains are of paramount importance to wolf recovery, therefore data on wolf habitat selection may help directing management decisions. We analysed 662.5 km of snow-tracking data of two wolf packs during two winter seasons (1999-2001) in the Western Alps to evaluate the selection of landscape attributes. We documented habitat use by continuous snow-tracking of wolves following the Study Design 1 (Manly *et al*., 1993). We tested the hypothesis that intra-territorial travel routes differ from areas within MPC in regard to landscape characteristics. Attributes selected for analyses included natural factors (vegeta-tion type, slope, aspect, topographic position, altitude) and anthropogenic factors (distance to roads, distance to human settlements). We used a GIS software package (ArcView) to overlay on digital maps these habitat variables. We used a logistic regression to evaluate the resource selection probability function. This data could be useful to predict wolf recoloni-zation, therefore management implications of this research may enhance efforts to maintain this endangered species in a fragmented habitat as the Alps.

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Proximate Explanations for Failed Pack Formation in *Lycaon pictus*

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Among the most social of all canids, the endangered African wild dog lives in packs in which the alpha pair typically monopolizes breeding while non-reproductive members help care for the offspring. Consequently, the size of the breeding population is directly related to the number of packs in the population. Although the formation of new packs affects both individual fitness and population dynamics, little is known about the process of pack formation and the proximate factors that influence the outcome. In this paper, seven cases of attempted pack formation are documented, of which four failed. Three possible explanations for pack annulment are considered: group size, mate competition, and mate choice (i.e., group compatibility). Our observations suggest that group compatibility can influence whether stable reproductive units form. The influence of individual behaviour, via the process of pack formation, on population dynamics is discussed. The potential conservation application of the theoretical study of wild dog pack formation is highlighted.

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Male Biased Sex Ratio in African Wild Dogs

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African wild dogs, *Lycaon pictus*, have male biased sex ratios at birth in captivity, among adults in most free-ranging populations and pups at den emergence (approximately 4 weeks). Secondary sex ratios from a long-term field study (1990 to the present) of wild dog life history characteristics in northern Botswana are presented here. In this study the adult population recorded by pack at year-end shows a significant deviation from parity in favour of males: 35 of 57 (61%, $P<0.03$) packs (excluding 13 ties) had more males than females. This bias was consistent with the sex ratio of pups: 32 (65.3%) of 49 litters (N=61 including 12 with equal numbers of males and females, $P<0.03$) had more males than females. There were significantly more males in the cumulative sample of pups: 328 of 593 pups (N=61 litters; 55.3%) were male; $P<0.008$. Analyses using multiple pack variables including maternal age, litter number, litter size, and various adult pack membership characteristics, indicate that only litter number (range: 1 - 6) can account for a significant portion of the variance in pup sex ratio. These findings are considered in terms of two hypotheses: local resource enhancement (cooperation) and local resource competition.

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About Supplanting Interactions in Social Canids

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Among the Canidae, wolves (*Canis lupus*) posess an extended system of interactions for solving their agonistic encounters with as few injuries as possible. According to Moran (1981), movements and postures of supplanter and displaced animals are mutually influenced. Such coordinated interactions also exist in other canids and in other mammals to a greater or lesser extent, e.g. in primates and ungulates. In young animals interactions are much more symmetrical than in adults, even during agonistic play. As they grow older they become more polarized, resulting either in a ritualized, choreographic fight or in direct aggression or chasing. Moreover, coupled, complementary movements in a similar manner to those of the wolves appear in the so-called "soft martial arts" like *taijiquan*, which requires a calm mental state and is reputed to be a therapeutic exercise. For an individual running the risk of being injured in fighting, it will be less stressful if he adjusts his movements to that of his antagonist, especially if the first is a subordinate animal. Variable levels of testosterone relating to hierarchical status of an animal could be responsible of his ultimate choice between showing a symmetrical response and a much more peaceful, complementary one.

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Conservation of Wild Dogs in South Africa: Problems With Establishing a Metapopulation

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Besides a fluctuating population of 200 - 450 wild dogs in the Kruger National Park there are no other conservation areas in South Africa large enough to contain a viable population. In 1997 a Wild Dog PHVA Workshop was held in Pretoria. One of the key recommendations from this workshop was to attempt to establish a second viable population of wild dogs in South Africa through the reintroduction of wild dogs into suitable areas and to manage the various sub-populations as a single meta-population. To date wild dogs have been reintroduced into three reserves with the reintroduction of a pack into a fourth area imminent. Although some progress has been made various problems including finding suitable areas and dogs for re-introduction, disease, fluctuations in reintro-duced packs and continuing negative feelings and ignorance of game ranchers and other stake holders in surrounding areas have hampered progress. The establish-ment of conservancies in game ranching areas and the tolerance to wild dogs by game ranchers are seen as an important but difficult challenge, but efforts to expand existing conservation areas, especially through the establishment of Transfrontier Parks offer some encouragement.

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Effects of Social and Environmental Factors on Coyote Vocalizations: a) Spectrographic Analysis of Barks and Howls, and b) Responses of Coyotes to Audio Playbacks

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We are investigating how social and environmental factors affect coyote (*Canis latrans*) vocalizations and responses to vocalizations. We recorded howls and barks from 3 female and 4 male captive coyotes. Analysis of spectrograms revealed that coyotes have individually distinct voices; discriminant analysis correctly identified individuals over 80% of the time. This analysis also suggests that there are sex-based differences in vocalizations. We conducted a playback experiment with free-ranging coyotes in northern California from March 2000 to April 2001. This series of 212 trials investigated how coyotes of different sex, age, and social status responded to playbacks over a variety of conditions. Nine playbacks were used: 4 coyote vocaliza-tions, 4 imitations of coyotes and/or prey, and a siren. We looked at how coyotes responded in different weather conditions and at different times throughout the year. Preliminary analysis indicates that territorial coyotes are more likely than transient individuals to approach or vocalize in response to playbacks, and that alpha, beta, and transient coyotes have different times when they are most responsive. Current field research is examining whether coyotes react differently to male versus female and foreign versus familiar vocalizations.

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An Analysis of the Costs of Red Foxes to Agricultural Interests in Britain

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Human-canid conflicts generally result from canids inflicting unwanted impacts on human livelihoods. Because these impacts often equate to financial losses, economic analysis is a relevant tool to use when considering them in that it enables decisions to be made about the allocation of resources amongst competing needs. The red fox is Britain's only native canid. Its situation exemplifies many of the issues involved in such conflicts, so it is an ideal subject for developing economic tech-niques to help resolve them. The fox is considered to be a pest primarily due to its predation on livestock (sheep, pigs, poultry and gamebirds). Fox predation imposes costs on farmers and landowners through the loss of stock as well as through measures used to prevent predation. Data on stock predation, husbandry, preventive measures, fox control and agricultural production were collected via questionnaire surveys of farmers and game interests across Britain in 1999 and 2000. These data were combined with information on regional fox population densities to look at the costs associated with fox predation at the farm level and how they are influenced by various factors, whilst attempting to find an optimal management solution from the farmer's point of view via financial analysis.

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Comparative Ecology and Conservation Priorities of Swift and Kit Foxes

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Swift foxes (*Vulpes velox*) and kit foxes (*Vulpes macrotis*) are taxonomically and geographically distinct North American mesocarnivores, whose range and abundance has drastically decreased. A comparative assessment of study sites in Canada, the United States, and Mexico suggests that these arid-land species are ecologically and demographically similar. Nevertheless, regional differences exist in the mechanisms that drive population dynamics and adaptations to local environments. For example San Joaquin kit fox reproduction is closely tied to precipitation levels while Canadian swift fox reproduction is affected by winter severity, and Chihuahuan kit foxes rely on prairie dog towns while swift foxes in Kansas have adapted to cropland agriculture. Despite such differences, shared range-wide threats include habitat loss and habitat fragmentation caused by urbaniza-tion, agriculture, and road developments. Moreover swift and kit foxes are the greatest victims of intraguild predation among canids, as coyotes kill up to 80% of monitored individuals throughout the range. We consequently assess regional data needs and propose collaborative research priorities that can address range-wide conservation challenges of both species.

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Reproductive Tactics in Golden Jackals (*Canis aureus*): A Model Incorporating Kinship, Behavioural Conflict, and Ecological Constraints

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Reproductive conflict, reproductive suppres-sion, and the recruitment of helpers are examined in golden jackals. Fitness benefits to dominants and subordinates in terms of pup survival is calculated for different subordinate breeding roles, e.g. i) sub-ordinate stays and helps, ii) subordinate stays and breeds, iii) subordinate disperses and breeds, and for different costs of dispersal. The results indicate that the dominant benefits more if the subordinate stays and helps (e.g. due to higher pup survival and coefficient of relatedness), than if the subordinate breeds at home or on a different territory. Subordinates would bene-fit more by breeding on the dominant's territory, than if they helped the dominant's pups. This creates a reproductive conflict and potential disagreement on the subor-dinate's breeding role on the natal territory. A quantitative analysis of jackal territorial tenureship indicates that sub-ordinates face a major ecological cons-traint, the difficulty of acquiring a territory, and hence the probability of successful dispersal in their first year is low. A model is presented to illustrate how the cost and benefits of reproductive tactics could shift with changes in related-ness to the breeding pair, changes in pup survivorship, and changes in the probability of securing a breeding territory.

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Selection of Marking Sites by Red Fox (*Vulpes vulpes* L.) in Spain

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Like many species of Carnivora, red foxes *(Vulpes vulpes*) mark their territory with urine, faeces and diverse secretions, selecting places and sites that guarantee or facilitate their detection by other individuals. In Valdelatas wood (259 ha) in Madrid, foxes deposit their scats mainly in clearings. Rabbits (*Oryctolagus cuniculus*), which are prey of foxes, indicate their presence and mark their territory in the same clearings by defecating intensively and scratching the ground. Within these clearings, fox scats are found on top of the soil and generally occupy the inner border of the clearings. Scats found in the centre, or at least well inside, the clearing are associated with prominent parts of environment such as stones, stumps of trees, or conspicuous anthropic objects, to which they seem to be attracted. Along tracks, foxes often place their scats on the sides of the track, and also sometimes on prominent points (mounds of terrain, stones, etc.). Central placement of scats only occurs on paths that are commonly used by foxes. However, these centrally placed scats are often in or close to the entrance to a clearing. The scarce number of scats found in principal tracks contrasts to the results from other areas less walked by people, such as Montes do Invernadeiro (Orense, Northern Spain), where in addition scats are placed on top sites, and more evenly distributed between intersection and no intersection sites.

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Diet and Habitat use in Jackal, Jungle Cat and Caracal in a Semi-arid Region of India

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Spatio temporal patterns and diet of jackal (*Canis aureus*), jungle cat (*Felis chaus*) and caracal (*Caracal caracal*) were studied to understand co-existence. The study was conducted between January 1994 and May 1996 in Sariska Tiger Reserve in India. Spatio-temporal patterns were studied through direct and indirect evidence in various habitats within the reserve. Scats were collected within the scrub area on 1-km transects, on dirt tracts, along paved roads and during random searches. Thin Layer Chromatography was used to identify scats of different predators from their fat and bile acid content. Rodent jaws in scats were identified from dentition. Jackals used the open habitats whereas jungle cats used denser habitats more. Jackals were largely diurnal whereas jungle cats tended to be nocturnal. Jackal diet had higher amounts of vegetable matter (43% scats) than jungle cat (16% scats) and caracal (17% scats) diet. These carnivores consumed three species of rodents: *Tatera indica*, *Golunda ellioti* and *Mus platythrix*. In terms of energetics rodents were less important for jackals than for felids. Rodents fulfilled 47 – 67% energy requirements for jackals as compared to 53 – 92% for felids. Rodent abundance was negatively related to disturbance from human activities.

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Hunting, Migration and Sinks/Sources Among Northern Canadian Wolf Populations

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In Northern Canada, wolf hunting can be substantial. In 1998, 633 wolves were killed at Rennie Lake (RL), an 8,000-km^2 taiga area that could sustain 53 resident wolves, assuming peak densities. In 1993-2000, 270+/-211 (mean+/-SD) wolves were hunted each winter. Some biologists are alarmed about potential overharvesting related to harvest methods, particularly snowmobile hunting. We aimed at determining whether sink-source mechanisms operate among distinguishable wolf populations. Alternative-ly, if population differences are not found, wolves could be assigned to a continuous population, and local hunting sustainability would be higher. We captured, fitted satellite or VHF collars, and drew blood from 68 tundra wolves. We sampled wolf scats (>30) and hides (>550) throughout Northern Canada and 304 hides from wolves killed at RL by three hunters in November-December 1999. We analysed 12 DNA microsatellites. This study is the first to document long-range migration of wolves. Tundra wolves migrate with caribou between distinct tundra-summering and taiga-wintering areas (defined as 95% kernels). Our data show that in 1998 wolves congregated in RL. We detected allelic differences between RL and tundra wolves. However, genetics and telemetry showed that some individuals appeared in both categories. We conclude that tundra wolves serve as source population for RL.

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The Status of the Canids of Saudi Arabia

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Five canid species are known from Saudi Arabia. They are: *Canis aureus, Canis lupus, Vulpes vulpes, Vulpes rueppelli,* and *Vulpes cana.* The status of each species is reviewed and its present conservation status is mentioned. The most common species is the red fox *Vulpes vulpes* and the least common is Blanford's fox *Vulpes cana*. An additional record of *V. cana* (skin and skull) has been collected from western Saudi Arabia and additional material of *C. lupus* has been collected recently from different parts of the kingdom. The known occurrence of each of the five species in Saudi Arabia is presented in a separate map.

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The Diet of Red Fox (*Vulpes vulpes*) In Two Areas of Parque Nacional da Peneda-Gerês (NW Portugal)

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Although studied in a great extent all around its distribution area, there is still much to learn about red fox ecology in Portugal. To reveal a little more of the natural history of this canid in the region, two studies were implemented in the two extremes of PNPG, the Castro Laboreiro and Montalegre regions. Both areas can be included in what is called the Agricultural Mountain System or *Bocage*, typical of NW Portugal. The system is characterized by small villages, surrounded by agricultural and pasture fields, intermixed with patches of deciduous forest (mainly *Quercus pyrenaica*), that occur especially in the river valleys. Despite this, there are ascertainable differences in the landscape structure and composition of these two areas. In order to study the tropic relationship between the red fox and it's prey in both landscapes, we estimated the relative density of small mammals (*Apodemus sylvaticus*, *Microtus lusitanicus* and *Talpa occidentalis*) and rabbits (*Oryctolagus cuniculus*) and evaluated fox diet by scat analysis (total of 682 scat samples). Rodents, arthropods and fruits were the main food items in the diet of red fox in both areas, but significant differences were seen between the diets of foxes in the two regions.

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Source-sink Dynamics Induced by Hunting of Culpeos to Reduce Sheep Predation in Patagonia

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The population dynamics of many canid species have been extensively studied, but the effects of heterogeneous spatial distribution of hunting on these dynamics have not been addressed explicitly. We studied the effects of hunting on culpeos (*Pseudalopex culpaeus*) to reduce sheep predation, tested a source-sink model to incorporate the spatial distribution of hunting, and analysed the effects of landscape changes on culpeo population dynamics. The study was done between 1989 and 2000 on two cattle and four sheep ranches in Argentine Patagonia, where we tested predictions about survival, fecundity, and dispersal by monitoring densities, collecting carcasses from hunters, and radiotracking 44 culpeos. We concluded that culpeo populations on sheep ranches (sinks) could not persist via internal population mechanisms and are maintain-ed by constant immigration from cattle ranches (sources). We used a simulation model to evaluate the management implications of our results. The landscape mosaic of sheep and cattle ranches is dynamic because ranchers switch activities occasionally in response to changes in beef and wool prices. The current percentage of land on sheep ranches in the region is ca. 63%. According to estimated vital rates of culpeos and landscape structure, the current hunting pressure on culpeos in the region would not be sustainable if that percentage rose above 70%.

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Bat-eared Foxes as Predators on Harvester Termites

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Bat-eared fox *Otocyon megalotis* distribu-tion in southern Africa nearly completely overlaps with those of the harvester termites *Hodotermes mossambicus* and *Microhodo-termes viator*. These taxa are the most common prey, both in frequency of occurrence and percentage volume of scats analysed, for most of the year. Morphological adaptations for preying on insects and especially termites include huge ears and acute hearing for locating prey, a broad tongue, modified insertion of the digastric muscle allowing up to 5 bites s^{-1}, and between 46 and 52 sharp, high-cusped teeth, while behavioural adaptations include coherence of the nuclear family group for up to 6 months, intra– and intergroup sharing of food-rich patches, selection of foraging habitats with high termite density and an activity regime, in southern Africa, that closely coincides with that of *Hodotermes* spp. Bat-eared foxes had significantly longer feeding bouts when feeding on termites in patches (9.7 ± 8.5 s $bout^{-1}$) than when feeding on insects not concentrated in patches (4.24 ± 1.72 s $bout^{-1}$), and spent significantly more of their foraging time actually feeding when preying on termites (69.5 ± 11.7%) than when preying on food not concentrated in patches (4.3 ± 2.4 %). A mean of 27.7 % of the foraging time hou^{r-1} was spent foraging in termite patches, resulting in effectively 19.2% of total foraging time actually feeding, compared to 72.3 and 3.1 % respectively when foraging for other prey. As *H. mossambicus* has energy values comparable to those of other insects (ca 21-22 kJ^{-1}) as well as protein and fat contents (15-20 %, and 5 % respectively) and are fed upon at a much higher rate than other insect or invertebrate prey, results suggest that termites are the most profitable prey and that bat-eared foxes are well adapted, perhaps uniquely so, to this particular food source. As one group consume > 4 million termites km^2 $year^{-1}$, these foxes are beneficial to farmers and should enjoy greater protection.

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Black-backed Jackal Social Organization in Relation to Food Dispersion on a Desert Coast

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Black-backed jackal *Canis mesomelas* living on the Namib Desert coast of Namibia feed nearly exclusively on food of marine origin, mainly seals and birds. Food availability (taxon, biomass and spacing of food patches) as determined by beach censuses vary along the coast, as does availability of water and shelter. Apart from very low numbers of Brown hyaena *Hyaena brunnea* other mammalian predators are absent. We compare a) group size b) density and c) territoriality of jackal at three localities – Skeleton Coast, Cape Cross Seal Reserve and Sandwich Harbour – with prey availability. Faecal analyses indicate that along the Skeleton Coast prey consisted mainly of birds, available at 0-2356, mean 236 g km^{-1}, and seals, available at 0-14.93, mean 4.28 kg km^{-1} of beach. Food patches were usually widely spaced. Mean group size of jackal was 1.5 (n=174), with densities of 0-0.8 (mean 0.38) jackal km^{-1} of coastline. Jackals only sporadically patrolled the beach and otherwise moved inland. Territoriality was weakly developed and broke down at seal carcasses and water sources. Seals at Cape Cross numbered 90-100 000, concentrated in ca. 6 km of beach. Prey here was predominantly seal, available at 57 kg meat km^{-1} coastline day^{-1}. Jackal groups constantly moved to and from the seal rookery. Mean group size of jackal was 2.1 (n=491); density fluctuated between 13 – 22 jackals km^{-1} coastline. At Sandwich Harbour, with a small (ca. 10 000) seal rookery and abundant birdlife in brackish wetlands, prey again consisted mainly of birds, available at up to 39.85 kg km^{-1}, and seal, available at up to 29.7 kg km^{-1} of coastline. Mean group size of jackal was 2.5 (n=22), density 2.0 – 4.0, mean 2.7 km^{-1} coastline, and jackal had territories. However, mussels and polychaetes available on tidal mudflats were shared by temporal spacing of different groups. Results indicate that at very low and super-abundant prey availability territoriality is absent, while at intermediate levels it is well developed, albeit with sharing of some food resources. Density, but not necessarily group size, of jackals was positively correlated with food availability.

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Howling Activity of Free-Ranging Wolves

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Studies were conducted in the Polish part of the Białowieża Primeval Forest (NE Poland) and in the Western Beskidy Mountains (S Poland), in 1994-2000. In the BPF during the 24-hour radio-tracking sessions, conducted with the same durability during the whole year, 136 cases of spontaneous wolf howling were recorded. Wolves showed the highest intensity of howling from July to October (57% of all cases), with a peak in August. Howling was most rarely heard in October and December (6% of all howls). Diurnal distribution of 115 howls with the exact time of starting, showed a prolonged peak of howling activity between 20.00 and 24.00 (56% of howls during the whole day) and a lack of howls from 09.00 to 14.00. The highest howling activity was found during the night (69%) and dusk and dawn (23%). In all cases wolves howled from the central part of their home ranges, not from peripheries. In the Białowieża Primeval Forest and the Western Beskidy Mountains 150 replies to simulated howling were received, in 1997-2000. For 41 replies the number of howling wolves was estimated and in 40 cases the howling length was measured. The duration of wolf howls varied between 15 and 160 s. (on average 62 s.) and was significantly positively correlated with the number of howling wolves. The time of reaction on the stimulation ranged from 0-120 s, on average 10 s., and was negatively correlated with the number of wolves in a pack.

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Problems of Wolf Protection in Poland

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Though the wolf is protected in the majority of Western European countries, there has not been a single wolf in the wild in most of them for many years. Poland is a unique country, where the wolf is both protected and still occurs. Currently, thanks to strict protection, the Polish wolf population is very slowly but significantly increasing and enlarging its range. It will play a very important role in the wolf recovery in Western Europe, as a source of migrating individuals. It is impossible to protect wolves solely through establishing national parks or nature reserves. For their benefit it is important to allow wolves to inhabit the managed forests and to increase accep-tance of these predators amongst local communities, mostly farmers, foresters and hunters. The present status of the wolf in Poland is criticized by hunters and livestock owners, who want the wolf to be returned to the status of game animal. There are a number of other threats to wolf populations, such as: wolf killing in the trans-border areas (in the Slovak Republic, Ukraine, Belarus and Russia); over-hunting of wild ungulates in wolf areas; poaching, lack of corridors between forest complexes; fragmentation of existing forests by highway building; and colonisation of agricultural areas by roaming wolves. This is the reason why widespread education and intensive monitoring, as well as resolving conflicts between men and wolves are fundamental to work for the long-term protection of wolves in Poland.

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The Ontogeny of Vocalization in the Domestic Dog (*Canis lupus f. familiaris*) Compared to the Wolf (*Canis lupus lupus*)

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Vocalizations in domestic dogs, especially the bark, are still a topic of scientific discussions. Most studies focus on a single vocalization, e.g. the howl or the bark, but only a few are investigating the whole repertoire of a breed and the communica-tive meaning of each sound. One of the aims of this study is to classify the different sounds and compare the ontogeny of the vocal repertoire of the dog to that of the wolf. The breed representing the domestic dog in this study was the Bull Terrier. In the first eight (8) weeks of life of a litter of nine Bull Terrier pups the behaviour of each animal was videotaped. The acoustic communication was sonographically analy-sed. This method of identification of different sounds is easier and the purely subjective auditive clas-sification can be verified by objectively measured parameters. For each sound the social context was noted, so the relationship between sound structure and signal function was heeded. The following parameters were used: fmax= maximum of spectro-graphic pictured sounds (Hz), xfo= average value of the lowest frequency band of harmonic sounds (Hz), xfd = average value of the frequency of strongest amplitude of noisy sounds (Hz), delta f= frequency range of sounds (Hz), duration of sounds (ms). The vocalizations found were divided into three main groups, *noisy, harmonic and intermediate*. For the Bull Terrier fifteen different vocalizations were discovered and were later fit into a sound system accor-ding to Schassburger. The changes in the sound repertoire (disappe-arance of infantile sounds) and its composi-tion during the early ontogeny were reported and the relation between the sound and the associated behaviour was recorded and analysed. Statistical analysis was run using "Excel 97". All results were compared with the vocal repertoire of other dog breeds and of the wolf. Concurrences and differences, e.g. the missing of the howl and the twelve different types of barking (and their meaning) found in the vocal repertoire of the Bull Terrier, were discussed.

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The Behaviour of Polar Wolves (*Canis lupus arctos*) Sharing an Enclosure with Brown Bears (*Ursus arctos*)

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There is a considerable shortage of studies about the behaviour of animals kept in mixed species exhibits, stu-dies about two species of carnivores sharing an enclosure practically don't exist. This study was focussed on the behaviour of three Polar Wolves *(Canis lupus arctos)* (2,1) that are kept together with three female brown bears *(Ursus arctos)*. The following questions stood in the centre of interest: How did the wolves behave towards the bears in general? How in case of an inter-specific conflict? Were there inter-specific interac-tions and who initiated them? How could the territorial behaviour of the wolves work in a confined space they have to share? How are conflicts over resources solved? The animals live in a wooded enclosure (4 a) in the "Wildpark Johannismuehle" in Branden-burg, Germany. Observations took place between Oct. 2000 and Aug. 2001. The animals were surveyed daily, the position within the enclosure (in form of coordinates), the status (active/inactive) and the behaviour of each animal (using a set of defined categories of behaviour) was recorded every 5 minutes. Generally the wolves showed intra-specific activities during 73% of the time ($p<0.01$). The majority of inter-specific interactions was initiated by the wolves (93%; $p<0.01$). They e.g. used the bears as substitutes for prey in their "hunting games" when practising pack hunting. In case of an inter-specific conflict, the wolves used pack strategy to "confuse" the attacking bear. The wolves used 100% of the enclosure, completely ingnoring the terri-torial claims of the bears. The rare conflicts over resources were mainly (86%) solved by threatening behaviour and escalated only in 4% of the cases ($p<0.01$). Summing up it may be said that the patterns of behaviour shown by the wolves in this mixed species exhibit are highly varied and enlarged by the presence of the bears.

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The Red Fox (*Vulpes vulpes*): Its Abundance and Diet in North East Ireland

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Spotlight counts, analysed using DISTANCE sampling, were used to index the relative density of red fox *Vulpes vulpes* populations in two upland and two lowland regions (160-341km^2) of north-east Ireland. Study areas ranged in size from 160-341km^2, with counts taking place in spring and autumn 2000/2001. Dietary information was gather-ed from the analysis of scats collected in the four regions during summer 2000 and winter 2000/01. Fox abundance varied regionally, with highest abundances being found in lowland regions. The highest spring abundance was 1.3/km^2, whilst the lowest was 0.27/km^2. During autumn, fox abundance in three of the areas was greater, and varied between 0.5-3.8/km^2. In summer, rabbits (*Oryctolagus cuniculus*) and birds (mainly Passerines) contributed most to the diet in lowland regions. In the uplands, rabbits, carrion (mainly sheep) and Irish hares (*Lepus timidus hibernicus*) were important dietary components. During winter, rabbits were the most important dietary item in all regions. The variation in fox abundance may reflect regional differences in control measures whilst dietary intake probably reflects the availability of food resources.

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A Comparative Study of Larynx Anatomy and Howling Vocalizations in Five Canids

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We investigated the laryngeal anatomy and howling vocalizations in timber wolves (*Canis lupus*), coyotes (*C. latrans*), Australian dingoes (*C. dingo*), New Guinea singing dogs (*C. hallstromi*) and domestic dogs (*C. familiaris*). Thirteen larynges were dissected for analyses. We compared 18 dimensions of the laryngeal cartilages (epiglottis, thyroid, cricoid, arytenoid, corniculate, cuneiform) and 3 dimensions of the associated musculature. We also conducted a spectro-graphic analysis on a total of 750 chorus-howls and of 193 solitary howls. Preliminary results indicate the presence of a mucosal flap in the larynx of dingoes and New Guinea singing dogs (NGSD), which extends from the vestibular and vocal folds into the lateral ventricle. The spectrographic analyses indicate that the howling vocal-izations of the five canids are qualitatively distinct. Dingo chorus-howls showed the greatest frequency variation while wolf chorus-howls showed the least. During a chorus-howl, dingoes howl with distinct pitches and as the number of individuals in the chorus increases, so does the variation in pitches. Dingo and NGSD howls also showed the greatest frequency modulation comp-ared to the other canids. If receivers are attempting to estimate the number of individuals howling, these highly variable chorus-howls might generate a confounding effect by making pack size appear larger.

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Wolf Conservation in Europe

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Human acceptance is the most important factor in the conservation of the grey wolf in Europe. However, the existence of the wolf has not yet been accepted by humans, as demonstrated by the fact that the wolf is persecuted whether it preys on domestic or wild animals, or for plain intolerance. The conservation model in areas with stable wolf populations does not provide long-term solutions and it causes many conflicts among livestock owners, hunters, conserva-tionists, and public authorities. Wolf mana-gement swings between tolerated and untolerated densities, with periods of high, generally illegal, mortality. This is inconsistent with the wolf's status since 1992 as a species of community interest in Europe. In addition, the quality of wolf habitat is generally poor, with wolves specializing in feeding on domestic animals as a result of access to live animals or carcasses. An alternative model for long-term wolf conservation in Europe should be based on novel approaches, such as: a) Recovery of wolf's natural trophic behaviour making use of wolf's capacity for trophic specialization. b) Restoration of wolf habitat by assuring the presence of the wolf's natural prey, curbing the invasion of free-ranging, untended livestock, restoring traditional herding and grazing practices, and keeping livestock carrion out of the reach of wolves. c) Educating people for wolf conservation by promoting awareness of the wolf's biology and the understanding that wild ungulates and lagomorphs are the wolf's most acceptable prey.

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The Scandinavian Wolf Research Project (SKANDULV)

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The Scandinavian Wolf Research Project (SKANDULV) was initiated in 1998 involving several Norwegian and Swedish research departments. SKANDULV is studying the recovering Scandinavian wolf population addressing questions about population dynamics, effects on prey populations, population monitoring, conflicts with live-stock, dogs and reindeer, population genetics and human dimension aspects. During 23 successive winters, 1978/79-2000/01, the wolf population in Scandinavia has been monitored by snow tracking. In December 1998, the first 7 wolves were radio collared in Sweden, and so far 28 wolves have been radio collared in Sweden and Norway. At present, 20 are still alive being radio-tracked at regular basis. Preliminary data indicate that annual home range of territorial wolves varies from 680 km2 to 1700 km2. The effects on the main prey species in Scandinavia, the moose, are being studied mainly by ground tracking wolves on snow and radio tracking wolves throughout the year to produce kill rates which then are related to moose production data. Locally, the wolf packs may have an impact on the moose population, whereas this effect is more dubious looking at the total distribution area of wolves. To reduce the problem of wolves killing hunting dogs, a "wolf telephone" has been installed where hunters may call and be informed about the latest wolf radio position, enabling them to avoid such areas.

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Seasonal Movement and Home Range of Sierra Nevada Red Fox in Northern California, USA.

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The Sierra Nevada red fox (*Vulpes vulpes necator*) is one of two red fox subspecies in California and the only one native to the state. It occurs at low densities throughout California's Sierra Nevada and Cascades mountains above 1300 m elevation and has been designated a state-threatened species. In March 2000, the University of California at Berkeley, Lassen Volcanic National Park, Lassen National Forest and the California Department of Fish and Game began a 30-month investigation of the basic ecology of the Sierra Nevada red fox population in the Lassen Peak region of northern California. Research goals include quantifying home range size, seasonal movements and activity patterns. As of July 2001, five red foxes (1 M, 4 F) had been radio-collared and tracked by telemetry. Summer home ranges (June – October; 95% MCP) averaged 992 ha (SD = 341 ha) and had little overlap, suggesting territoriality. In winter, the foxes moved up to 15 km southward to lower elevations, returning to higher elevations once spring returned. Photostations detected red foxes most often between 2100 and 0500 hrs. Research is ongoing and additional results to date will be presented.

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Succession Debt: Effects of Clear-cut Logging on Wolf-deer Predator-prey Dynamics in Coastal British Columbia and Southeast Alaska

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Clear-cut logging in the temperate rain-forests of coastal British Columbia and southeast Alaska initiates a pattern of forest succession that has long-term adverse consequences for wolves (*Canis lupus*) and their principal prey, sitka black-tailed deer (*Odocoileus hemionus sitkensis*). Twenty-five to 40 years after clear-cutting, regenerating stands of even-aged conifers grow into a "stem exclusion" stage characterized by a dense canopy and depauperate under-story. Once initiated, the patterns of change are inexorable and adjustments to future forest management will do little to mitigate the consequences. We call this set of circumstances "succession debt". Clear-cutting substantially reduces carrying capa-city for deer. Moreover, roads cons-tructed during logging facilitate access to wolf and deer habitat by people. The long-term effects include declines in populations of deer and wolves, greater vulnerability of deer to severe winter weather, greater probability that wolves will suppress deer numbers at low levels, increasing risk of unsustainable exploitation of deer and wolves, and increased likelihood of conflicts between hunters and wolves for deer. Moreover, the archipelago nature of the area likely amplifies these effects. Island populations are more vulnerable to distur-bance from logging and less likely to be readily recolonized. We compare wolf-deer systems from adjacent areas of south-east Alaska and coastal British Columbia that differ in degree of habitat alteration and human population. In sparsely populated and pristine coastal northern British Columbia, human-caused mortality of wolves is low, and prey populations are likely at historical levels. In contrast, Prince of Wales Island in south-east Alaska has undergone extensive harvesting of timber, and stem exclusion stage forest regenera-tion will dominate the forested landscape in 20–40 years. Harvests of 30-40% of the wolf population are common and we predict substantial declines in deer population over the next 50 years. Conflict between hunters and wolves for deer is increasing. Resource managers need to consider long-term consequences of forest management on predator-prey systems and recognize that mitigation of those consequences may not be possible.

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Modelling Territorial Animal Populations With Social Structure: Predictions From A Computer Simulation

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Ensuring the welfare of wild canid populations depends upon the ability to integrate species biology, the environmental aspects upon which those populations depend, and the factors controlling species abundance. Toward this end, we devel-oped an individual-based computer model using Swarm to mimic natural coyote populations. Swarm is a software platform that allows the user to describe individual behaviours for all individuals, link those behaviours in each concurrent time step, and assemble behaviours and objects in a hierarchical framework. Our model stands apart from previous modelling efforts because it relies on field data and explicitly incorporates behavioural features, such as dominance and territoriality, as major determinates of species demography. Individual variation, such as status within territorial social groups and age-based reproduction are assumed, but assumptions typically associated with most demographic models are not needed. The eventual goal is to incorporate other environmental comp-onents such as prey abundance and/or competing carnivores. This type of model could provide insights into potential mana-gement alternatives for when the gray wolf in the United States, as well as, African Wild dogs and other endangered canids.

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Love, Hate and Lunacy: Responses to the Wolf in the Middle Ages and the Present Day

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It is crucial for modern biologists and conservationists to consider the temporality of changing attitudes towards the wolf and its environment. The popular notion of the status of the wolf in the Middle Ages as a purely evil creature is too generalized. The medieval wolf seems to have been charged with a range of symbols from various sectors of society differing across time and space. From heraldic emblems and heroic poetry to biblical passages and bestiaries, the wolf seems to have fulfilled a series of important functions. Today the wolf is an object of admiration, inspiration, hatred and fear. From conservationists, zoologists, black metal bands and gothic novelists to hunters, farmers and politicians the concept of 'the wolf' is as much a social as a biological category. Wolves were hunted in the Middle Ages, they continue to be hunted today; werewolf trials pepper the late Middle Ages, today the werewolf continues to rage across the screen and book. So what has changed? This presentation consisting of a series of posters, will draw some broad contrasts and comparisons between the wolves of medieval and modern society and suggest why the wolf will continue to be used and abused both physically and conceptually in the future.

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The Fossil Record of *Canis* (Carnivora: Canidae) in South America. Comments on the Systematic Status of *Canis gezi*

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The fossil record of canids in South America began in the Upper Pliocene (Marplatan Age, Vorohueian Subage) with the first occurrence of the fox *Dusicyon.* Only in the Lower/Middle Pleistocene they were more diverse when *Theriodictis*, *Protocyon*, *Chrysocyon*, large species of *Dusicyon*, and supposly *Canis* are found. The genus *Canis* is recorded in the Ensenadan through the species *C. gezi*, which is known from an incomplete skull (the Holotype) and a fragment of mandible. Other species of *Canis* have been found in Upper Pleistocene sediments. Some of these records lack precise stratigraphic proven-ance (e.g. *C. nehringi* Holotype), and may be Bonaerian (500.000 to 200.000 years BP) or Lujanian (200.000 to 8.500 years BP) in Age. The review of the materials of *C. gezi* shows that these specimens share many characters with *Thriodictis* (e. g. para-occipital process expanded posteriorly; morphology of premolars; reduction of the M1 labial cingulum) that separate it from *Canis*. Thus this species must be assigned to *Theriodictis*, and possibly sinonimized to *T. platensis*. This preliminary study suggests that *Canis* immigrated in South America in the Upper Pleistocene, and has accurate stratigraphic records only since the latest Pleistocene (Lujanian).

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Conservation Genetics of Wolves (*Canis lupus*) in Italy

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Hybridization with free-ranging dogs is thought to threat the genetic integrity of wolves in Europe, although available data evidenced only sporadic cases of crossbreeding. Here we report results of population assignment and genetic admixture analyses in wild-living wolves sampled from various European populations, in dog samples including 30 different breeds and feral dogs, and in captive-reared wolves of unknown or hybrid origins, which were genotyped at the mtDNA control-region and at 18 microsatellites. Genetic variability was significantly partitioned among wolf populations and between wolves and dogs, suggesting that they represent distinct gene pools. Some wolf populations showed significant deficit of heterozygotes, positive F_{IS} and deviations from HWE. Multivariate ordination of individual genotypes and clustering of inter-individual genetic distances split wolf populations and dogs into different clusters congruent with prior phenotypic classification, but hybrids and wolves of unknown origin were not identified from genetic information alone. By contrast, Bayesian admixture analyses assigned all wolves and dogs to different clusters, independent of prior phenotypic informa-tion, and simultaneously detected the admixed gene composition of the hybrids. Admixture analyses showed a few individual "wolves", sampled in Italy and elsewere in Europe, which had mixed ancestry in the dog gene pool and could be hybrids.

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Evaluation of Different Techniques For Capture and Anaesthesia of Painted Hunting Dogs

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The painted hunting dog *Lycaon pictus* is one of the most endangered carnivores in Africa. Previous field research shows that reduction of anthropogenic damage from shooting snares and cars is pivotal to reversing this decline. Consequently when the species resides in inherently hostile, anthropogenically dominated, environ-ments, management of the species by collaring and translocation is essential for conservation purposes. This paper compares three drug regimens and four different capture techniques for painted hunting dogs. New data are introduced to evaluate the safety of different drug regimens and capture regimes as well as the usefulness of rectal body temperature and time to ataxia as indicators of stress. A new capture technique for this species is described which uses humane snares at night in tandem with ketamine to induce short-term amnesia. It is concluded that hyperthermia is concomi-tant with capture method and drug regimen and is likely to be a product of stress. Snare capture was the least stressful of the methods concurrent with direct human association, with helicopter assisted boma capture and fentanyl showing signifi-cant hyperthermic effects. Recommenda-tions for capture and anaesthesia protocol are discussed.

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The Golan Wolf Study: Ecology, Food habits and Livestock Depredation

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The study was conducted on the Golan Heights, an area of 1000 km^2 in northern Israel. Golan wolves are slightly larger than the wolves found in the south of Israel. In the 1980's, observations of wolves in the Golan were very rare, but since 1993 there has been an increase in the number of observations. Parallel to this increase there has also been an increase in livestock predation by wolves and a decline in the population of gazelles. On this basis, a study on the Golan wolves was established. The goals of this study were: to estimate the wolf population size and its condition, learn about the ecology and food habits of wolves in the Golan, and to learn how to deal with wolf predation on livestock. We estimate that wolf population in the Golan is between 80-100 wolves. The wolves' home range in the Golan of between 40-80 km^2 is small compare towolves in other areas, and the annual survival rate of the Golan's wolves is relatively low (48%). The diet of wolves in the Golan includes: gazelles, young wild boars, carrion and livestock. In 1999 after the livestock protection methods were employed, the of livestock predation cases were reduced by 30%.

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Culling Canids: Do We Know What We are Talking About?

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This talk focuses on the scientific methodol-ogy applicable to studies of deliberate culling. The red fox is perhaps the canid species in which deliberate culling has been most studied, and serves as my chief example. The basic questions are usually: What is the impact of culling on the canid population?, and What is the consequence of culling for some resource over which man and canid compete? Over the years, wildlife biologists have tried many ap-proaches to these questions, including bag record analysis, quantifying losses to dif-ferent causes of mortality, using age structure to derive survival rates, measuring cohort survival, experimental removal studies with controls, etc. Modelling also plays an important role. Current wisdom on culling issues in generally amounts to an untested paradigm derived from the full suite of such studies. Unfortunately, all the approaches have major methodological and interpretational pitfalls, and typically very low power to discriminate between competing hypotheses. In any case, the question addressed is often poorly defined. If - as wildlife biologists - we are to advise impressively on culling-related issues, we need to do a lot better than this. I make some suggestions for raising standards.

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Phylogeny of Canidae: Inferences from Combined Morphological, Behavioural and Molecular Data

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Phylogenetic relationships within the Cani-dae are examined based on molecular (cytb, COI, COII, 12S rDNA) sequences and 218 morphological, developmental, behavioural, and cytogenetic characters. Both separate and combined phylogenetic analyses were performed. To inspect the phylogenetic "behaviour" of individual taxa, the basic phylogenetic analysis was followed by the sensitivity analyses. The following tree of the Canidae is preferred: (*Urocyon* (*Otocyon* (*Vulpes* (*Nyctereutes* ((*Dusicyon* s. lat. (*Cerdocyon* (*Atelocynus* (*Speothos* + *Chrysocyon*)))) (*Canis adustus* (*Lycaon* (*Cuon* (*Canis mesomelas* + rest of *Canis*))))))). The ancestral canid is reconstructed as a *Urocyon*-like animal; the most derived canids are *Speothos*, *Chrysocyon*, *Lycaon*, and *C. lupus*; *C. mesomelas* and *C. simensis* accummulate unequivocal reversals. Changes of the developmental timings suggest that the large canid species may be paedomorphic. The group size, cooperative hunting, presence of male helpers, and polyandry are linked with evolution of the body size: in the ancestral Canini, the female body size change, followed by the origin of male helpers, seems to predate all other socio-ecological novelties. Monogamy, mon-estrum and obligate pseudopregnancy appears ancestral features whose adaptive values are most evident in the social species. However, as the primitive canids were not pack-living cooperative hunters, the adaptive value of the unique canid physiological system remains unclear.

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Use of Hoo Calls as a Tool in African Wild Dog Conservation

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A nine-year study of *Lycaon pictus* was conducted in Hwange National Park, Zimbabwe, in *Colophospermum mopane* woodland and *Combretum* thicket. Using hoo calls, a playback protocol (including simulated hoos) was developed to facilitate collaring operations and identify packs or emigrating groups (n = 23), and to study behavioural responses (n = 9). Wild dogs were known to be in the area prior to each trial. Dogs approached in 84% of trials from distances up to two kilometres. Sixty three percent of approaches were accompanied by hoo calling. Time to approach (n = 11) ranged from approximately 1 - 45 min (mean = 13 min). Assessment of unknown conspecifics appeared to motivate approaches and usually involved all pack members. Species-typical muted aggression, absence of territoriality, and signal design features may explain the proclivity to approach. Findings demonstrate that playbacks can be an effective conservation tool particularly where road networks are limited and/or thick habitat restricts off-road driving. Potential application lies in park boundary areas where wild dogs often encounter snares and in translocations from areas of high wild dog/human conflict to conservancies. Playbacks, in conjunction with other methods, also promise to be useful in surveying this species in relatively dense habitat.

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Golden eagles, Island foxes and Feral pigs: How Exotic Species turn Native Predators into Prey

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Predation, acting independently or in concert with competition, has increasingly been recognized as a biological deter-minant of communities. Less understood are the mechanisms by which invasive species modify community organization. Here we show how an exotic mammal has altered the relative importance of predation and competition in structuring an insular carnivore community. Prior to the intro-duction of feral pigs (*Sus scrofa*) to the California Channel Islands, the island fox (*Urocyon littoralis*) was an abundant apex predator competitively dominant to the smaller and rarer island spotted skunk (*Spilogale gracilis amphiala*). As a supple-mental food, pigs facilitated colonisation of the islands by golden eagles (*Aquila chrysaetos*). Eagles impacted foxes more than either pigs or skunks, causing a drastic decline in three populations of the endemic fox. Skunk populations increased as a result of this competitive release. Following the introduction of pigs, profound changes in the system occurred: eagles replaced foxes as the apex predator, skunks replaced foxes as the most abundant carnivore and hyperpredation replaced competition as the dominant biological force shaping this insular carnivore community.

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Coyote Predation on Domestic Sheep as a Model System to Investigate Positive and Negative Indirect Effects Between Prey

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Little is known about how an increase in abundance of one prey will affect predation on a second prey in vertebrate communities. Theoretically, positive indirect effects (e.g., "apparent mutualism") are most likely when the predator's abundance is unrelated (or weakly related) to its prey base. In prey-rich environments, where overall prey biomass is relatively stable, non-food related factors, such as disease, may be proportionally more important in determining predator numbers, thereby weakening numerical responses. I tested the hypothesis that predation on sheep by coyotes (*Canis latrans*) was ultimately reduced by increases in wild prey abundance in a prey-rich, Mediterranean environment during 1976--1995. Coyotes apparently exhibited a weak numerical response to primary productivity (used as a proxy for wild prey); numbers of sheep killed by coyotes were positively correlated with coyote abundance and negatively correla-ted with plant productivity. These findings suggest the occurrence of both immediate positive and delayed negative indirect effects between wild prey and domestic sheep. The pathway by which plant productivity (putatively) reduced sheep predation was stronger than the one by which it increased sheep predation, providing evidence in support of the hypothesis. However, conclusions are tentative due to the use of proxy variables.

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Movement and Habitat Ecology of the Raccoon Dog in Japan

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Two subspecies of raccoon dogs (*Nyctereutes procyonoides*) inhabit Japan: *N. p. viverrinus* on three of the major Islands, and *N. p. albus* on Hokkaido, the northernmost Island. I studied *N. p. viverrinus* in *satoyama* habitat (a combination of low mountains and farmlands with human residence) in Chiba Prefecture, approx-imately 70-km south-east from Tokyo. Although individuals showed significant differences in movements (e.g. stability and size of utilisation distribution, inter-fix speed, and nightly movements), two types ap-peared to exist in the study area. 'Mountain-type' is defined as animals that have a more natural environment, such as secondary forest and herbaceous areas, whereas 'village-type' is defined as animals that have a more artificial environment, such as rice field and cropland in their home range. Inter-fix speed was significantly higher in the 'mountain-type' than in the 'village-type.' If the topography is considered for three-dimensional home-range areas, the 'moun-tain-type' had significantly larger nightly home-ranges (100% MCP over night) than the 'village-type.' Fractal dimension of movement was also significantly larger in the 'mountain-type' than in the 'village-type,' suggesting that habitat complexity may reflect the degree of wiggling in movements. Conservation and manage-ment of raccoon dogs is briefly discussed in conjunction with the current status of the species in Japan.

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Is "Tanuki" a Separate Species?

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Several subspecies of raccoon dog (*Nyctereutes procyonoides* Gray 1834) are known. *N. p. viverrinus* inhabits Honshu, Shikoku and Kyushu, and *N. p. albus* inhabits Hokkaido in Japan. There are differences between continental subspecies and the Japanese subspecies (aka tanuki): 1) Karyotype and genetics: Tanukis have fewer chromosomes than other continental subspecies; *N. p. viverrinus* and *N. p. Albus* have 2n = 38 + Bs, while the Chinese raccoon dog, *N. p. procyonoides* and the Finnish raccoon dog (originally from the Ussuri-region), *N. p. ussuriensis,* have 2n = 54 + Bs. Preliminary DNA-analyses also suggest that there are considerable differences in gene frequencies between tanuki and *N. p. ussuriensis* from Finland; 2) Morphology: Body weight, skulls, and teeth of tanuki are smaller than those of the Finnish raccoon dog; 3) Physiology: Litter size tends to be smaller in tanuki. A greater tolerance to cold climate was observed in the Finnish raccoon dog; 4) Ecology: The Finnish and possibly the Chinese raccoon dogs are more carnivorous, and tanuki feeds on harder foods such as insects and coarse plant materials. Raccoon dogs hibernate in areas where the winter climate is severe. However, tanuki does not have to do so; 5) Palaentology: Tanuki is more likely a species that had differentiated by the Middle Pleistocene era. Although tanuki has common characteristics with other subspecies in reproductive physiology and mating behaviour, geographical isolation and adaptations to the mild, maritime environment in Japan possibly separated tanuki from others.

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RAPD Fingerprinting and Relatedness Among Dog Breeds and Grey Wolves

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Canis familiaris is the oldest domesticated animal, and is characterized by the greatest morphological variability among all other mammals. It is divided into several types varying in behaviour, ecology, morphology, origin, and time of isolated breeding. The grey wolf is considered to be the most probable ancestor of the dog, but the issue is not yet resolved. The aim of the research was to estimate the genome variability of pure breed dogs compared with wolves by the use of 368 RAPD-markers obtained with seven random primers. The subject included forty dogs of seventeen breeds, belonging to a few morphological types (windhounds and other: molossians, pinschers and shnauzers, sheep-dogs). Windhounds were presented by three aboriginal Russian breeds (Russian and Chortai Barzoi, South Russian steppe windhound); two aboriginal Asian breeds (Middle Asia Tazi, Afganistan windhound (not afganhound)); two aboriginal European breeds (greyhound and whippet). Wolves were represented by six animals, belonging to three different populations (Smolensk, Volgograd and Moscow Zoo). The resulting RAPD data were analysed following the numerical taxonomic approach, and the resulting classification was compared to that derived from morphological and ecological data. Chekanovsky's similarity coefficients were calculated to quantify the genetic divergence among dog breeds and *C. lupus* specimens. Nine percent of the RAPD markers (thirthy-three locuses) were present only in the wolf samples and were absent in the dog, which permits us to consider them as species-specific for *C. lupus*. The coefficients of intra-and interbreed gene similarity and diversity were calculated for every group of breeds and for the wolves. The greatest gene diversity was found among the windhounds (0.55), and was slightly smaller in the other dog groups (0.51). Wolves were characterized by the least genetic variability (0.45). UPGMA trees showed that all dog breeds formed the first separate cluster, including two non-mixing groups: the windhound and the group of other dog breeds. The second cluster involved all wolves and separated into *C. l. lupus* and *C. l. campestus* groups. Phylogeny of *C. familiaris* breeds and the origin of some dog breeds as well as the windhound type are discussed.

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Distribution of Conservation Areas For Wolf In The Carpathian Mountains

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The population of wolves in the Carpathian mountains was considered at the ecoregion level, considering trans-boundary distribu-tion. The countries considered are Poland, Slovakia, Ukraine and Romania. These host the largest European population of wolves, with a total estimate of greater than 4,000 individuals over an area of 150,000 sq km. The Carpathian wolf population is threatened by illegal hunting and, in some countries, a lack of legal protection. Due to economic expansion, compromises with interests on the land need to be found for successful management and conservation of this large predator. In this research, the distribution of areas where such compro-mises are reached has been investigated. Wolves mainly use areas phenologically stable over the four seasons, positively selecting for spruce forests and alpine vegetation. Where these areas are an-thropogenically exploited, such as Poland, they tend to use protected areas. In other countries, wolves roam over large forested areas that may be interspersed with rural settlements. The broad scale analysis of wolf distribution highlights the need for an integrated, pan-Carpathian approach for sustainable, economic management of this large carnivore, addressing the focus of future fine-scale research to some selected target areas.

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Spatial and Temporal Patterns of Resource Utilization by Culpeo Foxes (*Pseudalopex culpaeus*) in Central Chile

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The effects that the distribution of resources in space and time have on culpeo foxes (*Pseudalopex culpaeus*) were investigated in a semi-arid region of north-central Chile. Foxes were studied during a dry phase of an *El Niño* cycle, when natural prey species declined dramatically. The hypotheses that foxes responded both spatially and tem-porally to the variation of resource availability were tested, and results show that they modify their patterns of space utilisation and home range size. Parallel studies on small mammal population dyna-mics and habitat preference gave evidence of a significant concentration of rodents in small patches of "aguadas" habitat. In this research, it was found that these represented greater than 50% of the home range of foxes following the drought. Diet analyses also showed that culpeo foxes tended to supplement their diets with available alternative resources when their staple prey were scarce. Circadian rhythms of activity tended to be distributed more evenly through 24 hours when density of small mammals was low. Fox population in the study area declined following the small mammal density decrease. It was found that culpeo foxes in north-central Chile display a (i) spatial, (ii) temporal, and (iii) population response to resource availability and distribution, suggesting that they may be adapted to *El Niño* cycles.

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Do Food Resources Affect Home Range Size in Coyotes?

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The objective of this study was to investigate if food resources affect the sizes of coyote's home ranges. The study was undertaken over a two year period in a forest area in Durango, Mexico, and studied statistical relationship between food resources consumed (small mammals and fruits) and home range size (using radiotracking), A pattern of seasonal variation was found in the home range size of coyotes during the biological periods ($p<0.001$). Home range size decreased significantly during breeding and gestation period, but larger ranges were observed during pup raising and pup independence. A negative correlation was found between the home range size and mammal consumption ($r_S=-0.742$; $p=0.034$), while a significant positive correlation was found between home range size and fruit consumption ($r_S=0.745$; $p=0.033$). When the coyotes diet consists mainly of mammals, the home range size decreases. However, when the consumption of mammals is low, the coyotes compensate by having a high rate of fruits consumption, and home range size increases. Small mammals are chosen and consumed as a main food item in the breeding and gestation periods, as behavioral strategy to maximize their reproductive success in Durango, Mexico.

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Breeding and Parturition Seasons With Growth Rate of Mexican wolf (*Canis lupus baileyi*) Pups

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The Mexican wolf (*Canis lupus baileyi*) is endangered, and only recently has information about its biology, behaviour and ecology been documented. While some information exists on the mating and breeding season of adult wolves, there are no data on the growth rate of pups or on litter size. This paper introduces new data on these topics, including the growth of three-month old pups. Data were obtained from captive population reports in the inter-national studbook for the Mexican gray wolf, and from direct observations on two captive packs at the Western Sierra Madre in Biosphere Reserve "La Michilia", Durango, México. We report the dates for breeding and parturition season, and mean number of pups born per litter for the captive population. Growth rates were found to be close to the lower limit reported for the gray wolf.

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Landscape Study to Choose Suitable Areas for Mexican Wolf Reintroduction in Mexico

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Mexican wolves (*Canis lupus baileyi*) have been reintroduced in Federal Areas in the southwest of USA, and it is hoped they will also be reintroduced to Mexico. Almost 80% the Mexican wolf's original distribution was in Mexican territory. We used a Geographical Information System, a genetic algorhitm, and georeferenced data of wild wolves trapped in Mexico, to generate a map of historical distribution and the ecological niche of the species. The model of niche was based on four dimensions: temperature, pluvial precipitation, elevation and vegetation type. This map was overlapped with a map of the current vegetation of Mexico, to generate a map of the potential areas for reintroduction. The election of areas in Mexico, should fulfill the following characteristics: extensive forest, interconnected fragments, no geographical barriers, biological corridors, good water and prey availability, non-intensive cattle-raising, preferably with mining activity or forest in recovery or rest, and these characteristics that are found in our model.

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Aversive and Disruptive Stimuli for Managing Wolf Predation

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Removing newly established individuals is counterproductive when rebuilding preda-tor populations, and lethal control methods are often considered undesirable by mem-bers of the wildlife community and the general public. However, adverse inter-actions between humans and predators must be minimized to maximize support for maintaining wolf populations. We have designed and tested aversive and disruptive stimulus paradigms for limiting wolf predation on livestock non-lethally. In previous studies, electronic training collars were shown to be effective. In a management application, we have been challenged by technical and logistical difficulties but continue our evaluation of aversive stimulus devices. Using disruptive stimuli, we determined that behaviour contingent activation is important: 71% of coyotes exposed to randomly activated stimuli habituated to it, but only 14% of coyotes habituated when exposed to behaviour contingent stimuli. In manage-ment applications, our disruptive stimuli devices assisted wolf managers. On two study sites during two years, 16 cattle were killed by wolves in unprotected pastures and four wolves were removed as a result of predation events; in protected pastures no cattle were killed and therefore no wolves were removed. An important benefit of alternative management tech-niques is the increase in positive dialogue between those

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Diet of the Maned Wolf (*Chrysocyon brachyurus*) in a Private Natural Reserve in South-eastern Brazil

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Since 1982 a few maned wolves living in the Private Natural Heritage Reserve Serra do Caraça, State of Minas Gerais, Brazil, have been induced to visit the reserve hotel premises by daily offers of portions of beef meat. Our aim was to determine the diet of these animals subjected to the artificial feeding. We analysed 138 scats collected during 13 months, and from these registered 208 occurrences of food items (47,6% of small vertebrates, 15,9% of invertebrates, 10,6% of miscellaneous fruits, 6,3% of grasses and 17,3% of antropic food items and inorganics). Animal food items, mainly small mammals, were found throughout the period of study. Seeds, mainly of *Solanum lycocarpum*, were most frequent during the dry season. There was no correlation between the frequency of small mammals (R = 0.22) and fruits (R = -0,31) in the scats and their abundance in the wild. Considering small mammals and *Solanum lycocarpum* as the usual common food items of the maned-wolf diet elsewhere, at the Serra do Caraça reserve these items did not make up a high proportion of the diet of these maned wolves. (~13.5 kg of estimated consumed biomass). Such a low biomass value may be related to the daily artificial feeding which the maned wolves are submitted to.

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Distribution and Conservation of the Wolf in Saudi Arabia: Results of a Preliminary Survey

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The wolf (*Canis lupus*) is reported to be widely distributed over the Arabian Peninsula, but records of its presence were until recently scattered in space and time. In order to provide a comprehensive assessment of its status in Saudi Arabia, a field survey was conducted between November 1999 and March 2000. The survey included a series of on the spot investigations, together with interviews with herders, hunters, local authorities and knowledgeable people in rural villages. The survey results allowed the identification of several areas where the wolf appears to be present, and also to better define its present distribution range and conservation status. Wolves appear to be widespread and more common over the Western and South-western Regions; the most important areas for its presence appeared to be distributed along the Hejaz-Asir mountain system. Higher levels of range fragmentation were observed in the Central and Eastern Regions, where the wolf is reported to be less common and mainly restricted to more mountainous or rugged areas. Wolves appeared to have decreased during the recent past, owing to increased human disturbance and direct persecution. Due to the importance of traditional herding, and to the scarcity of wild herbivore populations, high levels of conflict with livestock were recorded over its whole range. Human persecution related to livestock damage is reported to be very common, which was also shown by the finding of more than 20 wolves killed in recent times. Direct persecution appeared to be the main factor potentially affecting its survival, especially in areas where the range is more fragmented.

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Environmental and Human Factors Affecting Maned Wolf Conservation in Argentina

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The maned wolf, *Chrysocyon brachyurus,* the largest South American canid, only lives in Bolivia, Brazil and Argentina. The information about the biology and ecology of this species is scarce and is one of the most important factors affecting its conservation. In Argentina, little is known about the geographical distribution and status conservation to propose an Action Plan. This proposal arose from previous surveys carried out since 1997 to 1999 by GECM´ members. The research will be conducted on Mburucuyá National Park area, NE Argentina, where eight wild carnivores occur: *Conepatus chinga, Lontra longicaudis, Procyon cancrivorus, Cerdo-cyon thous, Pseudalopex gymnocercus, C. brachyurus, Oncifelis geoffroyi* and *Herpailurus yaguaroundi*. This project will establish the maned wolf's historical and actual distribution, detect and understand the principal factors of its critical status and ensure the involvement of local com-munities in them. Field surveys will allow us to collect evidence and, through interaction with local communities, we want to learn more about their traditional use of natural resources, understand their social and cultural bases and the contribution to its critical status.

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Analysis of Human Attitudes for Wolf Conservation: the Case of Sierra de la Culebra (Spain)

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The analysis of the attitude of the human population that coexists with wildlife and exploits the same resources is essential to the development of long-term manage-ment and conservation plans for large carnivores. The Sierra de la Culebra, located in the province of Zamora (Spain), was studied with the aim of detecting and rectifying hostile attitudes and behaviours towards the environment. The study shows that most shepherds' beliefs about wolf behaviour are wrong even if they are based on direct observations. Those people not affected by wildlife damage have a positive opinion of the environment, and cite the usefulness of the indirect benefits provided by wildlife. For those affected, usefulness consists of the direct benefits of hunting or tourism. Due to the existence of a negative wolf culture and the bloody aspect of the attacks, the damages caused by wolf are magnified. The predisposition towards wolf existence is favourable in spite of the fact that that most people do not find any usefulness for the wolves. The predisposition towards wild ungulates (red deer, roe deer, wild boar) is more negative, with the wild boar being considered the worst species. The analysis shows that an information campaign about behaviour, usefulness, and ecological benefits of wolves and their natural prey is needed.

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Asking People about Bush Dogs: The Use of Ecological Informants and Insights on *Speothos venaticus* Natural History

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The bush dog (*Speothos venaticus*) is a rarely seen, primarily forest-living canid with, consequently, little known about its natural history. Indigenous and other local peoples living in areas where *Speothos* exists can potentially serve as rich sources of ecological knowledge, accumulated through hundreds of observations and inherited forest lore. A methodology is presented to document this knowledge and provide insight on habitat requirements, dietary preferences, activity patterns, social groupings, and reproductive behaviour. To help evaluate the technique and strengthen the *Speothos* data, informants are also asked the same questions regarding the coati (*Nasua nasua*). Eighty-six interviews were conducted in Bolivia, Ecuador, Paraguay, and Peru including informants of 12 indigenous groups and local colonists. Preliminary results indicate that informants report *Speothos* as a diurnal, primarily carnivorous species, commonly preying on *Agouti paca* and *Mazama* spp. in packs of four to eight individuals. In addition, previously undocumented *Speothos* population levels, hunting strategies, domestication anecdotes, and mythologies are discussed as well as limitations of the methodology and its application toward conservation.

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Limiting the Impact of Domestic Dogs on African Wild Dogs, Hwange National Park, Zimbabwe

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Societal attitudes towards the domestic dog (*Canis lupus familiaris*) population inhabiting the communal lands on the periphery of Hwange National Park, Zimbabwe, were examined. The domestic dogs of agro-pastoralists are a reservoir for rabies, and host to other canid diseases. Disease transmission is a particularly serious issue in the conservation of the African wild dog (*Lycaon pictus*) and proposals have been put forward to minimize domestic dog impact by shooting unaccompanied or uncollared dogs on sight. Other approaches advocate lowering the density of domestic dogs to reduce rate of contact between hosts and African wild dogs and to reduce host population density below the threshold needed to maintain endemic disease, by culling the female puppies or vaccination. The feasibility of these measures is explored in this paper. Only 30% of dogs in this study were vaccinated therefore management alternatives were necessary. Regional specificities, however, play an important and underestimated role. Measures previously suggested like culling the female puppies and shooting unaccompanied, uncollared dogs – while possibly appropriate in other regions – prove untenable in the Hwange communal lands. This study showed that 91% of dogs are free-ranging, 96% of dogs are uncollared, and 100% of interviewees were opposed to culling. Alternative suggestions, like neutering male dogs, are made and their potential is discussed.

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Wolves and Livestock: Problem Packs and Vulnerable Farms

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As wolves (*Canis lupus*) recolonize forest-agriculture mosaics in the Lake Superior region of the United States, their depredations on livestock are increasing, along with public complaints and compensation payments. We document 87 verified wolf depredations on domestic animals in the state of Wisconsin from 1976-2000. Calves were the most frequent target of wolf depredation, but farmed deer and hunting dog losses demanded the highest per capita and total compensation payments. We found that wolf numbers rose at a faster rate than did verified wolf depredations or the annual cost of compensation. Over two-thirds of Wisconsin's wolf packs have ranged near livestock without causing problems. We analysed landscape features in Wisconsin and Minnesota to identify vegetation cover and human land uses that predict wolf attacks on livestock. We found victimized farms had larger herds, and were surrounded by more wooded wetlands and deciduous forest with less cropland and roads than were unaffected neighbouring farms with similar operations. At a larger scale, townships with high proportions of pasture, hayfield, wetlands and deciduous forest but low densities of roads and open water faced a higher risk of wolf attack on livestock. We generate a spatially-explicit landscape model to predict future human-wolf conflict in the Lake Superior region.

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Interaction Between Wolf and Large Predators in Russia

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In Russia wolves come into contact with seven large and four medium-sized predator species. Brown bears (*Ursus arctos* L.) share most of their habitat with wolves, and commensalism is typical. Mutual aggression is common when they come into contact. although they seldom lead to bloody fights. Bears seldom approach closer than 400-500 m of wolves dens, but in winter wolves may be found in close proximity to bears' dens. Wolves may present danger to bear cubs under 1 year. Asiatic black bear (*Ursus (Selenarktos) tibetanus* G.) comes into contact with wolves in the forest ecosystems in the South of the Far East. They are skilled tree climbers which helps reduce the risk of being killed by wolves. Instances of cubs being killed by wolves have been recorded in the Sikhote-Alin' State Reserve. Skunk bear (*Gulo gulo* L.) have their habitat entirely within the northern area of wolf's habitat, and are a typical commensal. They may be killed by wolves, but in recent years no instances have been recorded. In some areas the skunk bear population is growing as a result of wolf population growth. Lynx (*Lynx lynx* L.) also have their habitat area entirely within the wolf's habitat area. Commensalism is not common, and interactions between the species are often antagonistic. Direct fights with wolf are rare, however they often lead to lynx's death. In human-disturbed ecosystems lynx population has a tendency to grow with a decrease in the wolf population. On the other hand, in the natural ecosystems where population density of both species agrees with the optimal capacity, co-existence of both species is dynamically balanced. Leopard (*Panthera pardus* L.) and snow leopard (*Uncia uncia* Schreber) are both scanty and may contact wolf in three isolated areas, but reliable data on contacts are absent. Tigers (*Panthera tigris* L.) come into contact with wolves in a small area – in the south of the Far East. In the beginning of the 20th century, wolf actively inhabited forest ecosystems of the Far East along with the decreasing tiger population. In the 1960s the tiger population grew, while the wolf population began to descrease. In the north of the region wolves began to co-exist with tiger by inhabiting more open, human-transformed areas. However, overlap of habitat use was common and there were cases of wolves feeding on tigers' catches. In the south of the region the forest ecosystems inhabited by tiger are completely free from wolves. Their isolated small populations occur only within local areas along railroads, coastline, and in the upper mountain areas. But in the last year wolves trails were observed in typical tiger forest habitat. Average size predators

coming into contact with wolf include, fox (*Vulpes vulpes* L.), polar fox (*Alopex lagopus* L.), badger (*Meles meles* L.) and Indian marten (*Martes flavigula* Boddaert).

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Characteristics of Oestrous Cycles and Inter-oestrous Intervals in Fennec Foxes (*Vulpes zerda*)

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We studied the reproductive behaviour and physiology of captive fennec foxes (*Vulpes zerda*) during oestrous cycles, as well as the distribution of those cycles across time, i.e., inter-oestrous intervals, when photoperiod was held constant (12h:12h). Profiles of faecal oestradiol and progesterone were similar to those seen in other canids. However, in contrast to other canids, oestrus was very short (mode =1day) with, typically, only one copulation, and the copulatory tie was extremely long (1h 17min ± 17min, mean ± SE). The lengthy tie may compensate for the brief oestrous period and single copulation, characteristics that, in this smallest canid species, may be related to vulnerability to predators. In the absence of photoperiodic cues, the mean inter-oestrous interval was 9.9 (± 1.2) mo, similar to that of the domestic dog. Because fennecs are reported to reproduce annually in their native range in northern Africa, our results indicate that photoperiod, even near the equator, may play a role in regulating breeding intervals in this species. However, because food availability was also held constant, nutritional level may be implicated as well. The adaptations and regulation of reproductive dynamics in fennec foxes may also occur in other tropical zone canids, but data are lacking.

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Why Are Dholes (*Cuon alpinus*) Abundant in the Nilgiri Foothills, Southern India?

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The dhole or the Asiatic wild dog, a Vulnerable species (IUCN Category Vu 2a), was once distributed over much of Tropical and Temperate Asia but presently survives in isolated populations within some forested tracts of tropical and sub-tropical south and southeast Asia. The northern foothills of the Nilgiri Hills, a spur of the Western Ghats in southern India, have densities of dholes, which may figure among the highest in the world. Two protected areas, the Mudumalai Sanctuary and the Bandipur Project Tiger Reserve, comprise a large fraction of the foothills of the Nilgiris and have dhole densities of at least 0.13 animals/km^2 and 0.095 animals/km^2 respectively. In both protected areas prey species exist at very high densities, with chital (*Axis axis*) comprising the principal prey of dholes. To identify reasons for high densities of dholes within this area we first analyse habitat attributes of the core utilization areas of study dhole packs to primarily ascertain whether prey dense habitats within the expansive open dry deciduous forests of Mudumalai and Bandipur, comprise significant proportions. Given that dhole packs utilize prey resource patches strategically, possibly optimizing hunting success, we next compare prey patchiness within core utilization areas and other areas. We then examine whether densities of other large carnivores and conflict with humans in both protected areas influence dhole densities. Both factors may have a bearing on mortality among pups and adults. Using our inferences from the above analyses we finally propose a model, which could potentially be used to assess the suitability of other landscapes for dhole populations.

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Hybridization and Conservation Genetics of Scandinavian Wolves

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The Scandinavian wolf population is critically endangered. During the mid-1970s the population was thought to be extinct. However, a few individuals were observed in southern Sweden by the beginning of the 1980s, and in 1983 the first reproduction took place. Currently the population size is estimated to be around 60-80 individuals. Lack of genetic variability and high levels of inbreeding have already been suggested to be threats for the long-term survival of the population. The development of proper conservation and management strategies requires de identification of the origin of the founder individuals, estimation of the rate of loss of the genetic variability and degree of isolation from neighboring populations, as well as the detection of possible migrants and hybrids with domestic dogs. In order to contribute to address these issues, we have developed canine Y chromosome micro-satellite markers. The use of these markers combined with nuclear markers and mitochondrial DNA sequences indicate a high degree of isolation between Scandi-navian wolves and those in Finland and Russia. The genetic analysis has also allowed to identify a hybrid specimen killed in southern Norway as the offspring of a female Scandinavian wolf with a male dog.

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Vocal Repertoire in the Dhole *Cuon alpinus* in Captivity

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Three independent structural components form the dhole vocal repertoire: low tonal, high tonal and pulsed vocal. Within these components, the dhole vocal repertoire consists of three vocal classes with eleven call types. Two wideband signals with pronounced pulsed patterns were assigned to the pulsed vocal class. Two vocal types between 6 and 9 kHz, were put into the high-frequency component class. The other seven call types with an expressed low-frequency harmonic component were put into the tonal signals class. The revealed vocal components differed in their impact on the structural diversity of the dhole vocal repertoire: the high variability of the low tonal component produces a structural radiation with a few vocal types, whereas the variability of both the high tonal and the pulsed components follow "one or zero" principle, i.e. a component is present or absent. The fact that the different components may be produced simultaneously indicates that they are produced by different vocal sources. On the basis of the structural analysis and situative occurrence, a scheme of structural transitions between different vocal types in the dhole was constructed.

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Biphonation in the Dhole *Cuon alpinus* Vocal Behaviour

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Dholes produce sounds with two fundamental frequencies: high frequency and low frequency, which may occur either simultaneously or separately. The low fundamental frequency lies between 0.3 and 2.5 kHz, whereas the high fundamental frequency lies between 5.5 and 10 kHz. In calls where both fundamental frequencies were produced simultaneously, they formed linear combinations. Such sounds with two independent frequencies represent biphonations that are characterized by additional combinative frequency bands. This indicates an interaction of two independent sources of sound oscillations in nonlinear systems. Biphonation has been reported as a regular component in a few species of mammals. However, our data on dhole vocalizations shows that biphonations occurred in many calls. Biphonation was observed in 20 to 92% of calls, which varied between individuals (n=14); the average occurrence of the biphonations was 44.3% (n=1317 calls). We therefore suggest that biphonations represent one of the most prominent features of dhole vocal activity. The physiological basis of the lower fundamental frequency results from a normal vocal fold oscillation. Two possible mechanisms for the high fundamental frequency are discussed: vorticity, and independent vibrations of vocal lips, the membranous parts of vocal folds, which were recently found in a small number of canids.

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The Demographic Nature of Wolf Predation

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Predation rate (i.e., kills/predator/time) is typically presupposed to depend exclusively on prey density. This assumption has profound influence on our perception of many ecological phenomena. Attempts to consider how predation rate might also depend on predator density have been poorly received. Acceptance may be limited because models of predator-dependent predation rate rely primarily on theoretical considerations, indirect evi-dence, and contrived laboratory demons-trations. We present direct evidence from an unmanipulated population of wolves and moose in Isle Royale National Park, USA that predation rate depends as much or more on predator density as on prey density. Our findings cast doubt on perceptions of several ecological themes stemming from five decades of overemphasis on prey-dependent predation (e.g., the influences of top-down or bottom-up controls on prey populations). Focused consideration on more realistic models of predation is clearly justified.

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Wolf Monitoring, Research and Management on the Scandinavian Peninsula

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During 23 successive winters 1978/79 - 2000/ 2001, the wolf population status, distribution and dynamics was monitored by snow tracking on the Scandinavian Peninsula (Sweden & Norway). The Scand-inavian wolf population has recovered from a few individuals and one pack in the early 1980's to about 100 wolves and 12 packs in the winter of 2000/2001. After the 1978-reproduction in the reindeer management area of northern Sweden, all new pairs and packs were located in the south-central parts of the peninsula, from 1983 onwards. A joint Scandinavian research project started radio-telemetry studies of wolves on the peninsula in 1998. One important research question is to find out to what extent this population is genetically isolated which at present is unclear. The nearest, neighbouring wolf-breeding area is located about 800 km to the northeast, along the Finnish-Russian border. During 2000 and 2001, several new management actions have been imple-mented in Scandinavia. Norway has established a wolf management zone, and the management has recently suggested starting license hunting on wolves. Most important to future survival of Scandinavian wolves is the decision of the Swedish parliament in spring 2001, to increase the Swedish part of the population to 20 annual reproductions or about 200 wolves in Sweden, as a first step management goal.

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Swift Fox, *Vulpes velox*, Re-introduction in Canada and the USA

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The swift fox has been the subject of two reintroduction programmes to date, one in Canada and one in the USA. In Canada the programme released both captive bred and translocated wild caught swift fox. Problems encountered and methodologies developed during this programme, which involved five jurisdictions, are described. The second reintroduction programme began in 1998 and is still in progress on Blackfeet Tribal Lands in Montana, USA. It is a partnership between the Blackfeet Tribal Fish & Wildlife Department, Defenders of Wildlife, and Cochrane Ecological Institute (CEI). This project is the first swift fox reintroduction programme in the USA and is releasing only individuals bred in captivity at CEI in Canada. Mortality of reintroduced radio-collared individuals has been low and breeding has successfully taken place every year since 1999. Results from this latest reintroduction suggest that reintroduction lessons learned from the Canadian swift fox release programme, coupled with reintroduction methodology developed and applied in the Blackfeet, USA, release programme, may be effectively used as guidelines for future re-introductions of captive bred swift fox.

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The Earliest Canids in Africa

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The Canidae have a long evolutionary history in North America before their first appearance in Eurasia. Thus, the first appearances in Africa of the main lineages of Canidae must be due to immigration events, most likely from western Eurasia, but also possibly from the Indian subcontinent. At present, 2-3 such events can be identified. The earliest known canid in Africa is from Langebaanweg, South Africa (ca. 4.8 Ma). This form, represented by well-preserved craniodental and postcranial remains, appears to have affinities with the fox lineage. The genus *Nyctereutes* is not extant in Africa, but it (or a related form) is known from several sites of the Pliocene. Its earliest known appearance is at Laetoli, Tanzania (ca. 3.7 Ma). The earliest record of *Canis* is from South Turkwel, Kenya (3.5 Ma). This may represent the same immigration event as *Nyctereutes*, though *Canis* is not known from Laetoli. The earliest *Canis* in South Africa is from Sterkfontein Mb. 2 (ca. 3.4-3.0 Ma). The genus *Eucyon* makes a late appearance at the Moroccan site of Ahl al-Oughlam (ca. 2.5 Ma). Several canids of unknown affinities are known from Africa, including the cf. *Megacyon* sp. from Laetoli and *'Canis' brevirostris* from Sterkfontein.

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The Pribilof Fox – An Insular Canid Facing an Uncertain Future

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Due to recent anthropogenic changes, the Pribilof fox *(Alopex lagopus pribilofensis)* is currently facing serious threats to its persistence. This subspecies of arctic fox is endemic to a small group of islands in the Bering Sea. It is morphologically distinct in being larger than mainland *Alopex* while having size-independent reduction of denti-tion. Pribilof foxes subsist mainly on northern fur seal *(Callorhinus ursinus)* rookeries and sea bird colonies. On St. Paul Island, foxes are distributed around the island's perimeter within 2km of these clumped and abundant natural food resources. The island's productivity contributes to unusual social organization among the foxes, including formation of multi-family social groups that jointly defend prime foraging areas. The population contains unique phenotypes, possibly as a result of inbreeding, with some individuals showing pelage intermediate between the blue (dark) and white colour morphs. A decline in arctic sea ice is exacerbating the genetic isolation of the Pribilof fox at the same time that anthropogenic risk factors are increasing. Recent development of a large commercial fishery and construction of a breakwater has created an artificial year-round food source and denning habitat in the harbour. The result has been a dramatic increase in the number of foxes residing in town and a concomitant rise in human/wildlife conflicts. Territorial foxes scent-mark on human property and occasionally become aggres-sive towards humans. As a result, human attitudes towards foxes are growing increasingly negative and direct persecu-tion is on the rise. "Urban" foxes forage daily in human refuse, and face exposure to zoonotic diseases from domestic cats *(Felis domesticus)* in town and dogs *(Canis familiaris)* present on ships. Insular canids have low natural immunity, and concentra-tions of animals may further decrease resistance to disease. Outside of town, organochlorine contaminants (PCBs/OCs) in the Bering Sea food chain may present an additional challenge to this top-level consumer. Despite their taxonomic status and a wide range of threats, Pribilof foxes currently exist with no legal protection. Population level management is urgently needed to ensure the survival of this unique canid.

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Activities and Successes of the Ethiopian Wolf Conservation Programme

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This paper examines the activities and successes of the Ethiopian Wolf Conserva-tion Programme (EWCP) since its inception in 1995. The activities of the EWCP are based on research – both past and ongoing. The paper reviews the most important results of this research for the conservation of the Ethiopian wolf (*Canis simensis*). The activities that result fall into two broad categories: education and implementation. Implementation includes campaigns to vaccination and sterilisation of domestic dogs within and surrounding wolf ranges. A recent survey of key areas covered by the vaccination campaign showed that we have achieved 93.1% coverage of dogs. This is well above the estimated 70% vaccination coverage required to control diseases. In contrast, we have only achieved 52.3% success rate with sterilisation of dogs. The efficacy of sterili-sation as a method of controlling dog populations is discussed. These data are viewed in the light of data on the parallel changes in the wolf population in the areas in which these campaigns have taken place. In addition, other activities of the EWCP are briefly reviewed.

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Ecology of Crab-eating foxes in Caatinga, a Dry Forest in North-eastern Brazil

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Feeding ecology, activity pattern and seasonal distribution in relation to water of crab-eating foxes (*Cerdocyon thous*) are described from Serra da Capivara National Park, the largest protected area in caatinga. Diet of foxes is described based on scat analysis for the dry season when they feed primarily on lizards and invertebrates. The activity pattern of foxes was studied based on remote camera data and direct observations. Foxes are active mainly at night but are considerably more active during the day in caatinga than in more mesic ecosystems. Greater diurnal activity is likely to be due to foraging for mainly diurnal lizards, as opposed to nocturnal rodents, which are found at very low densities in caatinga. Foxes moved to low elevations during the dry season and were observed closer to water during the dry season than during the wet season. Foxes were found in areas with more water holes during the dry season. Closer association with water holes during the dry season is probably related to changes in diet and foraging activity.

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New Perspectives in Wolf Research: GPS with Remote Download Facilities

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The Scandinavian Wolf Research Project (SKANDULV), which is run by several co-operative Norwegian and Swedish research institutions, is studying the recovering Scan-dinavian wolf population. At present, 20 wolves are radio-collared. To increase precision and continuity of data and to reduce field efforts, we considered the use of GPS technology. In February 2001, we fitted a non-differential GPS collar (GPS-SIMPLEXTM, Televilt Positioning AB, Sweden) with remote download facilities to a territorial male wolf. The positioning data is transmitted at pre-programmed times via VHF-coded signals, while also being stored in an on-board memory. The battery has a capacity of about 4500 positions at standard conditions. Our experiences so far are based on the remote download of 90% of all data stored in the memory. Mean monthly positioning success rate was highest from February to April (94-96%), and decreased gradually during summer (May 90%, June 88%, July 68%). We consider the possibility of remote downloads very useful for instantaneous visualization and analysis of data, in order to find prey remains to assess predation rates, to measure temporary habitat factors, and for information purposes. The remotely received data are safe in case of collar failure, theft or destruction.

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Bush Dogs (*Speothos venaticus*) in Eastern Paraguay: a Preliminary Analysis of Diet and Habitat Associations

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The bush dog, *Speothos venaticus*, exists as a virtually unknown species in the wild. Studies on captive bush dogs have provided insight into their social behaviour and reproductive potential. Few documented observations exist despite a reported wide geographic range for the species (southern Panama through northern Argentina). In eastern Paraguay, at the southern end of their range, bush dogs are confirmed to exist within the Mbaracayú Forest Nature Reserve (Canindeyú Depart-ment); a remnant of the Interior Atlantic Forest. Our current study is focused on evaluating the role of the bush dog as a part of the mammalian carnivore community within the Reserve. Bush dogs co-exist with as many as twenty other mammalian carnivore species at this site. All previous information on the species from this location resided within the local and indigenous communities. To date the investigation has been entirely non-invasive, relying on faecal samples and tracks. Diet analysis is based on collected faecal samples, confirmed to be bush dog by molecular analysis. In addition, an analysis of habitat associations within the reserve has been initiated. We will present preliminary results from this study for bush dogs as well as summarize what is known of the species in eastern Paraguay.

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