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ABSTRACTS

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ORAL PRESENTATIONS

1 - oral

INVITED SPEECH

THE CHALLENGE OF SAVING *URSUS ARCTOS MARSICANUS*, THE ABRUZZO BROWN BEAR

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In the Apennines mountain in central Italy, about 100 km east of Rome, a small population of Abruzzo brown bear (*Ursus arctos marsicanus*) is still present. It has been separated from the Alpine population for at least 4-600 years and it shares a unique mtDNA haplotype. Its extent of occurrence is estimated to be 1,500 – 2,500 km^2 with occasional sightings in a larger area. In spite of being one of the most endangered Italian mammal species and inhabiting one of the oldest Italian National Park, there are no reliable population estimates for the Abruzzo brown bear. In the last 30 years, population estimates based on miscellaneous approaches, from expert opinions to direct observations on sample areas, ranged from 25-100 bears, the lower number being the most likely current estimate. Currently, several indirect signs seem to confirm the continuing negative demographic trend of the population. From 1980-1988 bear attacks on livestock in Abruzzo decreased 84% and, accordingly, bear sightings by the Abruzzo National Park wardens were less frequently reported.

The species is fully protected, but illegal killing (including accidental killing by hunters) appears to be the single most important threat to the population. A minimum of 53 bears have been found dead from 1971-1997 and 84% of known bear mortalities (n=37) were from illegal or accidental killing by humans.

Bear damage to livestock, crops, beehives used to be important issues until the late 80s' but now they are not of immediate concern, and there is no memory of attacks on humans. Habitat degradation is often indicated as the most important threat to bears in Abruzzo and habitat suitability models have shown the actual fragmentation of the current bear habitat.

Conservation of the Abruzzo brown bear is a most difficult challenge, and options are decreasing very fast, because of:

- The intrinsic biological characteristics of the species
- The conflicts with human activities
- The high human-caused mortality
- The largely insufficient size of protected areas
- The highly fragmented management by national and local authorities
- The absence of a long term and science-based conservation strategy

Two fundamental actions are urgently needed:

a) a renewed effort of scientific research aimed at estimating the size of the population and collecting the basic information on its demographic trends, vital statistics and spatial patterns,
b) a new strategic approach to overcome the traditional divisions among different authorities and to establish a functional coordination of all conservation efforts.

2 - oral

TRENDS OF DEMOGRAPHY AND DISTRIBUTION OF CANTABRIAN BROWN BEARS

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The brown bear population in the Cantabrian mountains (northwestern Spain) is small (possibly about 100 individuals), isolated and endangered. Bears are found in two nuclei, a large western group (W) and on to the east (E), with specific genetic characteristics and no demographic contact, at least in recent decades. The demography of both nuclei has been monitored from 1989 to 2003 by a coordinated network of wardens and naturalists working in four autonomous regions. The number of females with cubs of the year (FCY), the number of cubs per female and the area covered by the FCY have all been recorded.

Over the 15-year period, there were 115 FCY (95 in W and 20 in E) and 200 cubs of the year (171 in W and 29 in E), i.e., 7.7 FCY and 13.3 cubs per year. Trends of FCY in both nuclei were similar, with an initial decrease (1989-1994), followed by a recovery (1995-2003), which restored the initial values. The number of cubs per female was low, slightly higher in the western (1.8 SD=0.5) than in the eastern nuclei (1.4 SD=0.5) ($Z=-2.46$; $p=0.014$; $n=115$; Mann-Whitney U-test) and seemed to be stable. The area covered by the FCY also decreased, followed by a recovery in both nuclei, reflecting their demographic patterns. Nevertheless, the original area has not been completely re-colonized. The surface occupied in 2003 FCY was 11% smaller in the western nucleus (from 1,602 to 1,416 km^2) and 37% smaller in the eastern one (from 1,153 to 720 km^2) than in 1989. The area deserted by the FCY was situated in the middle of the two nuclei, so the gap between them was wider in 2003 than in 1989.

We conclude that Cantabrian brown bears are recovering in numbers, but that the isolation of the two nuclei is jeopardizing the recovery of the whole population. Habitat quality has not changed dramatically in areas that are not yet re-occupied, so the philopatry of the females may be the main cause for slow re-colonization. Both nuclei are still severely endangered, especially the eastern one, which only has 1-3 breeding females every year. The conservation priorities for coming years should include the recovery of the range occupied by breeding females and promotion of contacts between both populations.

3 - oral

BROWN BEAR POPULATION AND HABITAT FRAGMENTATION IN ROMANIA

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In the frame of the PIN MATRA project "Building a Regional Ecological Network in Romanian Carpathians" was carried out a study regarding brown bear population distribution in Romania. The field data, expert inputs and GIS analysis on the Carpathians mountain range have shown that the future developments that are foreseen in Romania could have an impact on the brown bear population. The main threat is the habitat fragmentation caused by infrastructure developments and socio-economic changes. If these developments will not be accompanied by measures able to preserve the population connectivity, the future bear population in Romania is uncertain.

The analysis was done by using GIS techniques and has covered 22 counties and more than 750 hunting units on the entire Romanian bear habitat. There were identified the main areas in which the developments have a certain impact on bear population and there were analyzed the main types of factors that are involved in this process. Thus, there were identified the corridors that link the bear populations from different Carpathians areas, with a special focus on the Apuseni bear population (western Romanian Carpathians). Other areas of interest are: Prahova Valley (intensive tourist developments, high road traffic and proposed motorway) and Olt Valley (high traffic and proposed motorway).

Based on the existing situation and by using the field data and experts inputs, was carried out a GIS modeling study that have shown the possible scenarios for the future brown bear population connectivity in Carpathians. Also, there were identified the areas with high bear population densities and the key location for the future connectivity of the Romanian brown bear population.

The study results are integrated in the GIS maps and Vision Plan of the proposed regional ecological network based on habitats for large carnivores (bears, wolves and lynx) in Romanian Carpathians. These results will be used by the Romanian authorities for the strategic planning and long term biodiversity conservation in the Carpathians and will support the designation of the future NATURA 2000 sites in Romania.

4 - oral

NEW PROBLEMS AND POSSIBLE IMPROVEMENT FOR THE CORRIDOR BETWEEN TWO CANTABRIAN BROWN BEAR SUBPOPULATIONS (NW SPAIN)

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Brown bears (*Ursus arctos*) currently occur in the Cantabrian Range over 5,000-7,000 km^2 and are located in two nuclei, covering roughly half the area each one. The number of bears is estimated to be 70-90, with the western population being 2-3 times larger than the eastern one. Both bear subpopulations or nuclei are approximately 30 km apart due to heavy infrastructures (highway, railway, reservoirs) and mostly unforested areas. One of the main goals in the conservation and eventual recovery of the Cantabrian bears is to improve the communication between both nuclei.

The first goal in this study was to estimate the barrier effect of the High-speed Railway project (-TAV-, currently under construction). The project includes a double tunnel of 25.4 km long that will be built from 8 different locations, during 6-10 years. Bear movements were simulated over a 1km^2 grid in a 12,550 km^2 area with bear habitat quality maps, with the projected TAV in the centre of the studied area. Bear movements were ruled among between adjacent squares depending on the quality values of each square, beginning in a source (reproduction nuclei) and with a maximum number of movements. Probabilities of connection between western nuclei (with reproduction) and eastern one (without it) were compared in the present scenario (without TAV) and next future scenario (with TAV) resulting in 18 and 19% decreasing probabilities of connection (construction phase and functioning phase respectively).

The second goal was to estimate the possible increase in the probabilities of connection between nuclei through the improvement of bear quality habitat. Three scenarios were defined and evaluated. Scenario 1: increasing 1,300 ha of forest cover equally distributed in one area of 65 km^2. Scenario 2: increasing 6,570 ha of forest cover in 438 km^2. Scenario 3: increasing 9,105 ha of forest cover in 607 km^2. We estimated the increase in the probability of connection in each scenario and we compared it

with the current situation, but with the presence of TAV in the functioning phase. Scenario 2 resulted in an increase of 15% in the probabilities of connection (thus not reaching current situation without TAV), while models from scenarios 1 and 3 did not increase the probabilities of connection. Small management projects (1) seem to have no effect but bigger ones (3) surprisingly could not "drive" individuals between nuclei either.

We discuss the methods and analysis in the context of the Environmental Impact Assessment procedures and eventual compensatory measures. We also discuss the limitations and advantages of the simulations and the management possibilities to improve communication between Cantabrian brown bear nuclei.

5 - oral

THE RELATIONSHIP BETWEEN POPULATION VIABILITY ANALYSIS AND POLICY FOR LARGE CARNIVORE CONSERVATION IN EUROPE

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Population viability analysis is becoming an increasingly sophisticated method within conservation research. In addition, the increasing availability of field data is allowing increasingly realistic models to be constructed. The concepts of viability and the results of the various models are being constantly used by researchers, conservationists and politicians, often with little understanding of the details behind the concepts or the calculations. Therefore, it is increasingly unclear how these models should be used in formulating management policy and in guiding management actions when it concerns large carnivores in a continent as diverse as Europe. We firstly look at the general issues of viability, focusing not only on the demographic and genetic aspects, but also on the concept of ecological, or functional viability. Secondly, we examine the way the viability concept has been used in the formulation of national and international legislation. Thirdly, we examine how the concepts and the legislation relate to each other across the varied realities of different European populations. Our main goal is to determine just how far scientific arguments, as expressed through viability analysis, can be used in setting policy, and when more fundamental values, or issues such as economics and social acceptance must enter the decision making process.

6 - oral

FACTORS INFLUENCING PUBLIC PERCEPTION OF LARGE CARNIVORES IN SLOVAKIA

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Knowledge of and attitudes towards the brown bear (*Ursus arctos*), grey wolf (*Canis lupus*) and Eurasian lynx (*Lynx lynx*) and their conservation and hunting management in Slovakia were assessed in 2003-04 by written questionnaire survey. The study aimed to identify what most influenced levels of acceptance, for example geographic region (relative carnivore abundance), socio-demographic

factors, level of fear, knowledge and previous experience of large carnivores, perception of population size or particular carnivore species.

A self-administered questionnaire was prepared containing 50 items arranged in six sections: attitudes and perceptions; knowledge; management issues; sources of knowledge; personal experience; and socio-demographic factors. Most questions were measured on a 5-point Likert scale ranging from "very negative" to "very positive" or offered multiple choice responses. Questionnaires were distributed and collected personally in one region where large carnivores were present at relatively high densities (Liptovský Mikulás, 49.1% of all respondents) and in a second region where these species were rare or absent (Nové Mesto nad Váhom, 44.9% of all respondents). The target audience of the survey consisted of three distinct groups: residents 16 years and older (*n*=800), pupils aged 12-15 years (*n*=157) and woods people (shepherds/farmers, hunters/foresters and employees of mountain hotels (*n*=121). In addition, 30 tourists in the Liptovský Mikulás region and 70 shepherds/farmers in various other regions also completed the questionnaire.

Generally, respondents held neutral to positive attitudes toward large carnivores. The most accepted species was the lynx, the least accepted was the wolf. Fear seemed to be an important factor influencing attitude. Very fearful people had the most negative attitudes toward bears, wolves and lynx. Bears were rated most dangerous and were most feared. Residents aged 16-35, males and those living in towns were more positive toward large carnivores than their counterparts. Hunters/foresters and tourists had the most positive attitudes while shepherds were the most negative occupational group. Level of knowledge tended to be low. A positive correlation was found between knowledge and level of acceptance, except among those most affected by real or perceived damage (i.e. woods people). More than 90% of respondents indicated that they would like to learn more about large carnivores. Television was important in shaping respondents' perceptions and was the most preferred medium for obtaining information. Lack of education/information and problems with people were most often cited as important management issues. More than 65% of respondents thought that hunting should be banned in National Parks.

7 - oral

CANTABRIAN BROWN BEAR FOOD HABITS. PRELIMINARY RESULTS FROM A LONG TERM STUDY

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Brown bear (*Ursus arctos*) food habits were examined in three different nuclei within the Cantabrian population (NW Spain). We used feces collected with varying intensity between 1974 and 2004. In the three nuclei (Western, Central, and Eastern), bears demonstrated to be highly omnivorous, being graminoids and forbs the most important food items during spring, fleshy fruits during summer, and dry fruits during fall and winter. In the central area, bears fed on a great variety of both fleshy, and dry fruits with similar relative importance in % of volume, especially in summer. In the Western area a sequential substitution of predominant items occurred: being forbs in spring, bilberries in summer and acorns in fall and winter the main food sources. Acorns were especially important for bears in the Eastern area during almost the whole year, although graminoids and some fleshy fruits constituted important complements to diet when acorns were scarce. As an important part of this descriptive study, we exhaustively addressed brown bear food habits during the so-called hyperphagia period, when bears are gaining the fat that is essential for winter dormancy and reproduction. For two of the studied nuclei, it was also possible to investigate whether changes in food habits have occurred by analyzing temporal changes of diet composition. We used general climatic indicators as potential predictors of these temporal changes in the whole Cantabrian range, but we also account for other

factors potentially able to modify brown bear food habits at the local scale (considering local factors that have followed different temporal trends in the two nuclei above mentioned). General climatic indicators such as temperature and the winter NAO index were good predictors of some diet changes, although local factors seem to modulate the final effect of climate change on diet composition. We were able to identify global warming, and grazing pressure (competitors) as main factors explaining changes in diet composition, and we discuss their implications on nutritional balance and habitat management. We conclude that the occurrence of some food items in the hyperphagic diet may be conditioned by changes in their distribution or phenology driven by global warming. In addition, the enormous grazing pressure found in one of the studied areas can be considered as a real threat for brown bears that should be managed to prevent further damages on this very small, already threatened population.

8 - oral

VARIATION IN BROWN BEAR DENSITY ACROSS A FRAGMENTED LANDSCAPE

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Brown bears (*Ursus arctos*) were once widespread across the European and North-American continent. Across a little over a century they were hunted to local extinction over a large share of their original habitat. In the same period, human development in terms of settlement, intensified land use, logging and infrastructure development modified and fragmented the original plain, mountain and forest habitats. In Scandinavia, especially the amount of recreational and second home resorts located in remote forest and mountain areas have increased by 5-8,000 new cabins annually, forming one the most significant increases in human disturbance in recent years. At the same time, protection efforts on brown bears have resulted in growth of the Norwegian-Swedish bear population from a few hundred to more than 2,000 individuals. Little, however, is known about to what extent expansion of bears is limited by availability of habitat across a fragmented landscape. We compared habitat use of 117 radio-collared male (58) and female (59) brown bears in forests in relation to terrain ruggedness, bogs, towns and resorts 1985-2003. In addition, independent collection of bear scats from over 100 individual bears was performed by hunters in the 12,128 km^2 large study area located in south-central Sweden and Norway. These scats were subjected to DNA-analyses and one random scat location for each individual bear plotted against habitat type and 10 random positions (located >100 hours apart) from radio collared bears.

Radio collar data and scat data were highly correlated and revealed corresponding results. Abundance of female bear locations was highest in rugged terrain in undisturbed areas located more than 10 km from resorts and towns, and lower in bogs and less rugged terrain types. Use was significantly higher than expected from availability in rugged undisturbed areas. Overall, 75% of all female bear locations were located in the 30% of the area constituting rugged terrain located more than 10 km from disturbance, while similar habitat was avoided near towns and resorts. Areas dominated by bogs and flatter terrain was used less than expected by females. Males also preferred undisturbed rugged terrain types, but generally used presumably lower quality habitat more than females, although habitat within 10 km from towns and resorts was also for males generally used less than available. Use of lower quality habitat by males may be a function of lower social status especially surrounding larger aggregations of reproductive females concentrated in prime habitats. Overall, 42 % of the bear habitat received low use due to disturbance from towns, infrastructure and resorts. In spite of an expanding and immigrating bear population, these disturbed habitats have received little use. If habitat use in the study area is representative for Swedish and Norwegian bear populations, the majority of their original

range and habitat may have been lost due to human development in the last century. Conservation efforts need to emphasize undisturbed rugged terrain types and regulate development of recreational resorts and human outdoor activity in order to safeguard continued reestablishment of bears.

9 - oral

DELINEATION OF SUB-POPULATION BOUNDARIES DUE TO ANTHROPOGENIC FRAGMENTATION OF GRIZZLY BEARS IN SOUTHWEST CANADA AND NORTHWEST USA USING GENETIC ANALYSIS

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Meta-population structure may develop from combinations of natural fractures and anthropogenic population fragmentation. The detection of biologically-based population boundaries and their causes is necessary to understand and effectively manage these fragmented systems. We describe the human-induced meta-population structure of grizzly bears (*Ursus arctos*) in southwest Canada and the northwest USA as derived through genetic analyses. We used 15 locus microsatellite genotypes of 1,266 wild grizzly bears across our 150,000 km^2 study area and two levels of analysis that provide insight into the structure and genesis of population boundaries in this system. First, we used a Baysian Monte Carlo Markov Chain algorithm designed to detect population boundaries with no *a priori* assumptions of group membership. Second, we used individual-based population assignment methods and multiple linear regression to measure sex-specific movement rates and fragmentation in relation to human disturbance. Together these results suggest where spatially explicit discontinuities exist in the regional distribution of grizzly bears sufficient to detect and suggest explanation for the presence of population and sub-population units. We identified eleven immediately adjacent sub-populations characterized by limited female and varying degrees of male inter-change and two isolated populations. The future of grizzly bear persistence in southwest Canada and the northwest USA is likely dependent on management actions that promote and ensure meta-population function (inter-change of males and females) between these fragmented sub-units. Our results lay out the regional structure, and suggest direction for workable, realistic, and necessary management actions.

10 - oral

ANNUAL REPRODUCTIVE SUCCESS IN MALE BROWN BEARS

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We studied male annual reproductive success (ARS) and its determinants (phenotypic characteristics, age, population density) in two Scandinavian brown bear (*Ursus arctos*) populations. We defined ARS as the number of documented yearling offspring produced annually. Paternity was determined using molecular techniques. In general, older and larger males had higher ARS. Older males may be more efficient and experienced in competition for reproduction (male dominance). Large body size is of direct benefit in male-male competition and of advantage in endurance competition for the access to females. However body size was relatively more important in our northern study area. This appeared to be related to the different age structures between the two study areas. In the southern area the male age structure was evenly distributed throughout all age classes. In the north the population consisted of very few old large and several young males; middle-aged bears were largely missing. Relatively more younger males reproduced in the northern area than in the south and ARS did not increase with age. If younger males compete for access to reproductive females, none of them have the advantage of age and experience; thus body size may have been a relatively more important factor deciding the outcome of the competition in the north. Population density was positively correlated with male ARS, as expected, because males were more successful when there were more females to mate. Multilocus heterozygosity was found to be important for male ARS. It has been hypothesized that individual heterozygosity may be reflected in male qualities, which may be of benefit in direct male-male competition or sperm competition.

11 - oral

PACIFIC SALMON DELIVER PERSISTENT GLOBAL POLLUTANTS TO THE COASTAL GRIZZLY BEARS OF BRITISH COLUMBIA

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Grizzly bears are omnivorous mammals that rely upon a variety of terrestrial foods, and in some cases, migrating salmon. While studies highlight the vulnerability of marine mammals and seabirds to contamination by Persistent Organic Pollutants (POPs), terrestrial wildlife are widely viewed as uncontaminated as a result of their low trophic level. By sampling the hair and fat tissue of 12 grizzly bears from different locations in British Columbia, we aimed to 1) quantify the diet of individual bears over time using stable ^{13}C:^{12}C and ^{15}N:^{14}N isotope ratios, and 2) characterize the relative contribution of two distinct food webs (marine vs. terrestrial) to the contamination of these bears using this dietary information.

Stable isotope signatures in growing hair reveal that, while some BC grizzly bears rely entirely on terrestrial foods, others switch in late summer from terrestrial foods to Pacific salmon. This latter feeding behaviour led to increased accumulation of many POPs, including organochlorine pesticides and polybrominated diphenyl ethers (PBDEs) in our study bears. While terrestrial food-consuming bears were exposed to low levels of POPs, the salmon-eating bears had higher concentrations of POPs,

especially those contaminants typically associated with marine food webs. Our results suggest that increased exposure to endocrine-disrupting POPs through their consumption of salmon may represent an additional conservation concern to some North American grizzly bears, and highlight the global nature of environmental contamination.

12 - oral

BEAR-SALMON RELATIONSHIPS: A REVIEW

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The annual aggregation of brown and black bears at salmon streams across the Pacific Rim has long fascinated naturalists and represents one of the most sought after wildlife-viewing experiences in the Northern hemisphere. Yet, until recently, ecological and evolutionary aspects of bear-salmon relationships have generated very little scientific interest. In the past decade, however, both bears and salmon have been at the forefront of restoration efforts (population and habitat restoration, reintroductions), and conservation concerns (preserving viable populations of both under conditions of exploitation and habitat loss). Consequently, a growing number of studies have focused on how bears influence salmon behavior and life-history, the individual- and population-level fitness effects of salmon on bears, and the ecological impacts of this relationship on stream and riparian ecosystems. Accordingly, we review the current state of knowledge of bear-salmon relationships.

When streams are sufficiently small, predation rates by bears can be high, with over 50% of fish killed in many systems. In these streams, predation is often selective, with ripe fish (greater energetic reward) and/or larger salmon often experiencing disproportionately higher rates of predation, although salmon density and bear social dynamics plays a role in selective predation. Consequently, predation may serve as an evolutionary force shaping body size and life-history (primarily the number of days fish are on the spawning grounds before senescent death). At larger streams, bears have fewer effects on salmon populations because predation rates are reduced, often to the number of sites where salmon become accessible.

Salmon can have profound effects on bears at both the individual and population level. Salmon returns are highly predictable in space and time, and thus seasonal movements of bears are largely centered around the timing of salmon availability. At the population level, bears with access to salmon produce, on average, larger litters and achieve larger body sizes, and occur at densities up to 80x greater than 'interior' populations with no access to salmon. The aggregations of bears at salmon streams can produce highly agonistic interactions, and thus some bears choose to forage in less-productive but perhaps safer alpine areas while salmon are available.

Finally, bears often drag salmon from the stream and partially consume the carcass, resulting in a pulse of marine-derived nutrients (salmon tissue), from the stream to the riparian forest. A number of scavengers utilize these carcasses as an important food source, and the carcasses act as slow release fertilizer (depending upon rate of decomposition), with ammonium and nitrates being orders of magnitude higher in soils near carcasses for up to 3 months following deposition. The nutrients enhance microbial communities and may enhance growth rates of riparian shrubs and trees. We discuss the implications of these aspects for management and conservation of bears and salmon.

13 - oral

DOES INTERSPECIFIC COMPETITION FOR BERRIES OCCUR BETWEEN BROWN BEARS *URSUS ARCTOS* AND OTHER ANIMALS IN CONIFEROUS-DOMINATED BOREAL FORESTS?

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We investigated the possibility of competition for berries between Scandinavia brown bears *Ursus arctos* and other mammal and bird species in the coniferous-dominated boreal forest of Middle Sweden during autumn in 2000-2002. The berries investigated were *Vaccinium myrtillus*, *V.vitis-idea,* and *Empetrum hermaphroditum,* which are the most important species for bears. We compared berries in cages with two mesh sizes and open plots. None of the categories of plots differed in amounts of number of berries per m^2, number of berries per m^2 foliage, nor ripe biomass. We conclude that competition did not occur between brown bears and other berry-eating species in our study area.

14 - oral

KIN-RELATED SPATIAL STRUCTURE IN BROWN BEARS *URSUS ARCTOS*

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Kin-related spatial structure may influence reproductive success and survival and hence the dynamics of populations and has been documented in many gregarious animal populations but few solitary species. In brown bears (*Ursus arctos*) in Scandinavia, 40% of the females (n=69) and 90% of the males (n=60) showed natal dispersal, and both the probability of dispersal and dispersal distances are inverse density dependent. The philopatric behaviour among females suggests that kin-related social structure may occur, but studies in the literature are conflicting. Using molecular methods and field data we tested: (1) whether kin-related spatial structure exists in the brown bear, a solitary carnivore, (2) whether home ranges of adult female kin overlap more than those of non-kin, and (3) whether multigenerational matrilinear assemblages, i.e. aggregated related females, are formed. Pairwise genetic relatedness between adult (5 years and older) female dyads (n=2,805) declined significantly with geographic distance, whereas this was not the case for male-male dyads (n=1,993) or opposite sex dyads (n=4,768). The amount of overlap of multiannual home ranges was positively associated with relatedness among adult females (n=37). Maintenance of this structure within matrilines is probably due to kin recognition. Plotting of multiannual home range centres of adult females (n=67) revealed formation of two types of matrilines, matrilinear assemblages relatively exclusively using an area and dispersed matrilines spread over larger geographic areas. The variation in matrilinear structure might be due to competitional differences among females and habitat limitations. Our results suggest that female brown bears show territorial behaviour with two types of territories, "single bear territories" and "group territories" consisting of related females.

15 - oral

BLACK BEARS SEXUALLY SEGREGATE AT THE LEVEL OF INDIVIDUAL SALMON STREAMS AND INDIVIDUAL TRAILS, NOT HABITAT TYPE

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We studied use of salmon-spawning streams by male and female black bears (*Ursus americanus*) on Kuiu Island, Southeast Alaska. We sought to explain at what structural habitat level black bears sexually segregate on these streams. Since females may have young of the year, using the profitable salmon streams may be dangerous, as males also congregate on salmon streams, and infanticide is known to occur in males. Thus, we hypothesized that bears exhibit sexual segregation on these streams. Based on *a priori* predictions of how male and female use differs, we asked whether the sexes use different habitat types (tidal and forested), which differ in access to cub escape cover (trees), different trails and/or different creeks. In addition, we asked whether they temporally segregated, in terms of the ontogeny of the salmon run. In order to increase sample size of individually-identified animals, we used genetic tagging. While this method greatly increased sample size, with respect to other methods such as radio telemetry and standard visual observation, it did not allow us to differentiate between females with and without cubs. Thus we acknowledge that our hypotheses do not address the segregation of females with cubs from males in particular, but we ask whether the effect size differentiating male and female use in general, is great enough to detect sexual segregation that may be driven by females with cubs. We collected 1,554 black bear hair using barbed-wire fences on seven streams in two years. We extracted DNA and individually identified the samples using seven microsatellite primers. We produced a data set including 579 individually-known males and females on particular trails, in two habitat types (forested vs. tidal) in two years on seven different salmon streams. We used a nested (trail within habitat type within stream) logistic procedure (female, not female) with repeated measures (10 weekly visits to each stream) using PROC GENMOD. We compared likelihoods of models using AICc. We found that stream and trail were by far the most significant variables explaining female presence. Thus, we found that some streams can be considered "sow streams" while others are considered "boar streams," corroborating anecdotal accounts of long-time hunting guides. These results also indicated males and females use trails differentially. We did not find that females and males used areas that differed in escape cover. We suggest that either the effect size between males and females (both with and without cubs) is not large enough to pick up a difference in behavior of females with cubs, that there is simply no effect, or that our perceptions of escape habitat are in correct. In the oral presentation we will speculate on these behavioral differences of male and female bears on salmon streams. This study also highlights the use of genetic tagging answer behavioral questions that are difficult to address with other techniques; radio-telemetry is hindered by low sample size, and visual behavioral observations are relegated to only day-time observations.

16 - oral

POPULATION ABUNDANCE AND GENETIC RELATEDNESS OF AMERICAN BLACK BEARS ON 3 NATIONAL WILDLIFE REFUGES IN COASTAL VIRGINIA AND NORTH CAROLINA, USA

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We conducted a 5-year study on 3 national wildlife refuges (Great Dismal Swamp NWR, Pocosin Lakes NWR, and Alligator River NWR) to assess population abundance and genetic relatedness of American black bears in eastern North Carolina and Virginia, USA. We collected hair samples from baited barbed wire enclosures for 2 consecutive summers at each refuge, analyzed samples for individual identification, and used the results in a mark-recapture framework to generate population estimates for each area. Nearly 5,500 hair samples were collected over 4 summers, and nearly 500 individual bears have been identified from these samples. Hair samples collected in 2004 currently are being analyzed and results will be available during summer 2005 to complete our demographic analyses. Preliminary results indicate some of the highest bear densities reported in the literature. Home range sizes appear to be small compared to other areas in the region.

We will assess genetic relatedness using a suite of 16 microsatellite markers for a subset of bears at each refuge. We will use population genetic parameters such as F_{ST}, genetic distance, and gene flow (Nm) to determine relatedness of bears within and between each refuge. Assignment tests will allow us to generate estimates of dispersal and migration across the landscape. We also will use genetic data from other projects in the southeastern United States to provide a context for genetic differences that are observed between these refuges. This dataset will be one of the first to explore genetic parameters over such a large area of black bear habitat.

17 - oral

MOVEMENT PATTERNS OF FEMALE BROWN BEARS WITH CUBS IN EUROPE; APPLICATION TO POPULATION MONITORING

Ordiz A[1], Naves J, Fernández A, Huber D, Kaczensky P, Mertens A, Mertzanis Y, Mustoni A, Palazón S, Quenette PY, Rauer G, Rodríguez C, Swenson JE

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Counts of females with cubs of the year (hereafter, FWC) have been used as an index for monitoring brown bear populations and/or estimating a minimum number of adult females in several small and medium-sized populations. The goal of this paper is to improve the criteria to differentiate FWC using distance in space and time between sightings, since discriminating among different family groups is a usual constraint in this procedure. We used telemetry data from 11 FWC from South and Central (SC) Europe and 22 from Sweden to answer the question: "What is the probability that after an observation of a FWC, this same family group has moved "x" kilometres after "y" days?

Straight-line distances travelled by each FWC were estimated on a daily basis. Using moving windows, we calculated straight-line distances covered during intervals from 1 to 180 days, or the maximum interval allowed by the data, for each FWC. In a second step, maximum values (highest percentiles) of distances over time were obtained for each FWC. We considered two major periods of

bear activity: spring, from first observations after denning until the end of June, and the remaining active season until denning. We used generalized linear models to distinguish groups of FWC according to geographical variables. Native females living in the boreal forest of Scandinavia moved farther than native females living in the temperate forests of SC Europe. Differences among FWC in SC Europe appear to be related not only to habitat characteristics, but also to the different status (native/released) of the studied bears.

In spring, 90% of the straight-line movements of FWC during 7 days were within 9.5 km for the females living in boreal forest and within 7.25 km for the 5 females released in SC Europe. With the same percentage for 2 native females in SC Europe the distance is less than 3 km. After spring, 90% of the observations during 7 days were within 14 km for the females living in boreal forest and within 19 km for the released females in SC Europe. For the corresponding number of days and probability, the distance is only 7.25 km for the native FWC in SC Europe.

In conclusion, these results can be a useful tool for biologists and managers for estimating the minimum number of family groups. However, this method does not allow calculating the probability that two observations close in space and time belong to different family groups. In this sense, the method is probably more useful in areas with low densities of FWC.

18 - oral

INVITED SPEECH

UNDERSTANDING PEOPLE: HUMAN DIMENSIONS AS A RESEARCH TOOL AND AN APPLIED APPROACH TO IMPLEMENTING MANAGEMENT PLANS IN EUROPE

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19 - oral

COMPARISON OF SPATIAL BEHAVIOUR OF TRANSLOCATED AND NON-TRANSLOCATED BROWN BEARS IN EUROPE

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In the framework of three brown bear conservation programs in European Union (LIFE projects), 16 adult and subadult brown bears were successively translocated from Slovenia and Croatia to Austria, France and Italy. Two females and 1 male were released in Austria between 1989-1993 and in France between 1996-1997 and 3 males and 7 females released in Italy between 1999-2002. During this period 34 males and 14 females were captured both in Slovenia and Croatia and radiotracked in the framework of monitoring studies of brown bear populations in these two countries. The aim of this study is twofold i) describe the spatial behavior of bears released in a new environment and compare it

with non-translocated brown bears from source population; ii) give critical biological data for managers planning future translocations.

Analysis of spatial behaviour was done by calculating serial and annual home ranges, comparing home ranges between successive years and by calculating straight line distances between successive daily radio locations. On average translocated bears exhibited a higher mobility and a larger home range in the year of their translocation than non-translocated bears of the same age and sex class. For translocated bears the release point did not necessarily become a central point in the home range as several bears never revisited the area. Our results show the possible variation in the spatial behavior managers have to expect when translocating bears. Further analysis are needed to determine how much of this variation can be explained by differences in habitat distribution and quality, bear density or individual traits of translocated bears.

20 - oral

BROWN BEAR (*URSUS ARCTOS*) REINTRODUCTION IN CENTRAL ALPS: SCIENTIFIC RESEARCH AS A MEAN FOR BIOLOGICAL KNOWLEDGE AND SOCIAL ACCEPTANCE

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In order to save from an ineluctable extinction the relict nucleus of brown bears (*Ursus arctos*) surviving on Brenta Dolomites (Trentino - Italy), in 1996 Adamello Brenta Natural Park set up a project that led, in 4 years (1999-2002), to the release of 10 individuals belonging to the Slovenian population. The operation, approved by European Union which co-funded the project by LIFE Nature financial instrument, involved, in addition to the Park, Trento Autonomous Province and Italian National Wildlife Institute.

Considering the project main goal, scientific research has been thought about, in the first phases, as a minor importance activity compared to what was necessary to favour a positive outcome of bears' releases. Notwithstanding, thanks to the collaboration with University Institutes, it was later possible to deal with research issues, mainly using data deriving from the radio-telemetry activity which was carried on with the aim to evaluate the progress of the project (7773 fixes, 970 working days/man in total). In particular, studies about spatial utilization (home ranges and core areas) have been realized, with special reference to the behaviour of bears in the periods following the translocation (maximum distances, "exploration" speed). The whole of these analysis, compared to literature data, confirmed the positive course of the project, showing that the behaviour of released bears was similar to that described as typical for the species.

The set of radio-telemetry data was moreover used to validate the Environmental Evaluation Model realized in the framework of the Feasibility Study (Duprè *et al.*, 2000) which set the conditions for the project of reintroduction itself. This analysis led to an increase of 12.26% (6.76% former classified as "not suitable" plus 5.5% former considered "rocks, glaciers and scattered vegetation") in the area that can be considered suitable for bears in respect to what had been hypothesized in the planning phase.

The 173 scats collected during field surveys permitted instead to set up a preliminary study on bears trophic behaviour: this research, after having confirmed the already known food habits of the species, will be deepened in the future through the comparison with data resulting from a controlled diet experiment on captive bears.

Aim of present work is thus to underline the utility that realized researches had in the framework of communication activities performed during the project of reintroduction of bears in Italian Central Alps. In particular, the possibility to supply detailed and up-to-date information on released bears' behaviour and habits seems to have encouraged the social acceptance of the species.

In a general context, it seems possible to assert that scientific research, beyond giving useful information for population management, plays a decisive role in supporting positive outcome of conservation projects.

21 - oral

GUIDELINES FOR BROWN BEAR REINTRODUCTIONS IN EUROPE

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Reintroduction and augmentation are valuable tools for species conservation, but, if done without proper planning, can cause severe undesired effects and often fail. Translocations of bears are particularly challenging, because these are very costly programs, with low rate of success, and require many years to be completed. Furthermore, bear translocations are often very controversial and the human dimensions of this kind of programs should be deeply taken into account. In fact, reintroductions and augmentations can be strongly opposed by local people, both because of the damage bears can cause to human activities, and the risk of attacks to humans.

In Europe, the precarious conservation status of several Brown bear populations (i.e. Cantabrian mountains, Pyrenees, Central Italy, Alps, etc.) impose to not a priori exclude translocations from the recovery alternatives. However, the characteristics of the region - a densely inhabited area with highly fragmented landscapes – indeed make bear translocations in Europe particularly complex.

In the present paper, we review the main technical, biological, socio-economical and organizational aspects of bear translocations so far attempted in Europe. The review covers the several projects carried out before the 1970s (e.g.: Eastern Slovakia, Bialowieza Primeval Forest) - that in most cases lacked any science based planning and management strategy - and the more recent programs (Austria, France-Spain, Italian Alps) - that have focused particular attention to post-release monitoring and conflict management. We did not consider releases of captive bears into the wild because of surplus captive stock, releases of confiscated dancing bears, and nuisance translocations.

On the basis of the available information on the translocation projects so far carried out in Europe, we draw the main lessons that can be learnt and identify guidelines for future bear reintroduction and augmentation programs. The guidelines address the main critical aspects that should be evaluated when planning a translocation, including: source of founders; potential impact on the source population; size and structure of the release stock; methods of capture, handling, transport and release; conflict management, communication strategy and evaluation of public attitude; post-release monitoring; administrative, organizational and financial aspects.

22 - oral

NEW RE-INTRODUCTION OF BROWN BEARS IN PYRENEES MOUNTAINS, FRANCE

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23 - oral

BROWN BEAR - HUMAN CONFLICT IN TURKEY

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The information on brown bear (*Ursus arctos*) population in Turkey is very limited. Efforts of trained biologists on collecting systematic information on its range, habitat and its interaction with humans have started only in the past few years. Can & Togan have recently presented the current status of brown bear in Turkey (Ursus 15, 2004). As true for elsewhere in the world, the future success of any conservation effort on large carnivores including brown bear largely depends on limiting the carnivore-human conflict in carnivore landscapes. Authorities have not kept proper records on brown bear-human conflict, and there is no reliable information on bear-human conflict in Turkey. Therefore, in order to understand the brown bear-human interaction, we interviewed national and local authorities (n=27), local people (n=85) and village headmen (n=35) in Northeastern Turkey; we reviewed the official complaints (n=112) made by local people to the wildlife authorities and we scanned 17 daily national and 15 local newspapers published in Eastern Black Sea region between 2000 and 2005 for the news on brown bear-human interaction. Field surveys were also conducted to understand the relative abundance of brown bears and brown bear-human interaction in the provinces of Bolu and Kastamonu (2001-2004) and in the Rize-Artvin region (2002-2005). The preliminary results show that Kure Mountains (Kastamonu) and Eastern Black Sea Mountains (Rize, Artvin and partly Erzurum provinces) are the major brown bear-human conflict areas. The main reasons for bear-human conflict in terms of their importance are damage to beehives, damage to orchards and damage to livestock. The depredation has mainly occurred only cattle and sheep. A few bear-human encounters have resulted in human injuries. It has also been observed that 4-7 bear cubs per year are taken from the wild by the locals, some of which become habituated to humans. We conclude that the general lack of awareness and knowledge on brown bears even in major brown bear areas, the decrease in the quality of the suitable brown bear habitat in terms of food supply, and unguarded livestock and unprotected beehives are the main causes of brown bear-human conflict in those areas. In order to limit the brown bear-human conflict, we recommend identifying the core brown bear habitats, including them in forestry management plans as areas to be protected, implementing relevant carnivore damage prevention techniques, and implementing a brown bear awareness program for local people and authorities in the major conflict areas. Increased commitment and vigilance by the national and local authorities in implementing relevant legislations will also play a critical role in the protection of brown bears and their habitat in the identified major brown bear-human conflict areas.

24 - oral

DAMAGE PREVENTION, COMPENSATION FOR LOSSES, EMERGENCY TEAMS AND COMMUNICATIONS EFFORTS FOR MANAGING CONFLICTS WITH BEARS IN TRENTINO: COSTS, TRENDS AND RESULTS

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In the 90s the Brown bear was almost extinct in the Alps, and in 1999 the Adamello Brenta (Central Alps) Nature Reserve, in cooperation with the Trento Provincial Authority and the National Wildlife Institute, with the financial support of the European Union, began to reintroduce bears into the area. Ten bears were released in the 1999-2002 period, and 11 cubs have been born so far.

The newly formed population lives in a densely inhabited area, frequently visited by tourists both in summer-autumn and in the winter. Agriculture is widespread, and especially in summer livestock graze in high altitude alpine pastures. Beehives are common in a large portion of the area, including medium and high altitude areas. Damage caused by the relocated bears is frequent and encounters with bears by tourists, livestock breeders and local residents are quite common.

The main challenge of the authorities is thus the effective management of conflicts, with the aim of enabling coexistence between bears and humans in the long term. Apart from economic issues, the presence of bears also causes concern among residents and tourists, and these emotional aspects cannot be dealt with except by proper information and communication strategies.

To respond to these challenges, the Trento Provincial Authority (responsible for wildlife conservation and management in the area) has thoroughly reviewed its internal legal and regulatory framework, and has carried out major re-organisation in its wildlife management department. Specifically, the efforts focused on 1) checking on and rapidly compensating for damage, 2) incentives for the implementation of damage prevention measures, 3) the prompt action of an emergency team in critical situations, 4) information and communication campaigns.

In the present paper we report on recorded economic losses, temporal trends and types of predation in the 1999-2005 period. We also report on the incentives funded for the implementation of preventive measures, and the types of facilities created. In relation to the emergency team, structure and procedures are described, together with the type of actions carried out and the results over the 6 years of work. Lastly, we describe the major communications campaigns carried out and how public opinion was measured.

The monitoring and constant evaluation not only of the bears, but also of damage, conflict and response are crucial for the optimum use of available resources and to make management effective. More generally, this information is critical for assessing ongoing success (or failure) in ensuring the long-term coexistence of bears and humans in this region of the Alps.

25 - oral

THE EFFECT OF TRAFFIC VOLUME ON THE ROAD CROSSING BEHAVIOR OF BEARS IN CENTRAL FLORIDA, USA

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The bear population in central Florida's Ocala National Forest (ONF) has accounted for 45% of the state's vehicle-caused mortality from 1976 – 2003, and contains 8 of 15 chronic roadkill areas. State Road 40 (SR-40), which bisects this population, had the greatest number of mortalities. Interest in improving this road provided an opportunity to document bear movements, highway crossing patterns and behaviors associated with a range of traffic levels.

We captured 138 bears >1-year old, and radiocollared 95 of them (49 F, 46 M). Most were trapped along a segment of SR-40 within ONF with relatively low traffic volume, but 13 collared females were trapped along a segment of SR-40 with higher traffic volume in the small community of Lynne. Collared bears were monitored 1-3 times per week and we acquired 7,204 locations (5,177 from the ground and 2,027 from an airplane).

Eighty-six radiocollared bears crossed SR-40 a minimum of 388 times. Logistic regression analysis indicated statistically significant differences in the probability of observing a crossing of SR-40 between consecutive locations of ONF males, ONF females, and Lynne females. At any given distance from SR-40 and elapsed time between locations, the odds of observing a crossing by an ONF male bear were 4.8 times greater than the odds of observing a crossing by an ONF female bear and 11.3 times greater than such odds for a Lynne female bear. The estimated odds ratio indicated that a crossing by an ONF female bear was 2.4 times more likely than a crossing by a Lynne female. Further, the odds of observing a crossing for bears that were eventually struck by vehicles were 3.1 times greater compared to other bears. When crossing probabilities were compared between ONF (1 F, 3 M) and Lynne (3 F) bears that were hit by cars, the odds of observing a crossing by an ONF bear were 11.9 times greater than the odds of observing a crossing by a Lynne bear. Lynne bears tended to cross SR-40 less, yet have a greater likelihood of being struck when they did. We documented the mortality of 12 radiocollared bears, 6 in each area. Most (58%) of the mortality was caused by collisions with vehicles. Of collared bears, 4 (5%) within ONF and 3 bears (23%) from Lynne were killed by vehicles. Traffic volume on SR-40 in Lynne averaged 15,000 vehicle trips per day versus 5,100 vehicle trips in ONF. A log-rank test indicated a significant difference in the shapes of survival curves among the three groups. Cox proportional hazards regression indicated that Lynne females were 10.9 times more likely to die at any time compared to ONF females. Annual survival rates of 62.4%, 92.9% and 76.5% were calculated for Lynne females, ONF females and ONF males, respectively. This survival rate for Lynne females is among the lowest reported for females in North America. If these survival rates are representative, then the population in Lynne would be in jeopardy without an adjacent source such as ONF. However, the mortality rate for ONF bears is low and sustainable under present conditions.

26 - oral

A NEW GPS-GSM BASED METHOD FOR STUDYING BROWN BEAR BEHAVIOR IN HUMAN CONTACTS

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We report a new method of studying brown bear (*Ursus arctos arctos*) behavior in human contacts. The method combines the technologies of Global Positioning Systems (GPS) and Global System for Mobile Communication (GSM). A GPS-GSM - collar on a bear locates itself with the help of GPS -module while the GSM –module sends the location information as a SMS -message (short message) via GSM -mobile phone network to the researcher. The collar is interactive and it can receive SMS-commands for instance to adjust the interval at which location information is transmitted. We have tested the method in experiments in which persons equipped with GPS-GSM -mobile phones, which function like the bear collar, approached a GPS-GSM-collared bear. Spatial locations of the bear and the approaching persons are displayed on the digital map displayed on the computer screen in real time, which allows interactive performance on human-bear contacts. The mean dispersion of spatial information was 2.5 m and the success rate in the experiments was 81.2% (new spatial locations successfully received when requested). Behavior of the bear varied greatly in trials although the approach procedure was kept as constant as possible. In indirect approaches the bear stayed in its original location or escaped. If the bear escaped, the escape initiation distance varied from 37 to 624 m. The escape initiation distance was not always the minimum distance between the approaching persons and the bear, as often the bear stayed motionless while passed, but started to flee when the people had passed it. Detailed knowledge of bear behavior in human contacts contributes to the management of bear populations. Presenting unbiased scientific information about bear behavior to the public, who often has prejudice against large predators, will help authorities to justify their management actions.

27 - oral

EXPLORATION TO THE COFÁN TERRITORIES: THE USE OF GAME TRAILS, NON-INVASIVE GENETIC SAMPLING, AND CAMERA TRAPS AS TOOLS FOR ANDEAN BEAR SURVEYS

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The knowledge about the distribution, presence/absence, abundance, habitat use and food habits of a species is fundamental to the development of management and conservation plans. That knowledge has been particularly hard to get with species showing low densities and species hard to see and trap such as the Andean bear. There is a strong need for benchmark data and surveys techniques throughout the Andean bear distribution to field those information gaps.

During the last 5 years, WCS Northern Andes Andean Bear Program have tried several non-invasive techniques in order to gather information about wild Andean bear populations. Surveys along game-trails, collection of hair samples on mark-remark sites for genetic sampling and the use of camera traps were the most successful techniques used to gather information about presence/absence, activity,

seasonality, food habits, resource availability, and population genetics. At the Cofán exploration the 3 techniques were used in order to test their effectiveness as survey techniques to gather benchmark information and also as techniques for Andean bear population monitoring.

Between the 10 and the 26 of February 2005, we surveyed 9 areas around the Sur Pax mountain in Ecuador, between 1,200 and 2,340 m.a.s.l. 7 transects were done along ridgeline areas and 2 transects along valleys. We found game trails with bear activity signs along all the transects surveyed along ridgelines. The type and number of signals varied among trails. 150 feeding and scat signs were found, identifying 11 different food items. We were able to collect 70 hair samples searching on 144 mark trees along 6 game trails. 2 bear pictures were taken using 8 camera traps, placed along 2 game-trails for only 2.5 and 4.5 days. No bear trails or bear activity signs were found on the valley transects.

The above results show the efficacy of surveying game trails to explore new areas in order to gather information on presence/absence, habitat use and food habits. Mark trees along the bear trails are an excellent source of hair samples for genetic studies, and camera traps can be placed along trails to gather information about the pattern of activity, frequency of use of such transects and the amount of bear sign related to that use. We strongly recommend the use of the above techniques for surveying new areas, or monitoring populations of high interest.

28 - oral

LONG-TERM HEALTH EFFECTS OF CAPTURE AND HANDLING OF GRIZZLY BEARS IN WEST-CENTRAL ALBERTA: IMPLICATIONS FOR ANIMAL WELFARE AND GOOD SCIENCE

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In 1999 the Foothills Model Forest Grizzly Bear Research Program was initiated with the goal of providing new knowledge and tools to aid in the long-term conservation of grizzly bears (*Ursus arctos*) in Alberta. With as many as 35 bears captured per year, and some captured more than once, an important consideration has been the potential for long-term adverse effects as a result of capture and handling. Our analyses of health and movement data gathered during the project show four lines of evidence to suggest capture of grizzly bears can result in significant injury with consequential long-term effects on body condition and animal movement. First, results from blood analyses indicate bears captured by leg-hold snare often have elevated white blood cell counts and serum concentrations of muscle enzymes consistent with significant muscle damage. Second, analysis of serum myoglobin concentrations and post mortem examination of an animal that died approximately 10 days following capture indicate capture by leg-hold snare may cause exertional (capture) myopathy. Third, analyses of body condition over time indicate bears captured multiple times over different years are in poorer body condition than bears captured once only. And fourth, analysis of movement rates for individual bears indicate many bears move little in the days following capture with movement rates remaining sub-normal until approximately 3 weeks following capture. Although these findings have obvious implications for the interpretation of data, they also emphasize need for improving capture methods and minimizing deleterious effects on wildlife.

29 - oral

ASSESSING BEAR POPULATION SIZE AT AN ECOSYSTEM SCALE

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We describe the planning, science design, and management of a study to estimate the size and distribution of the grizzly bear (*Ursus arctos*) population from hair samples found on 31,410 km^2 in northwestern Montana, USA. Microsatellite analysis of the hair was used to identify individual bears for use in a mark – recapture population estimate. We employed two methods concurrently to sample bear hair: 1) 2,555 baited hair snag stations were distributed using a 7x7 km grid, and 2) repeated visits to a network of 5,115 bear rub trees, sign and fence posts, and power poles along trails and roads. No lure was used to attract bears to rub objects. During 4 14-day capture sessions in 2004, we collected 20,800 hair samples at baited sites and 13,000 samples from rub objects.

Planning began two years prior to the start of field sampling. Budget forecasting was the most time-consuming element of the planning process. After we made initial forecasts in early 2002, frequent revisions were required as funding projections and, hence, the study design changed. During fall 2002, three workshops were held to address science design, logistical, and outreach issues. Experts in bear biology, population modeling, and genetic analysis were convened for three days to advise on study design, e.g. sampling density, use of rub trees, moving snags between sessions. When funding dropped significantly in 2003, a redesign workshop was held to determine the optimal design for the available funds. Partner agencies met to plan the logistics of employing, housing, and delivering supplies to the 200 technicians needed to for the fieldwork. Because grizzly bear management is controversial, agency staffs developed a communication plan to ensure accurate, consistent information was released. During summer 2003, 60 technicians located and prepared rub objects for sampling on 8,000 km of trail, constructed 440 cattle exclusion fences at snag sites, and obtained access permission from 100+ landowners to prepare for hair sampling in 2004.

We describe strategies for working at large scale, such as: 1) methods of coordinating activities among the federal, state, tribal, and private entities involved with an ecosystem-scale project, and 2) procedures for data collection and genetic analysis to prevent, detect, and correct errors. We also make recommendations for directing 200 widely dispersed field employees and conducting fieldwork on extensive tracts of private property and in remote areas where communication is limited. The study area was divided into nine subunits, each with a leader to direct field crews. A core staff of seven ensured that each subunit had sufficient personnel, equipment, and supplies. Communication was facilitated by conference calls after each sample session. Employees were recruited primarily through a website that received 17,000 hits during the 5-month hiring period. Data quality was enhanced by intensive training of personnel, GPS units pre-loaded with snag site an rub tree coordinates, customized field maps for each crew assignment, quality control personnel assigned to each subunit to ensure that field protocols were applied correctly and consistently, and bar-coded hair sample numbers on peel-off labels that eliminated transcription and data entry errors. Lab analyses use multiple error prevention and detection protocols, including positive controls on each electrophoretic run, and blind sample testing.

30 - oral

ASSESSING BIAS OF GLOBAL POSITIONING SYSTEM RADIO-COLLARS TO STUDY BLACK BEAR DISTRIBUTION PATTERNS IN A TEMPERATE FOREST ENVIRONMENT, OLYMPIC NATIONAL PARK, WASHINGTON

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For approximately 90 years two hydroelectric dams have blocked annual returns of anadromous fish to over 113 kilometers of the Elwha River in Washington State's Olympic National Park (NP). The United States Department of Interior now proposes to remove both dams to fully restore the Elwha River ecosystem and native anadromous fisheries. Dam removal and subsequent salmon restoration may result in altered nutrient flow dynamics throughout the watershed, with potentially profound effects on the park black bear population.

To provide baseline information by which to assess the long-term ecological effects of salmon restoration on distribution patterns of bears in Olympic NP, I used Global Positioning System (GPS) radio-collar technology to describe broad-scale patterns in seasonal distribution and movements of black bears prior to dam removal. Due to concern over variable success of GPS collars in a temperate forest environment, I quantified systematic fix-acquisition biases of GPS radio-collars across a range of environments and subsequently developed a system for weighting GPS location data in an effort to reduce these biases.

Unweighted bear location data from GPS collars were positively biased toward habitats with open canopy covers and little topographic obstruction. Therefore, weighted bear location data were used in analyses of home range and resource selection. Bear home ranges averaged 68.73 km^2 for males and 25.10 km^2 for females. Bears did not select habitats in proportion to availability. They selected meadows during all seasons, though particularly during fall, and selected hardwoods during spring. Finally, bears exhibited cyclical and predictable patterns of annual elevation change, and were closer to the Elwha River during spring than during fall.

The application of weighting factors to biased bear location data provided a viable approach to reducing bias in analysis of home range and resource selection, and contributes to the current discussion over use of GPS radio-collar technology for tracking wildlife. Additionally, these data provide valuable baseline information for assessing the future effects of salmon restoration, and help Olympic NP biologists prepare for monitoring programs along the Elwha River.

31 - oral

INVITED SPEECH

NON-INVASIVE GENETIC SAMPLING AND POPULATION ESTIMATION OF BROWN BEARS IN EUROPE

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Non-invasive genetic sampling using hair or feces provides a powerful new tool for monitoring bear populations. The development and application of DNA-based population monitoring for bears began during a study of the endangered Pyrennean brown bear population (Taberlet *et al*. 1997). Over the past eight years, these methods have been expanded and adapted. DNA-based population estimation has been applied to bear populations in North America (Kendall *et al*. 1997, Woods *et al*. 1999, Poole *et al*. 2001, Mowat and Strobeck 2000, Boulanger *et al*. 2003, Paetkau 2003, Romain-Bondi *et al.* 2004), South America (Viteri and Waits 2002), and Europe (DeBarba *et al*. 2004, Lorenzini *et al*. 2004, Bellemain *et al*. 2005). The number and diversity of studies demonstrate the great potential of non-invasive genetic sampling for bear conservation and management. However, this research has also revealed a number of new challenges to accurate population estimation including field-based study design (Woods *et al*. 1999, Boulanger *et al*. 2004), laboratory-based errors (Taberlet *et al*. 1999, Waits and Leberg 2000, Paetkau 2003, McKelvey and Schwartz 2004, Roon *et al*. 2005, Waits and Paetkau in press), database management challenges (Paetkau 2003, Waits and Paetkau, in press), and appropriate statistical analysis methods (Boulanger and McLellan 2001, Miller *et al*. in press). Bear population size estimation with barbed wire hair trapping has been used extensively in the United States and Canada but there are now a growing number of non-invasive genetic sampling studies of European brown bear populations. Our presentation will give an overview past and current efforts to estimate population size and monitor brown bear populations in Europe. We will summarize the goals and methods of field sampling, laboratory analysis and statistical analysis for non-invasive genetic sampling projects in Spain, France, Italy, Austria, Greece, Scandinavia and Croatia. Our evaluation includes studies utilizing hair trapping with barbed wire, rub tree hair collection and scat collection. We will compare and contrast methods used, capture rates, success rates, and challenges. Comparisons will also be made to non-invasive genetic sampling projects in North America. Based on our comparisons, we will make recommendations for future non-invasive genetic sampling projects in Europe and highlight future research needs.

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32 - oral

NON-INVASIVE DNA SAMPLING YIELDS A DIVERSE SUITE OF ECOLOGICAL INVESTIGATIONS OF GRIZZLY BEARS IN BRITISH COLUMBIA, CANADA, 1995 TO 2005

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The use of DNA has expanded the range and scale of ecological questions that can be investigated much like radio telemetry did 40 years ago. Besides being a reliable and permanent marker, DNA carries a wealth of supplementary information, which has proven advantageous for research into management and conservation of a variety of species, but in particular solitary carnivores that are usually found at low densities. Over the past decade we have used non-invasive genetic sampling to explore a suite of ecological questions of grizzly bears (*Ursus arctos*) in British Columbia, Canada, many of which were impractical a decade ago. Grizzly bears occur across ~85% of BC's 947,800 km^2 area of mostly forested, mountainous terrain. These dense forests make sighting bears from aircraft uncommon and aerial census unpractical. In 1995, the first operational-scale sampling project using DNA from bear hair collected with barbed wire hair traps was tested. The success of this experiment led to large scale sampling (1,650 to 9,866 km^2 grids) in 19 areas covering a combined 74,853 km^2 where genetic IDs (minimum of 6 loci) of >1,100 grizzly bears were recorded. Estimating density was the primary goal in most areas, and resulted in estimates ranging from 5.6 to 44.1 bears/1,000 km^2 ($\bar{x}$ =30.1) with 95% CI of between 17 and 125% ($\bar{x}$ =50%) of the estimated density. Estimating population trend, distribution, and presence in areas were grizzly bears are rare, as well as population fragmentation in a heavily settled area, were also explored. When the spatially diverse samples were combined with human and landscape features, we were able to quantify factors that influence grizzly bear distribution, population fragmentation and competition with black bears (*U. americanus*) and to map variation in bear densities across the landscape. The hair samples also enabled the estimation of sex-specific dispersal distances and patterns, regional movements, and patterns of genetic diversity. General diets from the analysis of stable-carbon (δ^{13}C) and nitrogen (δ^{15}N) isotopes in the hair complemented the DNA-based analyses. In addition to summarizing these studies, we discuss what we have learned using DNA to improve sampling efficiency and study designs that may enable greater inference. We first discuss stratified sampling related to ecological and human influences and meta-

analyses at the provincial or national scale. Planning across broad scales may lead to improved extrapolation and even provincial estimates as well as improved monitoring of population trends. Over time, genetic samples collected over broad areas may reveal population increases and decreases, contractions and expansions, and isolation and reconnection of populations. When analyzed in a GIS environment, ecological or human variables driving these trends can be assessed and modified to ensure long-term grizzly-bear persistence across a varied and changing landscape.

33 - oral

NON-INVASIVE GENETIC MONITORING OF THE BROWN BEAR POPULATION IN THE CENTRAL APENNINES, ITALY

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Information on the status and populations dynamics of elusive species can be achieved through genetic methods, genotyping DNAs extracted from non-invasive biological samples (mainly excrements and hairs). Species, individual DNA fingerprinting and sex are identified in subsets of samples which contain enough integer DNA (usually from 40% to 80% of the total collected samples). Quality of genotyping procedures, reliability of the genetic data, estimates of minimum population numbers and population size, distribution of individuals and dispersal within the study areas, are then obtained by dedicated statistical procedures and software. In this report we will evaluate quality and information content of the field sampling schemes and DNA laboratory protocols, which have been implemented aiming at genotyping brown bear samples (N = 407) collected within a European Union LIFE project (2000 – 2003) carried out by the Forest Service in the central Italian Apennines. Field sampling included systematic hair collection through baited traps, opportunistic collection of scats along trails, occasional collection of specimens, and intensive surveys within *Rhamnus alpinus* patches, i.e. seasonal aggregation sites for bears. Laboratory protocols were implemented to obtain reliable individual genotypes and molecular sexing. Results obtained in preliminary assessments have been used to define a panel of markers and a standard multiple tubes procedure allowing the identification of individual genotypes with high reliability at the lowest possible cost. Individual genotypes identified so far (N = 42) have been used to obtain preliminary estimates of population genetic variability, to evaluate the performances of various population size estimators, sex ratio and individual distribution ranges in the study area. In particular, it was evaluated the information obtained from samples collected in 25 patches of *Rhamnus alpinus* in which bears congregate from mid-August to mid-October. Sampling *Rhamnus* patches seems to be a reliable method to collect bear samples alternative to trapping hair by baited barbed wire traps. This method is relatively inexpensive and might provide an index of bear population size.

34 - oral

MONITORING THE BROWN BEAR IN THE ITALIAN ALPS THROUGH NON-INVASIVE GENETIC SAMPLING

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We are using non-invasive genetic sampling (NGS), and collecting hair and feces in the field as a source of genetic material, as part of a comprehensive project that began in 2002 to establish a long term monitoring program that provides demographic and reproductive information on the small alpine brown bear population in Northern Italy. Since a translocation and augmentation plan was implemented from 1999-2002 and 10 bears from Slovenia were released in Western Trentino, the brown bear population in the Italian Alps has increased to almost 20 individuals. The local managers need to closely monitor the population and obtain critical data on bear reproduction and demography to evaluate the success of the translocation and to ensure the viability of the growing bear population. Further, the mitigation of human-bear conflicts is a high priority as the Italian Alps are in a highly populated and heavily used area. The primary objective of our research is to use NGS and modern techniques in conservation biology and molecular genetics to gather this information, and to assist managers with conservation and management decisions for the bears in Western Trentino.

We will present sampling design and results from 3 consecutive years (2003-2005) of field data collection and laboratory genetic analysis. In the field, we employed different techniques of NGS over a total area of about 650 km^2 for a period of 4-7 months each year. We are evaluating and comparing the effectiveness and the efficiency of 4 NGS approaches including baited hair traps, unbaited hair traps, sign survey, and opportunistic collection of fecal and hair samples with comparisons to observational sightings. In the 2003 and 2004 field season we collected 342 and 791 samples respectively. Genetic analyses of these samples allowed identification of 9 bears in 2003 and 15 bears in 2004, which were believed to represent 70-100% of the population at the time of sampling. The simultaneous combination of hair trapping and opportunistic collection of samples in the field was the optimal sampling strategy for this population. Data collection in 2005 will take place June-September. This sample provides very important baseline data for future non-invasive monitoring efforts for the small alpine bear population.

This study is being carried out in co-operation with the University of Idaho, the National Wildlife Institute of Italy (INFS), the Trento Province and the Parco Naturale Adamello Brenta (PNAB). This project received funding from the IBA Grants Program.

35 - oral

FORMATION OF BROWN BEAR LINEAGES IN EUROPE, NEW TIME-ESTIMATES AND THEIR RELATION TO LARGE-SCALE CLIMATIC OSCILLATIONS DURING THE LAST ICE AGE

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Earth climate has gone through several significant transitions during the past two million years. Massive ice sheets, surrounded with permafrost, lower temperature and moist accompanied with

reduced food and water availability, caused dramatic shifts in distribution of species, seen in fossil and pollen record. Recent data, based largely on the genetic analysis of subfossil remains, have considerably improved our understanding about the history of different animal populations. However, the link and temporal pattern between climatic changes and subdivision of animal populations into distinct evolutionary lineages, an evolutionary process that can lead to the formation of new species, is still largely missing. Brown bear has served as one of the model species in studies of Late-Pleistocene and Holocene migrations of large mammals. European brown bear population is divided into two distinct evolutionary lineages, the Western and Eastern ones. The Western lineage holds bear populations of western, southern and central Europe (Spain, France, Italy, Greece, Slovenia, Croatia, Bulgaria, Romania, but also southern Sweden). The Eastern lineage is represented by bears of eastern, central and northern Europe, such as Slovakia, Finland, Estonia, northern Sweden, Russia and Romania.

Hypervariable segment of the mtDNA control region of 242 brown bear samples was sequenced and 55 sequences were included from the GenBank. Bayesian statistical inference using Markov Chain Monte Carlo (MCMC) integration was employed in order to reconstruct the history of different brown bear lineages in Europe. Two parameters, time to the most recent common ancestor (TMRCA) and effective population size (N_e), were estimated. Our results demonstrate that formation of brown bear evolutionary lineages in Europe occurred during the last ice. Distinct pattern was observed, each lineage formation took place at the verge of large scale climatic transition. New time- and population size estimates for the brown bear history in Europe will be presented, and their relations to climatic oscillations during the last ice age will be discussed.

36 - oral

OPTIMIZATION OF DNA MARK-RECAPTURE SAMPLING STRATEGIES FOR GRIZZLY BEARS

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Despite the widespread use of DNA mark-recapture for estimation of grizzly bear population size, there has been relatively little empirical investigation into methods of optimizing design, field, and analysis strategies in an experimental setting. Because these surveys can be expensive, particularly when long-term monitoring is being considered, there is a need to minimize costs while not compromising accuracy and precision.

We designed a large-scale study (9,506 km^2) in the foothills of Alberta, Canada to test various sampling strategies associated with the hair-grab DNA method. The main sampling effort for this project used a traditional design in which bait sites were moved within 180 7x7 km grid cells for 4 2-week sampling sessions. However, we also tested other strategies concurrently with the traditional design. First, we placed a second lower strand of barbed wire on bait sites to see if this could identify a segment of the grizzly bear population (i.e. cubs) not sampled by the usual knee-height strand of barbed wire. Second, we sampled fixed sites within each cell to test the utility of moving sites compared to the less-expensive method of not moving sites. Third, we attempted genotyping every hair sample and then retrospectively subsampled the data to determine optimal ways to minimize genotyping costs. Fourth, we ranked bait site areas using previously developed resource selection models (RSF) from GPS collared bears. Using these ranks, we retrospectively stratified the data using RSF score and then randomly resampled the data to evaluate the utility of RSF stratification as a method of sample design optimization.

Because this was a field study the true number of bears was unknown. However, it was possible to compare population estimates from each test data set (reduced by each optimizing strategy) to those from the "full data set" (sites moved, both top and bottom wires). A key objective was to determine if potential biases introduced by each strategy could be accounted for by modeling in program MARK. We present the results from this study, and when applicable, use simulation methods to determine the applicability of these results to other studies that have different densities of bears. Careful experimentation designed to optimize methods will improve study efficiency, and may lead to convergence of study designs across geographic areas, allowing increased inference from comparative analyses.

37 - oral

INVITED SPEECH

HARVESTING BEARS: DO WE UNDERSTAND WHAT WE ARE DOING?

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The first invited paper about harvesting bear populations was presented at the Eighth International Conference of Bear Research and Management in 1989. The paper reviewed the results of population models that examined the effects of harvest on population growth. An important premise of these models is that all individuals are assumed to have an equal impact on population growth. Since then, we have learned more about the population consequences of harvesting bears, but the basic conclusions are the same; bear populations are vulnerable to overharvest, and the killing of adult and subadult females has the greatest impact on population growth.

This is the second invited paper on this theme, and is based mostly on studies of brown bears, which are hunted throughout most of their range. Whether hunted or not, human-caused mortality is the dominate cause of death in most brown bear populations. The basic premise in my paper is that all individuals do not have an equal impact on population growth. This is a reasonable assumption, given the high demographic variance shown in brown bears. This means that if hunters knowingly or unknowingly select individuals with high or low fitness, the output of the above-mentioned models may be grossly inaccurate. If any such fitness traits are strongly heritable, harvesting by humans might even be a selective pressure in bear populations with long-term and probably irreversible effects. This has been shown in some ungulate populations. Killing of dominant adult males may have effects not predicted by population models if it results in increased juvenile mortality, through sexually selected infanticide. In addition, a lack of adult males forces females to mate with young males, which they do not prefer as mating partners when given a choice. The latter has also been observed in ungulate populations. We now know that many females are socially organized into exclusive matrilinear assemblages, but we do not know the effect of harvesting on this social organization. Density-dependent effects have now been found on reproductive output, age of first successful reproduction, body growth rate, dispersal probability, and home range size of brown bears. This means that the population effects of harvesting an individual also depend on the density in the area. Hunting regulations might also have unforeseen consequences. For example, protecting females with dependent young may selectively protect small, less productive females that produce small young, which have lower natural survival in addition to staying with their mother longer than larger young, thus increasing the litter interval.

Many of the ideas I present are speculative, and my presentation is meant to be provocative. Nevertheless, I strongly believe that managers and researchers have a scientific and moral obligation

to understand the consequences of harvesting bears on the level of individuals. Only when this is known can we make reliable inferences about the effects on populations.

38 - oral

GRIZZLY BEAR-HUMAN INTERACTIONS IN THE Ä'ÄY CHÙ' VALLEY AND SHEEP BULLION PLATEAU, KLUANE NATIONAL PARK AND RESERVE

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In fall of 2004, Kluane National Park & Reserve (KNP&R) commissioned an update of analysis of hiker-bear interactions in the Ä'äy Chù' Valley (Slims) and the Bullion Plateau area of KNP&R. We analyzed a total of 1464 reported bear-human interactions from 1988-2004, 612 of which were reported between 1998 and 2004. A previous review by MacDougall *et al*. (1998) found that while the Sheep Bullion Plateau trail only accounted for 8.3% of the overnight visitor use (n=1,516/18,326 person days, 1988-1997), it comprised 27.5% (n=233/848) of the reported bear-human interactions for the entire Ä'äy Chù'Valley and Sheep Bullion area and involved a high proportion of interactions with grizzly bear family groups. This research led to the closure of the Sheep Bullion Plateau to overnight camping in 1998; thus, a primary objective of the 2004 update was to evaluate the effectiveness of this management action. The most significant impact of the closure of the Sheep-Bullion Plateau to camping was a reduction in the number of reported bear-human interactions on the Plateau trail, from 233 (1988-97) to 16 (1998-2004). Other human use, environmental and bear-related variables may also have contributed to this decline. The 1998 - 2004 update also found that grizzly bears exhibited different behavioural responses to visitors using the trails/routes on opposite sides of the Ä'äy Chù' River Valley. Visitors reported a higher level of habituated behavior (lack of a fleeing response) to human activity on Slims West (the more popular trail which received 59.6 % of overnight visitor use) and a higher frequency of "wary" behavioral responses by both solitary bears and family groups to visitors on Slims East (which received 36.8 % of overnight visitor use). For example, 67.7% (n=21/31) of the family groups who encountered visitors on Slims East left the immediate area, versus 33.3% (12/36) on Slims West. Grizzly bear family groups on Slims West exhibited more "stationary and watchful" behaviors (30.6%, n=11/36) versus those on Slims East (9.7%, n=3/31), regardless of the distance to their observers. The majority of interactions occurred while visitors were hiking (75.6%), followed by camping (21.3%). Interaction rates on the two most popular routes/trails were higher in June rather than August (the month of highest visitor use). We hypothesize that the fluctuation of visitor use levels from 434 person days (2002) to 1,396 person days (1991) on Slims West influenced the encounter rates and cohort of bears involved in bear-human interactions. The net decrease in visitor use in recent years on Slims West was accompanied by a decrease in interactions involving family groups and a decrease in bluff charges by females with cubs, from five in 1995-1997, to one between 1998 and 2004. The frequency of non-aggressive reactions to visitors has increased from 79.5% (n=151/190) from 1988-1997 to 85.9% (n=340/396) from 1998-2004. Despite limitations in public observational data, this study highlighted the value of visitor–reported bear observations as a management tool and provided recommendations on improving the bear information management system, and reducing the potential for negative bear-human interactions through a variety of management tools.

39 - oral

EFFECTS OF ACCESS AND HUNTING ON THE DEMOGRAPHICS OF BLACK BEARS

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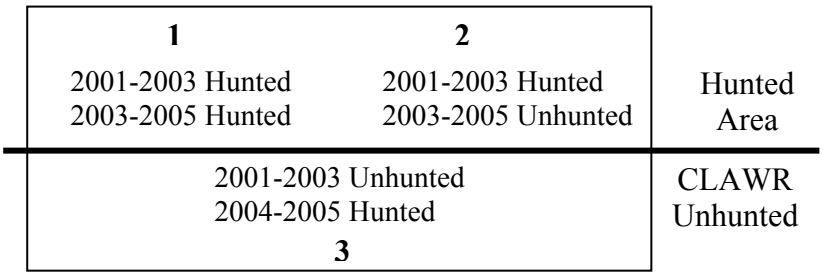
We examine how unrestricted access by hunters to linear features in the landscape (roads, cutlines, etc.) affects black bear (*Ursus americanus*) demographics. Black bears are particularly susceptible to the level of access in the landscape due to the practice of baiting, which increases hunter success and selectivity for large trophy males. The role of adult males in population regulation is presently unclear making it difficult to predict potential indirect effects of selectively removing these bears from a population. These results are part of a 4 year study comparing adjoining hunted and unhunted areas in the boreal forest of Alberta, Canada. Hunted study areas 1 and 2 are on crown land where outfitters operate while study area 3 is in the Cold Lake Air Weapons Range (CLAWR), where access is strictly monitored and hunting is not permitted. From 2001 to 2005, 304 bears have been trapped and 287 bears individually marked in adjacent hunted and unhunted study areas in northeastern Alberta. A combination of VHF and GPS radiocollars were used to track adult male and female bears in each study area. Dens of collared bears were visited every winter (n=243) to quantify bear body measurements, age of first reproduction, litter size, and cub survival in each area. Yearlings found in dens in the CLAWR were equipped with expandable rot-off collars to monitor survival and/or dispersal from an unhunted area. Hunting pressure was experimentally manipulated in areas 2 and 3 (see figure) in an attempt to tease apart the effects of population structure and density on demographic parameters. Results show significant differences in population structure with a predominance of subadult males in the hunted area. After accounting for age, year, and reproductive status, male and female bear weights were not different between study areas. We found no difference in litter sizes between populations but females in the ununted population produced their first litter of cubs at a significantly older age than females in the hunted population. Factors influencing cub survival and management implications will be discussed.

Experimental Design



40 - oral

MULTIDIMENSIONAL APPROACH TO BEAR MANAGEMENT IN CROATIA

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With all of its biological features, its important place in the mind of humans, and the considerable amount of international interest for its conservation, the management of large carnivore such as brown bear (*Ursus arctos*) in Europe is very challenging. The management plan is expected to bring together different interests such as ecological, aesthetical and economic, as well as care for the safety of people and their properties. It should also ensure conditions for the long-term survival of the brown bear, the species listed as an endangered by different international regulations, but also the game species in Croatia. Careful evaluation of the actions affecting the population size represents the most critical part of this plan. Those actions should ensure the size of the bear population within the social capacity of the habitat. In other words, the density of bears should be one that is acceptable to people. In this way, possible conflicts with people are minimized, whilst the long-term viability of the population will be ensured. In order to achieve this goal, a series of other actions and measures related to the bears' habitat and human activities in the habitat (e.g. highway construction and so on), the feeding of bears by humans, the prevention of problematic bear occurrences and the scientific monitoring of all changes in the population have to be regulated. The implementation of the plan is, for the most part, a task of the hunting management experts, however, representatives of all other interest groups should also be actively involved. Finally, the plan should undergo occasional revision, which should take place more often than is the case for some other management plans. In large carnivore management, and especially in bear management, there are no final and universal solutions. Each change in the number of bears, the areas of their presence or behavior, requires new decisions. The plan offers guidelines for the decision-making process, and in the case of new circumstances, it will be adjusted through revision processes. Croatian citizens, citizens of neighboring countries, as well as Europe and the world, expect that Croatia, with its Brown Bear Management Plan, officially accepted in May 2004, is ensuring the long-term existence of as many bears as possible in its habitats, with as few negative effects as possible.

41 – oral

WHAT ARE GRIZZLY BEARS REALLY DOING AROUND ROADS??

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Numerous studies have examined the relationship between roads and grizzly bears and although conclusions are variable, the general consensus is that roads negatively impact grizzly bear survival. Human use of roads result in grizzly bears being struck and killed by vehicles, shot by hunters or poachers or becoming unafraid of humans and consequently perceived as "problem bears" and removed from the population. By understanding where and when bears cross roads we can develop a more effective way to minimize their exposure to humans and thus increase their probability of survival. In this paper, we compare grizzly bear road crossing frequencies in west-central Alberta to determine whether crossing frequency is related grizzly bear age or sex, time of day, season or traffic

volume. We look at known mortalities to determine if bears that were frequently using roaded areas are the bears being killed. We also examine whether females are using areas near roads because of the food resources or as a way to avoid males.

42 – oral

QUANTIFYING THE EFFECT OF ADULT MALE MORTALITY ON CUB SURVIVAL RATES

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Disturbance in male social system by removal of adult male individuals has been related to the survival of the cubs in the Scandinavian brown bear population. It has been suggested that after a reproductive male individual dies other males have access to females that they have not mated with previously and gain from inducing female receptivity by killing dependent cubs. Quantification of the effect that removal of adult males exerts on cub survival is essential to assess the effects of different strategies of harvesting on the population growth rate. Prerequisite for such an analysis is to be able to separate between the cub mortality caused by the removal of adult males and other factors. The cause of cub mortality is often difficult to observe in nature. However, the problem can be approached by dividing the cub mortality into mortality during and after the mating season, because the mortality related to removal of males should be highest during the mating season.

We have previously collected information about the litter status (with or without a litter) of radio tracked females from two study areas in Scandinavia. The areas differ in their levels of adult male hunting and the cub mortality is higher in southern, more harvested, population. The observed litter interval was higher in northern population, which can not be explained by the difference in mortality rates alone. The status of the females was recorded after emerging from the den and again in the end of summer. We used Bayesian data augmentation techniques to reconstruct the information about the status of the females during the mating season and to estimate litter mortality rates. This was based on the assumption that the females do not mate if they are accompanied by a litter. Thus they can not be followed by cubs-of-the-year in two consecutive years unless the litter has been lost during the mating season.

Analysis shows that most of the cub mortality in southern study area was concentrated on mating season, whereas in northern study area the mortality was higher after the mating seasons. This difference in the temporal distribution of cub mortality rates also explains the observed patterns of litter intervals. The number of died adult males in the proximity of each female per year will be added into the analysis. Furthermore, the analysis can be made more detailed by including the effects of first reproduction and the number of cubs. The results from the full analysis will be presented.

43 - oral

CHANGING DYNAMICS IN THE RELATIONSHIP BETWEEN BEAR HARVESTS AND BEAR HUNTERS, BEAR NUMBERS AND FALL FOOD ABUNDANCE IN MINNESOTA, 1982–2004

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Agencies responsible for managing hunted bear populations benefit from understanding the factors influencing bears' vulnerability to harvest. In Minnesota, USA, increasing harvests of American black bears (*Ursus americanus*) from 1971-1981 closely tracked increasing hunter numbers. Subsequent to establishing a quota system in 1982 that regulated hunter numbers, however, unaccountable year-to-year fluctuations in harvests made it clear that other factors also affected the number of bears being killed by hunters each year. We monitored bear population size and trend through modeling, periodic tetracycline mark-recapture studies, and population reconstruction. We also documented the abundance of natural bear foods during the hunting season each year through surveys of 50-80 natural resource personnel across the bear range. We postulated that higher bear numbers would result in higher harvests, but that abundant natural foods during the hunting season would lower hunter success, as well-fed bears would be less likely to visit hunters' baits.

During 1982-2000, permitted numbers of hunters increased from about 1,800 to nearly 17,000, but thereafter declined to 13,000. Bear harvests increased concurrently, from <400 bears shot in 1982 to almost 5,000 in 1995. After 1995, harvests averaged about 3,500, showing little or no trend, but wide yearly fluctuations. Multiple linear regression indicated that for the period 1982-1995, the number of males killed each year was almost entirely explained by the number of hunters (r^2 = 0.97) and was largely unrelated to food abundance. In contrast, the number of females killed, particularly adult females, was strongly related to both hunter numbers and the availability of fall foods (model R^2 = 0.93, partial r^2 = 0.90 for hunters and 0.71 for foods). Because males and females appeared to respond differently to food conditions, the sex ratio of the harvest also varied closely with fall food abundance (partial r^2 = .90).

After 1995, however, these relationships changed. Plots of regression results using a 10-year moving window (e.g., 1984-93, 85-94, 86-95, etc.) indicated that by the mid-1990s the influence of hunter numbers on harvests had declined dramatically whereas the relationship between food abundance and harvests had strengthened for both males and females. These changes were likely related to changes through time in the ratio of hunters to bears, hunter density on the landscape, and/or bear population demographics. We examine each of these in relation to observed changes. Results demonstrate that harvest management is always a "work in progress" and argue for the value of long-term monitoring of multiple variables, even when relationships appear to be well established.

44 - oral

REDUCING BROWN BEAR PREDATION TO BENEFIT MOOSE HUNTERS. AN ALASKAN APPROACH

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In a 28,000-km^2 area in eastern Alaska, the moose (*Alces alces*) population has remained at a density of about 1.3 – 1.6 moose/km^2 for over 20 years while evaluation of habitat indicates a density of 2.6 – 3.9 moose/km^2 could be supported. Evidence suggests that predation of neonatal moose calves by brown bears (*Ursus arctos*) and predation of adult moose by wolves (*Canis lupus*) are primary contributors in keeping this hunted moose population at these low densities. The Alaska Board of Game, a regulatory body appointed by the state governor, identified this moose population as important for human consumption and which would be capable of achieving higher densities through intensive management approaches. This board enacted special regulations during 2004-2005 in an effort to increase numbers of moose for hunters by reducing predation from wolves and brown bears. During winter and spring, 2005, 60 wolves were killed by aerial shooting in the 17,000-km^2 core area used by this moose population. Within a 7,000-km^2 portion of this area, the program also dictated that up to 60% of an estimated 135 resident brown bears be killed by 30 June 2005. Offspring younger than two years of age and females accompanied by those offspring cannot be legally killed, and sale of hides, claws, or other bear parts was not allowed. However, a person issued a special "control permit" could take an unlimited number of bears as long as the limit for the control area was not exceeded. Control permits also allowed baiting of brown bears, a practice not legal for sport hunting. Use of baits as a hunting method is allowed in some jurisdictions in the USA and Canada for American black bears (*Ursus americanus*) but has not been allowed for taking brown bears in North America for >50 years. The only previous programs to reduce brown bear numbers in Alaska have utilized methods such as extended season length or waiving tag fees and have limited a hunter's take to no more than one bear per year. Reduction of brown bear numbers as a method of increasing the harvestable surplus of moose has shown equivocal results where it has been tried in Alaska; however, the level of reduction that this program envisions has not been accomplished elsewhere as a management goal. If the population is reduced to 60% of its present estimated size in this control area, population models indicated the female segment of the population would not recover to former levels for at least 10 years, assuming hunters kill no additional females. This suggests that predator control measures may have substantial effects on numbers of brown bears in local areas for many years. We discuss the results of past management efforts to increase harvestable surplus of moose by increasing harvest or translocation of brown bears. We also suggest research and adaptive management approaches to help better assess outcomes for this or any similar future program.

45 - oral

HARVEST MANAGEMENT AND SUSTAINED YIELD OF ALASKA'S BROWN BEARS

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We evaluated patterns of harvest related to management of brown bears (*Ursus arctos*) across Alaska from 1976 – 2003. The historic range of brown bears remains occupied in Alaska. Densities vary from about 10 to >600 brown bears (all ages)/1,000 km^2. Brown bears are hunted across most of Alaska with the exception of some national parks, some viewing areas and residential areas. During this

period >32,000 brown bears were harvested during spring and fall hunting seasons and the highest harvest takes place in coastal areas where brown bear densities typically exceed 300 bears (all ages)/1,000 km^2. Harvest has been focused on male brown bears for many decades in Alaska and females with cubs cannot be harvested anywhere in the state. Protecting the adult female segment of the brown bear population from harvest has proven to be an excellent sustained yield management tool. For example, 73% and 66% of the bears harvested from the Admiralty, Baranof, and Chichagof islands (ABC islands) and Kodiak Island respectively, have been males. Harvest management goals vary across Alaska from 4% of the total estimated population with <1.5% of the estimated female population on the ABC islands, to ~10% for some highly productive interior populations. Kodiak Island's bear harvest management program is managed at a fine scale, whereas most other portions of the state manage harvest over much larger areas. In much of Alaska, harvest is below sustained yield so there is no need for fine-scale management. For some interior Alaska brown bear populations, management has recently focused on reducing numbers to enhance ungulate populations. Research results indicate that in one area during 1983, brown bears killed as many as 52% of neonatal moose (*Alces alces*) calves where wolves had already been reduced through a control program. Survival rates of moose calves in the same area suggest that bears continue to be a major predator of moose calves. Management in this area is currently focused on substantially reducing both wolf (*Canis lupus*) and brown bear numbers. The present management goal for the area is to reduce brown bear numbers by up to 60% through more intensive harvest, but still not allowing kills of females with cubs. We will explore the biological and socio-political background of managing healthy and productive brown bear populations that occupy a variety of habitats and face mounting challenges from humans.

46 – oral

USING SATELLITE TELEMETRY TO IDENTIFY SUB-POPULATION STRUCTURE OF GRIZZLY BEARS IN THE MACKENZIE DELTA RELATIVE TO PIPELINE DEVELOPMENT

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The construction of a pipeline to transport natural gas from Canada's north to southern markets will initiate a significant increase in the level of anthropogenic activity in the Mackenzie Delta region of the Northwest Territories. For Canada's grizzly bears this region also represents the northern edge of their distribution. In multi-use landscapes the zone of influence resulting from a disturbance extends beyond the actual footprint, but the extent of the influence within a regional context must be assessed. Barren ground grizzly bears move across great expanses to meet their resource needs and the influence of a localized disturbance could result in landscape-level repercussions on grizzly bear distribution and population dynamics. High mobility and overlapping home ranges suggest that grizzly bear subpopulations can be considered semi-permeable entities with dynamic membership. Identification of subpopulations of grizzly bears within the Mackenzie Delta will improve the ability of wildlife managers to assess changes at the regional level.

We assess both fuzzy clustering and traditional cluster analysis to identify core areas of use and to delineate subpopulation boundaries. Global Positioning System (GPS) telemetry information from collared grizzly bears was analyzed in a Geographic Information System platform (ArcGIS 9.0). The fuzzy clustering approach assigns partial instead of absolute coefficients of group membership, which is more representative of population structure than traditional cluster analysis. Subpopulation structure was evident within the pipeline development area. We use a raster-based approach to develop a spatially explicit model that estimates the proportion of each subpopulation likely to be influenced by disturbance at any place in the region. Analyses are used to identify the zone of influence from

pipeline development, increased associated anthropogenic disturbance, and the implications for subpopulations and regional-level population dynamics.

47 – oral

IDENTIFICATION OF FUNCTIONAL CORRIDORS WITH MOVEMENT CHARACTERISTICS OF BROWN BEARS ON THE KENAI PENINSULA, ALASKA

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We use Global Positioning System locations from brown bears (*Ursus arctos*) on the Kenai Peninsula of south-central Alaska to illustrate a technique that identifies functional corridors from animal movement characteristics across a landscape. We derive movement density, speed, and the angular deviation of movement from paths drawn between locations. We use a cluster analysis to classify the landscape into non-habitat, primary habitat, and corridors. We identify areas with high amounts of sinuous movement as primary habitat patches and areas with high amounts of very directional movement as highly functional bear corridors. We examine differences among landscape types with a classification tree. Primary habitat was associated with fishable reaches of salmon streams. Bear corridor locations were characterized by a combination of factors constraining movement, such as large lakes and land cover types, and most-efficient paths between fishable reaches of salmon streams. The time between bear locations and scale of analysis influenced the number and size of corridors identified. Bear locations should be collected at intervals $\leq$ 6 hours to correctly identify travel corridors. Our corridor identification technique will help managers move beyond the theoretical discussion of corridors and linkage zones to active management of landscape features that will preserve connectivity.

48 – oral

SPATIAL NETWORKS: VISUALIZING GRIZZLY BEAR MOVEMENT AND CONNECTIVITY ACROSS CONTINUOUS LANDSCAPES IN ALBERTA, CANADA

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Current global positioning systems (GPS) based-studies have allowed for considerable research advances in the fields of conservation biology and wildlife management specific to large ranging species. For grizzly bears, drawing links between connectivity, bear-landscape interactions and movement behavior is difficult. In west-central Alberta, Canada, the grizzly bear population is not restricted to island patches and continues to interact spatially within a landscape characterized by gradients of human disturbance. As such, we are interested in connectivity approaches that recognize movement within and across heterogeneous landscapes.

Models for measuring and understanding connectivity based on spatial networks have been promoted as a complement to existing approaches. By reducing landscape complexity to simple network components, the spatial configuration of patches (nodes), connections (least-cost movement paths between patches), and paths (multiple connections) can be analyzed. Combining a spatial network approach with the capabilities offered by geographic information systems (GIS), GPS data and resource selection function (RSF) models provide an opportunity to explore, quantify, and validate connectivity in the context of grizzly bear habitat selection and resulting spatial movement patterns.

We generated landscape-level spatial networks to assess connectivity for female grizzly bears in both foothill and mountain environments. Mountain landscapes were found to be more connected or less impacted by fragmentation than foothill landscapes. By incorporating habitat selection models, our results indicated a strong link between structural connections and the distribution of grizzly bears demonstrating the possibility of functional corridor utilization. The spatial network approach proved to be a versatile tool for defining spatial configuration, including critical patches and movement connections, specific to the needs of female grizzly bears. Iterative removal of habitat patches, or network nodes, was shown to affect both spatial movement patterns and resulting connectivity rates. As patches were removed from the landscape, a bear's ability to traverse the landscape was shown to decrease. However, this was further dependent upon patch size and placement within the landscape. For grizzly bears, patch removal techniques allow land-use managers to envision the quantity of habitat loss acceptable to grizzly bear movements as demonstrated by network structures. Overall results suggest that maintaining large-scale connections would help to limit the effects of local fragmentation. Results emphasized the flexibility of spatial network approaches for addressing both structural and functional connectivity-based research questions for Alberta's grizzly bears.

49 – oral

INVITED SPEECH

CONSERVATION OF SLOTH BEARS IN SRI LANKA: IMPLICATIONS FROM RESEARCH

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The subspecies of sloth bear, *Melursus ursinus inornatus*, is unique to Sri Lanka. Sloth bear populations in Sri Lanka are vulnerable to decline because of rapid habitat loss and conflicts with humans. Conservation actions for the sloth bear have been hampered by a critical lack of knowledge of the bear's distribution, status, and ecology. We initiated a pilot study in 2000 using remote cameras to collect data on relative density and habitat associations of sloth bears in Wasgomuwa (39,385 ha) and Yala (126,781 ha) National Parks. Data from that study indicated that sloth bears were more abundant in Wasgomuwa National Park, so we initiated a telemetry study there in 2002 to determine home ranges and habitat selection. We captured and radiocollared 10 adult sloth bears and used the telemetry data in a compositional analysis. We determined whether placement of home ranges was associated with habitat type and we examined habitat selection within home ranges. Mean 95% kernel home ranges were 2.51 km^2 for adult females and 3.78 km^2 for adult males. Home-range establishment within the landscape and use of habitat within home ranges was non-random ($P = 0.0036$; $P = 0.09$, respectively). Although areas outside the national park were accessible to bears, home ranges were almost exclusively placed within the national park boundaries. Within those home ranges, grasslands were used less than all forested habitat types that provided more cover. Our estimates of home-range sizes are the smallest reported for sloth bears and other bear species of comparable size. We speculate that high habitat productivity contributed substantially to the small home ranges. Thus, despite its relatively small size, Wasgomuwa National Park may support a sizeable population of sloth bears. The

restriction of human activity within protected areas may be necessary for long-term viability of sloth bear populations. The maintenance of forest cover along travel corridors, and in areas with existing sloth bear populations, is recommended. In 2004, we conducted surveys to determine the island-wide distribution of sloth bear populations and document the incidence and nature of human-sloth bear conflicts. We interviewed 277 individuals attacked by sloth bears between 1964 and 2004. Analysis of 120 attacks indicated that all attacks occurred in forest habitats remote from villages. Injuries to the head or face resulted from 44% of the attacks and 50% of attacks resulted in a long-term physical disability. Most attacks (81.6%) occurred between 0900-1600 hrs, when humans entered forests for hunting or gathering forest products. Severe injuries occurred particularly when an individual was alone. Female bears with cubs were responsible for 38% of attacks and 32.5% of attacks resulted in sloth bears being wounded or killed. A strong culture of hunting and collection of forest products exists among rural people in Sri Lanka. Because of frequent bear attacks, attitudes among villagers towards sloth bears generally were negative. Thus, reducing the risk of sloth bear attacks will be crucial for conservation of the species. Encouraging humans to advertise their presence and travel in groups when they visit areas inhabited by sloth bears may be an important step to increase human safety.

50– oral

HUMAN-MALAYAN SUN BEAR CONFLICTS IN MANIPUR STATE, INDIA

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We carried out a survey in the Chandel and Ukhrul districts of Manipur state, India to study the human-Malayan sun bear (*Helarctos malayanus*) conflict during 2004-2005. Information on human casualties was collected by conducting informal interview of the tribal people in randomly selected villages within Yangaoupokpi Lokchao wildlife sanctuary, Chandel district and Ukhrul district. To resolve the conflict, understanding of the extent, conflict areas and circumstances of human casualties by the bear is necessary.

In total 95 human injury cases were caused by sun bear in this region during 2000-2005. Males were mainly attacked (97.7%) and female victims were only 2 (2.3%). Injuries were caused to face, nose, eyes, neck, hand and legs. Bear attacks were recorded in all the seasons, but maximum cases occurred during autumn and winter months. During March, April, November and December, 17.9 %, 15.8 %, 23.2 % and 18.9 % casualties respectively occurred. Out of 88 cases, victims were mainly in the age group of 21-30 years (37.5 %), followed by 31-40 years (34.1 %) and 41-50 years (21.6 %). Bear accounted for only 1.1 % , 3.4 % and 2.3 % cases in the age group of 10-20 years, 51-60 years and 61-70 years respectively. Information on sun bear attacks on human beings and circumstances are presented and discussed. Maximum cases i.e. 63 (66.3 %) cases occurred in forests, followed by 14 (14.7 %) cases in crop fields and 18 (19 %) cases in the vicinity of villages. These victims were involved in either cattle grazing, farming or crop protection or moving in forests or vicinity of villages or non-timber forest produce collection. Most of these incidences occurred during morning, evening and night time when bears remained most active. There were 9 food items of bear and local people interests. Collection of these items by people coincided with the time when bears remained most active.

Important recommendations are: 1. People should be alert and vigilant in wildlife areas, 2. restriction on human activities in forests, especially in night, 3. regulation on collection of food items as non-timber minor forest produce of bear interest, 4. protection of potential bear habitat and its improvement, 5. Public education and awareness among local tribes towards conservation and natural history of sun bear and 6. Research on ecology and management of sun bear is necessary.

51– oral

STATUS OF HIMALAYAN BROWN BEARS IN PAKISTAN

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Like rest of their range in South Asia, Himalayan brown bears are poorly studied in Pakistan. Their populations are declining and have gone extinct from some known patches in the past 100 years. Historically brown bears occupied almost the entire range of the mountains of northern Pakistan, approximately 130,000 km^2. The are now distributed over three mountain ranges and four intermountain highlands. The western Himalaya ends at Nanga Parbat, and is separated to the north from the Karakoram Ranges by the Indus River. The Hindu Kush range extends westwards from Karakoram, and joins the Pamir Range in Afghanistan. The bears' range in Pakistan falls under three administrative divisions; the NWFP province, state of Azad Jammu and Kashmir, and Northern Areas. Wildlife management is a provincial subject in Pakistan, therefore these administrative divisions have three different legislations. Bears are however protected under wildlife acts of all provinces, and recently designated as critically endangered in IUCN's Red List of Mammals of Pakistan. Though Deosai plateau in western Himalaya hosts the only stable population; seven small populations persist in Himalya, five in Karakoram, perhaps one in Hindu Kush range, and four in southern highlands. The sizes of these populations hardly do exceed 10 individuals, except for Deosai and adjoining hills where around 40 bears have been counted in the year 2004. Eight National Parks and many wildlife sanctuaries and game reserves have been established in northern mountains of Pakistan. These PAs provide legal protection to 11 bear populations in at least part of their range, however habitats of some important populations like Gurez, Shontar and Babusar do not enjoy any legal protection. Apart from the efforts of state institutions, The Mountain Areas Conservation Project (MACP), Protected Areas Management Project (PAMP), and Deosai Brown Project are the outstanding conservation initiatives in the bears' range.

Populations reported from Chitral, Hazra and Waziristan are locally extinct. The bear population in Pakistan has retracted eastwards, therefore losing connectivity with Afghanistan and Tajikistan. It is however well connected to the Indian populations in Zanskar and Kashmir, and movement towards China in north through glaciers of Karakoram seems to occur as recently spoors have been observed in these areas. The utmost threat for their survival is habitat fragmentation from growing human population. Forest harvesting, agriculture extension where possible, infrastructure development are main factors contributing for habitat loss and fragmentation. Increasing livestock grazing and nomad graziers are the second big threat. Poaching, conflict with livestock, hunting for its commercial parts, and growing un-managed tourism in its habit are also detrimental threats.

52 – oral

STATUS AND DISTRIBUTION OF ASIATIC BLACK BEAR (*URSUS THIBETANUS*) IN INDIA – AN ASSESSMENT OF CHANGES OVER TEN YEARS

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In India, the Asiatic Black Bear (*Ursus thibetanus*) inhabits the forested habitats in the Himalaya (1,200m to 'treeline') and the hills of North East India. It occurs in the states of Jammu & Kashmir, Himachal Pradesh, Uttaranchal, northern West Bengal, Sikkim, Arunachal Pradesh, Meghalaya, Mizoram and Tripura. In 1994-95, SSK evaluated the status and distribution of Asiatic black bear in

India through a questionnaire survey, few field surveys and expert knowledge. Results of that survey indicated presence of Asiatic black bear in 53 Protected Areas and 62 other areas. After 10 years, we assessed the change in the status and distribution of Asiatic black bear in India through questionnaire survey (n=75), results of recent field surveys and expert knowledge. Based on the status information acquired recently and rule-based modeling in the GIS, the potential Asiatic black bear habitat range in India has been estimated and compared with the estimate made in the 1994-95 survey. Substantial information on the status and distribution of Asiatic black bear in the North East India has been added to our existing knowledge. A comparison of the Asiatic black bear status in the different Protected Areas of India between the 1994-95 survey and the present (2005) survey will be presented and discussed along with threats to this species and its habitat.

53 – oral

INVITED SPEECH

CONSERVATION STATUS OF THE ANDEAN BEAR: A REVIEW OF WHAT WE HAVE DONE, WHAT WE ARE CURRENTLY DOING AND TO WHERE WE SHOULD GO

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The Andean or Spectacled bear (*Tremarctos ornatus*), is the largest carnivore, endemic and only bear species of the Tropical Andes. It is considered "*Vulnerable"* to extinction by The World Conservation Union (IUCN) on a world scale, being habitat destruction and poaching, principal threats for the species long-term survival. This paper aims to evaluate past activities related to Andean bear research and conservation based on the recommendations of The Spectacled bear Conservation Action Plan edited in 1999, and to identify priorities to focus future actions across the region.

In 1980, the Spectacled Bear Specialist Group (SBSG) was established to promote data collection on the species distribution, habitat use and diet. Several NGOs worked on the protection of areas within the bear's range, and undertook environmental education programs to motivate the species conservation. Zoological parks developed the Studbook for the Andean Bear, started captive breeding programs as part of the Species Survival Plan and generated guidelines for captive management. Following by-country initiatives The Spectacled bear Conservation Action Plan was edited in 1999 setting clear priorities for future actions. Information, threats, and conservation activities differed considerably among countries. However drawbacks for the development of management plans converged on lack of information on the species ecology, institutional strength, governmental support and public awareness.

By 2003, knowledge on the species ecology was still scarce, threats had risen due the increase on social impoverishment, and lack of funding had delayed the conservation and research process. Although in the Northern Andes (Venezuela, Colombia and Ecuador), national and international NGOs developed programs to obtain scientific-based information and carried out environmental education programmes, these were isolated efforts with little regional impact. The Ecoregional Strategy for Andean bear conservation in the Northern Andes Complex (Venezuela, Colombia, Ecuador and northern Peru), was developed to attend the need of a transboundary and self-involving management plan. In-depth and up-to-date evaluation of the species status, threats and conservation needs was undertaken, establishing specific goals and activities related to habitat conservation and management, policy, captive management, research and monitoring, and education. Such an effort was not carried out in the South (Argentina, Bolivia and southern of Peru) and this region remains under-studied, with only few isolated short-term initiatives.

Currently projects are focused on landscape analysis, habitat use, population sizes, genetics, telemetry, reintroduction and human-bear interactions. Priorities are still focused on the species ecology (distribution, habitat use, population size and trends) and the impact and mitigation of the effects of fragmentation.

54 – oral

PRELIMINARY RESULTS OF THREE–YEAR TELEMETRY STUDY OF ANDEAN BEAR IN THE INTAG REGION, ECUADOR

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Probably the Andean bear, *Tremarctos ornatus,* is one of the least well-known species of the *Ursidae* family. Little is known about the habitat use, activity patterns and home range of this species, although it is in danger of extinction in Ecuador. The few studies carried out on this species are based mainly on the analysis of secondary information, such tracks, scats, tree markings and tree nests. This lack of information has seriously impeded efforts to develop scientifically sound conservation strategies for the species in Ecuador. Obtaining direct information about Andean bears in the wild must be given utmost priority to develop better conservation strategies for the species.

This paper presents preliminary results from a radio-telemetry study of this species in a fragmented landscape in the Intag region, northwestern Ecuador. This is an on-going study. The results presented refer to the preliminary study of six bears (4 females and 2 males) that were captured using "Iznachi" traps and outfitted with motion-sensitive transmitter collars. The bears were radio tracked between September 2001 and July 2004.

Home range sizes were estimated from 1,336 locations, using 100% minimum convex polygon estimate. Preliminary results show that the females have small and "established" home ranges. The average home range for females (n=4) was 28.95 km^2.

Conversely, male bears moved widely and rapidly over large, often inaccessible areas. The average home range for males (n=2) was 108.6 km^2. Male bears use movement corridors, especially along ravines (two males traveled an average of 18.75 km from their capture sites). These movements allow males to link bear populations that are isolated by large distances, but may bring them into conflict with local farming communities.

Much intraspecific tolerance was indicated among bears in this study due to extensive home range overlap

The activity patterns were calculated from 3,923 readings. The bears were more active during the day than at night. Activity was highest throughout daylight hours (06H00 to 18H30), declined after sunset, and was lowest between O2H00 and 05H00. The bears did not appear to have long periods of deep sleep during the nocturnal period, requiring short naps during the day (usually between 10H00 and 15H00).

The data obtained from this study is vital for a better understanding of the behavior, environmental requirements and ecological role of this species. The data should help environmental authorities and NGOs make appropriate decisions in relation to programs of environmental education, handling of bear-related problems in local communities, and the creation and design of protected natural areas and wildlife corridors.

55 – oral

POPULATION ESTIMATION AND GENETIC DIVERSITY OF THE ANDEAN BEAR IN ECUADOR

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The Andean bear (*Tremarctos ornatus*) is the only species of bear in South America. This species occurs across the eastern and western slopes of the Andes Mountains in Venezuela, Colombia, Ecuador, Peru and Bolivia. The Andean bear is threatened at a global scale and in danger of extinction in Ecuador. The main threats for the species are habitat fragmentation and conflicts with humans. Habitat fragmentation may lead to isolation of bear populations and loss of genetic diversity. Here, information about population size, sex identification and genetic diversity was obtained trough non-invasive sampling techniques. A total of 148 bear samples (hair) were collected in Oyacachi (72,100 ha) from February to August 2003. The genetic analysis involved DNA extraction and amplification of 5 microsatellite loci (G10B, G10C, G10J, G10H & UarMu50). Genotypes were obtained for 71 samples from which, 23 bears (18 males & 5 females) were identified in the area. From the unique genotypes (23), allele diversity (A=5) and heterozygosity (He=0.58) were obtained. These results are promising since the genetic indexes are higher than in previous reports. Also, it constitutes the first estimation of numbers of bears in the wild. This information is necessary to determine the current status of the wild populations in order to delineate and prioritize areas for the conservation of the species.

56 – oral

MONITORING BEAR MOVEMENTS IN DIFFICULT TERRAIN: ANDEAN BEARS IN THE APOLOBAMBA RANGE, BOLIVIA

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Prior to this study, radiotelemetry had never been attempted on wild bears in the Andes due largely to the area's thick forest, cold and rainy weather, and precipitous terrain. Although these factors did hinder tracking success, we used radiotelemetry to study the activity (Paisley and Garshelis, in press) and movement patterns of Andean bears, *Tremarctos ornatus*. This paper describes habitat use, home range size, daily and seasonal movements, social interactions, and responses to areas of human use. Additionally, we present a transparent method for dealing with incomplete tracking data and for making use of untriangulated radio-bearings.

Two male bears were radiotracked for 1 year in the steep and rugged Apolobamba Range of Bolivia. Both bears used a high-altitude grassland habitat that extended over 30% of the study area 50–70% of the time during the height of the rainy season (Nov–Feb). In contrast, they used the cloud forest and the ecotone between the two habitat types 60–80% of the time during the dry season. This difference likely related to seasonally-varying food resources. Fruits were more abundant in the cloud forest and ecotone habitats, especially during the dry season, whereas *Puya* sp., a terrestrial bromeliad, provided a year-round food source in the grassland. Ungulate carrion, a rich but widely dispersed food source, appeared to be more available in the wet season, possibly explaining longer daily movements of bears at that time of year.

Radio-locations obtained from triangulation of 2–10 radio-bearings on the two bears (n = 71 and 75) yielded small estimates of home range size (7.4 km^2 and 6.6 km^2; 100% MCPs). Overlap between the two home ranges (100% MCPs) was extensive (~75%), and distances between the two bears located simultaneously in the area of overlap suggested a generally solitary habit with occasional tolerant contact (e.g., traveling together for up to 4 days). However, the bears avoided contact with people and human-related food sources such as nearby fields of maize.

The rugged topography sometimes obstructed the radio signals. It also impaired our ability to access alternative tracking sites other than the ridge bisecting the study area and several more peripheral points we commonly used. Of all our attempts to radiotrack the two bears, triangulation was impossible in 10% and 20% of cases where we heard a signal, and we failed to hear any signal in 20% and 16% of cases. Thus, tracking success using triangulation was only 70% and 64%; these locational data clearly underestimated home range size. Hence, we developed a method for estimating locations from single radio bearings and the elevation of the bears, as obtained by lowering the antennae on the other side of a barrier and identifying the point of cutoff for the signal. These data increased minimal home range estimates to 19 and 10 km^2. Although the boundaries of these areas were inexact, the expanded home range estimates come closer to describing the real spatial demands of the bears. We discuss the utility of radiotelemetry for studying poorly known bears in mountainous terrain.

57– oral

ANDEAN BEAR-CATTLE CONFLICT IN OYACACHI, CAYAMBE-COCA ECOLOGICAL RESERVE, ECUADOR

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Many rural or indigenous populations in Ecuador live close or within governmental protected areas. The environmental sector is always mentioning the impact that these communities produce on nature because of productive activities and the responsibility that local people have in preserving these areas. Nevertheless, very little is spoken about the costs that people confront when living within or adjacent to protected areas.

One example of such cost is the result of Andean bear-cattle conflicts. This conflict occurs in many localities throughout the Andean bear (Tremarctos ornatus) distribution range and it has become chronic in some specific sites. One of those areas is Oyacachi, a indigenous community of 120 families with 55,000 hectares of ancestral land, located in the northeastern highlands of Andes mountains, inside Cayambe-Coca Ecological Reserve, Ecuador. Between 2001 and 2004, 41 predation events took place in Oyacachi, where 61 cattle have been lost. This work presents the results of a research focused on the ecological, social and economic aspects of the Andean bear-cattle conflict at Oyacachi community.

The study area showed high habitat availability for the Andean bear. The species has a high and moderate presence probability in 27% of to the study area. This probability is distributed in a 43.26% in highlands or paramos and 56.74% in forest. Barely 5% of the study area has a high and moderate probability of cattle predation by Andean bear. The 41 predation events were concentrated in the altitudinal belt of the forest-paramo ecotone. The community lost USD 46,576.30 between 2001 and 2004 and could loss other USD 28,039.59 in the next nine years. These costs include direct costs such as meat, milk production and reproductive capacity, and indirect costs such as cattle transfers. The losses are distributed only in 28 of the 120 families that live in Oyacachi, which corresponds to 25% of the total of families. There is poor knowledge about the conflict, yet a positive attitude towards its resolution. Unfortunately, the solutions that were identified by the community only address economic

compensations. No cattle or Andean bear management programs which could help reduce the number of predation events were addressed. The perceptions towards the species have become negative due to the conflict; however the attitudes and practices remain positive since people dislike the idea of killing the bears as a solution.

The above results suggest that moving cattle to areas with low conflict probability and increasing surveillance could lower the predation risk. However, higher management costs should be taken into account. Also, an environmental education program is needed to improve peoples' perceptions towards the Andean bear. Finally, some sort of financial mechanism should be implemented to compensate the affected families.

POSTER PRESENTATIONS

58 - poster

THE SEX RATIO OF *URSUS ARCTOS* IN NORTH-WESTERN RUSSIA

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The sex ratio is one of main parameters of demographic structure of mammalian population, the study that allows having the information on population changes. In all species of carnivorous mammals the age dynamics of the sex ratio is observed very distinctly.

According to the zoo data the sex ratio in brown bear is close to 1:1. In the Leningrad zoo was 53.6% males (11 litters), Moscow zoo – 45.4% (5 litters), Tallinn zoo – 52.6% (14 litters). We analyzed the data from the hunting bags and own data from the northwestern part of Russia. From the den-hunting data on sex ratio in different age groups of *Ursus arctos* in Karelia, in cubs (taking from dens) it was near 1:1. The part of males consists 52% in yearling (n=48), and 60.9% in adults (n=42). In Leningrad Province males consist 56.8% of adults (n=58).

The different types of bear hunting are selective, and probably, not show the real situation in sex ratio of the brown bear population. The large specimens (usually they are males) are shot more often. In the autumn period, a part of males is essentially larger that partly depends on a selectivity of this hunting type (shooting the females with cubs is strictly prohibited). Therefore, according to the all-year hunting data the males constitute the main part of hunted bears (78% in Leningrad province, 68.3% in Pskov and Novgorod provinces). In the winter period (data of den-hunting), a sex ratio of hunted bears is rather equal.

59 – poster

PROBLEMS RELATED TO SUPPLEMENTAL FEEDING OF BROWN BEARS IN SLOVENIA: TO FEED OR NOT TO FEED?

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Supplemental feeding of brown bears is among regular activities of the conservation management of brown bears in Republic Slovenia. Its traditional backgrounds sourced from the hunting practices in last two centuries. On large private estates in 19th Century the bears have been baited and shot from high-posts erected on trees, on so called Luderplätze (in German language Luder = carrion). The corpses of horses and cattle have been exposed there to bait the bears. In post-World War II, supplemental feeding of bears became a regular management tool inside the bear range, since it was believed that meat baits would prevent bears from emerging out of the forests and thus staying away from the settlements and human properties.

Through the data on spatial distribution of radiocollared bears, collected during the international bear project in Slovenia in 1993-1999, but also during current Slovenian bear telemetric project we found, that individual home ranges of bears have been adjusted to the distribution of feeding places. We speculate that recent population of bears in Slovenia is to the great extent food conditioned. Bears visit also the places on which wild boar is supplementally fed by the hunters yearlong, and where the maize corn is used as supplemental foods. To find out the importance of supplemental feeding for bears we

analyzed 429 scats of brown bears, which we collected in the period 1993-1995 on three distinct locations inside the core conservation area of the species. The scats have been collected opportunistically, whenever they have been encountered.

Scat composition	Maize corns*	Carrion
Volume %	10.1	6.3
% frq. of occurrence	26.8	13.3

Table 1. The % frequency and % volume of supplemental foods in 429 analyzed scats of brown bears (n=429) collected in the core conservation area of the species in southern Slovenia.

Although the quantity of ingested supplemental foods might hardly be evaluated as crucial for the survivorship of bears, we believe that the distribution of feeding places and the provision of supplemental fodder strongly impact spatial distribution, as well as the behavior of bears. Current distribution of feeding places attract bears to stay in the vicinity of human settlements.

The problems arising from traditional ways of supplemental feeding of brown bears should be taken into account with care. We suggested to reduce the number of feeding places and their re-distribution away from the vicinity of human settlements. But we did not advice the total ban of supplemental feeding, since the very effects might be negative in the sense of keeping current densities of brown bear population in Slovenia.

60 – poster

OBSERVATIONS ON ASIATIC BLACK BEAR (*URSUS THIBETANUS*) AT DACHIGAM NATIONAL PARK, KASHMIR, INDIA

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We made observations on some aspects of the ecology of Asiatic Black Bear (*Ursus thibetanus*) at Dachigam National Park (141 km^2; 34° 54′ to 34° 11′ N and 74° 54′ to 74° 09′ E) from January 2002 to December 2002. The Encounter Rates (number seen/hour search and number seen/km walk) for Asiatic black bear at Dachigam National Park varied between seasons. The mean Encounter Rates were 0.64 bear/hour search and 0.20 bear/km walk in summer (June to August); 0.36 bear/hour and 0.12 bear/km in spring (March to May); and 0.37 bear/ hour search and 0.12 bear /km walk during autumn (September to November). During winter (December to February), no bears were sighted as they were hibernating. The overall typical group size of Asiatic black bear at Dachigam National Park was 2.04, but it varied from 2.04 in spring to 2.33 in summer, and to 1.45 in autumn. The overall young to adult ratio was 41.86 young/100 adults, but it varied from 60.71 young/100 adults in summer to 50 young/100 adults in spring, and to 11.86 young/100 adults during autumn. The diet of Asiatic black bear was largely dependent on the availability of the food plants in different seasons at Dachigam National Park. During spring, the black bear fed on *Quercus robber, Aesculus indica, Rosa macrophylla, Rosa webbiana,* besides *Prunus armenica, Morus alba* and *Morus nigra*. In summer, the black bear fed on plant species such as *Morus alba*, *Morus nigra*, *Prunus persica, Prunus pyrus, Prunus armenica, Prunus ceresifera, Prunus prostate, Pyrus communis, Rosa macrophylla, Rosa*

webbiana, Rosa bageriana, Rubus fruticosus, Rubus hoffeneistrianus and *Berberis lycium*. During autumn, the black bear fed on *Juglans regia, Aesculus indica, Rosa macrophylla, Rosa webbiana* and *Quercus robber*.

61 – poster

THREAT AND CHALLENGES FOR SLOTH BEAR (*MELURSUS URSINUS*) CONSERVATION IN CHHATTISGARH STATE, INDIA

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It will not be inappropriate to say that Chhattisgarh is the state of sloth bear. Forest cover in Chhattisgarh encompass of 68,786 km^2 area, which is 50.87% of state geographical area. All 14 sanctuaries (8,287 km^2) and reserve forests come under the administration of 7 forest circles. Sloth bears are widely distributed in the entire state. More than 10000 sloth bears have been estimated in the state by Forest department and 60% bears of this population, are living outside the protected area. Comparatively bears are safe in protected areas but bears are at great risk in unprotected areas due to expansion in human settlement, agriculture land and encroachment in forest land. Due to biotic pressure and habitat loss, sloth bears in unprotected areas has been exposed to human being. Human-bear conflict is on the rise and sloth bear hunting for meat, bile, and its body parts has increased during recent time. There is great need to protect sloth bear habitat in unprotected areas. Moreover, community living in such transitional areas should be made aware for coexistence with bears through organizing seminars and workshops. Such steps will not only be helpful in sloth bear conservation in the state but people also can be made aware about the significance of sloth bear conservation in their respective areas. In addition, interaction with people will also reduce their hostility towards bears.

62 – poster

ANDEAN BEAR (*TREMARCTOS ORNATUS*) STATUS IN THE AMAZONAS DEPARTMENT, PERU

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The Andean bear (*Tremarctos ornatus*) is a threatened species along all its distribution and in Peru is considered as Endangered. To estimate the status of this species in the Amazonas Department we develop field assessments and interviews during November and December of the 2003, and bibliographical information review of the registers in the study area. To estimate the potential presence areas we determine the natural habitat remnant analyzing satellite images (LandSat) and digital maps of roads, protected areas, human settlements and altitude.

The potential presence of Andean bear was estimate from 600m to 4,300m covering an area of 1'677,247 ha that represents 42.3% of the Amazonas Department. It corresponds to the premontane and montane forest and paramo habitats. This area is localized in all the provinces of the Department and includes three Natural Protected Areas. Santiago Comainas Reserved Zone is the most important for the bear conservation in Amazonas, maintaining 610,612 ha of estimate potential habitat and has connection with other non protected areas mainly in Ecuador. The Alto Mayo Protected Forest and the

Cordillera del Colan Reserved Zone are small to maintain viable populations, but they are mainly connected among them, been necessary to establish a conservation corridor between both.

The main threats for the Andean bear are loss and deterioration of habitat and hunting. The bear is hunted for self-consumption, commercialization and due to consider a damaging species (livestock and corn depredation). Many lack of information exists about the protection laws for this species in the rural and urban communities. On the other hand, the bear occupies an important place in the culture and customs of many communities of Amazonas (folkloric medicine, legends, dances, etc.).

63 – poster

HUMAN-BROWN BEAR CONFLICT IN NORTHEASTERN TURKEY: ENCOUNTERS, DAMAGE AND ATTITUDES

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Brown bears (*Ursus arctos*) are still widespread in Turkey but numbers have declined in previous decades due to forest fragmentation and human persecution. The northeastern region, where settlements are small and scattered, is known for its relatively high levels of conflict, especially involving damage to beehives and orchards.

We aim to study the nature of the conflict in a 320 km^2 wide landscape within county Yusufeli, in the southeastern part of Artvin. The study area is characterized by a large valley between steep mountains, ranging from 900 m to 3,406 m. The slopes are mostly covered with oak woodland, spruce forest, rhododendron scrub and alpine meadows. Settlements are numerous but small, with some population movement to higher altitude houses in the summer. Farm plots and orchards are typically very small (~0.5 ha). Small numbers of cattle and sheep are kept by each household, which are sometimes grazed together under the supervision of a shepherd.

We have collected data on human-bear encounters in the last 15 years through government records, literature and interviews with the locals. The lack of proper record keeping meant that direct interviews (n=37) were most informative. Interviewed people ranged in age from 18 to 82 and were mostly farmers, but also included other professions. We obtained information on encounters with bears and any claimed damages between 2000 and 2004, as well as livelihood patterns and current attitudes toward the bears. Here we present preliminary findings and suggest ways to limit the conflict.

Of the fifteen close encounters recorded, four were while in a vehicle and the rest on foot. On seven of these encounters the bear and person(s) departed without any harm but in another seven cases the bear was either attempted to be shot at or run over. One bear attacked a woman and wounded her without apparent provocation. As a result of these encounters, two people were harmed and three bears were wounded (at least one fatally).

More than 51% of interviews reported bear damage between 2000 and 2004. Field crops and orchards were most vulnerable (77% combined) followed by beehives (15%) and livestock (8%). In five years only 15 sheep were depredated. Damages took place most often in June, August and September. Villagers took precautions with differing levels of sophistication and effectiveness against bear damage.

Almost all (95%) believed that bears have become more of a problem lately. Only 6% support full protection while 44% are against any protection; a significant proportion (38%) accepts protection if

population is regulated or if damages are compensated. Limited trophy hunting is seen as a solution by only about half the respondents.

64 – poster

MANAGING HUMAN-BEAR CONFLICTS USING NON-INVASIVE GENETIC SAMPLING AND GIS HABITAT QUALITY MAPPING IN WHISTLER, CANADA

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The Resort Municipality of Whistler, British Columbia, Canada (RMOW) consists of 165 km^2 of forests, wetlands, rocky alpine, and developed land. Development to support this resort has resulted in the conversion and fragmentation of forested areas and has insidiously intruded on functioning, viable ecosystems, thereby increasing the number of human and black bear (*Ursus americanus*) conflicts.

In this study we will develop and test a black bear habitat quality map using ArcView GIS and non-invasive genetic sampling. The map will be created by developing a black bear habitat quality ranking system which will be applied, based on local knowledge and literature, to a combination of biogeoclimatic zone, sub zone, variant, site series and structural stage, which is a classification system in British Columbia that groups similar segments of the landscape (ecosystems) into categories based on climatic, vegetation, and site. The biogeoclimatic ecosystem data will be collected using the Terrestrial Ecosystem Mapping System (TEM). Fifty-one barbed wire hair traps will be constructed and baited for 14 one-week sessions throughout early summer and fall and submitted to The Wildlife Genetics International Ltd. Laboratory in Nelson, British Columbia for DNA analysis. From these results, population estimates will be calculated and distribution patterns will be examined. Furthermore, a compilation of human and black bear conflicts will be conducted based on data collected by conservation officers, to spatially describe areas of distinctive management concern. This data will be used to test the habitat quality mapping system by overlaying it onto GIS-based datasets.

Upon completion, this study will provide baseline information by which to assess the long-term management and monitoring of black bear habitat quality and high bear-human conflict areas within the Resort Municipality of Whistler, British Columbia, Canada.

65 – poster

A DIET STUDY FOCUSED ON THE USE OF BROMELIADS BY THE ANDEAN BEAR AT THE SILLAR (CARRASCO NATIONAL PARK, BOLIVIA)

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According to many authors, species of the family Bromeliaceae are the most common items found on Andean bear (*Tremarctos ornatus*) diet studies. The distribution of bromeliads species at the Sillar spans from the 4,200 to 500 m.a.s.l. This wide distribution, matches the allocation of the Andean bear in this area. The aim of this study is to determine if the Andean bear eats bromeliads along two habitat types: grasslands and montane forest. A total of 14 transects 200x20m (4 in grasslands and 10 in forest) were set up randomly in an area of 35km^2. In each transect the number of bromeliads were recorded and scats or feeding signs were collected for further laboratory analysis. To avoid spatial and temporal autocorrelation the distance between transects were 800m. The results of this study will provide evidence of the use and importance of bromeliads in the diet of the Andean bear.

66 – poster

INUIT TRADITIONAL KNOWLEDGE OF GRIZZLY BEARS IN NUNAVUT, CANADA

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The Naonayaotit Traditional Knowledge Project (NTKP) is a GIS database of the knowledge of the Copper Inuit of Nunavut. This project was initiated in 1996 in response to a need for baseline information to assess the potential impacts of Ekati™, Canada's first diamond mine. We provided the Inuit with the technical expertise to develop a land-use planning tool that gave them the means of responding to land-use applications within their area of historical and current use using their own traditional knowledge (TK).

The consideration of TK in environmental assessments and in the evaluation of national species status has become mandatory in Canada but there remains little understanding of TK, let alone how it should be collected, compiled and implemented. Many within the scientific community discount the value of TK when compared to scientific observations, and there is distrust of scientific data within many Aboriginal communities. Conflicts arise when the TK and science of high profile species such as grizzly bears are contradictory, especially when regulatory changes based on science are proposed.

There are common threads between the knowledge of Aboriginal people and science because, simply put, traditional knowledge is sound natural history. TK is based on the observations of a group of related individuals over time about specific landscapes, cultural perspectives, animal populations and climatic conditions. It is unique to a particular people. TK can be thought of as an evolving "how to" manual for the use of specific places. If carefully documented and presented, TK is invaluable in understanding and managing wide-ranging, low-density species such as barren-ground grizzly bears. Further, TK has been collected over a time period that no biological study can match.

Detailed information on wildlife, habitat and land use was collected during structured interviews of 51 Inuit consultants. Their traditional knowledge covers an area of use that exceeds 700,000 km^2 over a time period that spans a century. Inuit were asked about their attitudes to bears, harvesting, encounters, abundance, distribution and habitat use. They reported major changes they had observed over time, especially increases in distribution and numbers of grizzly bears on the coast. Questions on major prey species, including barren-ground caribou, and changing use by people, help explain these observed changes.

The NTKP not only supports and complements biological studies on grizzly bears, it provides a regional perspective; a historical and current framework for understanding bear biology in a vast wilderness area that is logistically difficult and expensive to work in. Responses illuminate the issues that Inuit face with bears and how management decisions made by wildlife managers, often without the people's detailed understanding of wildlife distribution and abundance, have affected them. The NTKP not only is a tool for the Inuit in deciding how development will happen on their land, it is an invaluable resource for grizzly bear conservation and management.

69 – poster

DYNAMICS IN BROWN BEAR POPULATIONS IN EUROPEAN RUSSIA

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In the 13th century, travelers observed brown bears pastured in southern Ukrainian steppes along shores of Dnepr River. However since the 16th century bears have been met only in forested areas being exterminated in open habitats. Since the 17th century the southern edge of the bear range in Russia constantly retreated to the north concordantly with declining forested areas. The maximum withdrawal of the southern border of bear range was observed in 1960s. In 1975, when the numbers of brown bears in plain European Russia was minimum (ca 22,000), these predators were observed only in the regions with forestation more than 24%. In 1991, when in the same area the numbers of brown bears was maximum (ca. 43,000), they were observed only in the regions with forestation more than 36%. Undoubtedly, brown bear survival and forestation of territories are closely connected.

Table 1. Correlations between bears' density and forestation, and humans' density in 27 regions of plain European Russia.

	Person Correlations			Partial Correlations		
Years	1975	1991	2003	1975	1991	2003
Forestation	0.54 p<0.002	0.78 p<0.000	0.74 p<0.000	0.43, p<0.03	0.75 P<0.000	0.69 p<0.000
Humans density	-0.56 p<0.001	-0.55 p<0.001	-0.58 p<0.001	-0.46 p<0.02	-0.47 P<0.02	-0.48 p<0.01

During the 20th century in European Russia most of pristine forests were exchanged by young forests. However, the bears' density in the areas does not depend on squares of young forests. Bears favorite habitats are mature and over mature spruce and mixed forests, and young forests (Danilov, 1994). Since 1960s and up to early 1990s, a growth of bear numbers occurred mostly in northern and north-eastern regions of European Russia. Since 1991, management of hunting husbandry of Russia was destroyed. It leaded to mass extermination of large animals. However fortunate changes of habitat conditions also took place. Rural population declined and it diminished occasions of disturbance of the bears. A part of arable lands was abandoned and has been overgrown by shrubs. Along the southern border of the brown bear range the new localities with settled singles, small populations of bears, even with she-bears with cubs appeared. According to our observations and information from hunting

managers and local people the new populations have become stable (Baskin and Vaisfeld 2004). The modern situation in European Russia is paradoxical. In more northern part of the range slow decline of populations is observed. Opposite, near the southern border of the range we observe the brown bear expansion at the areas with strong forest fragmentation. We found significant negative correlation ($r = -0.71$ $p<0.000$) between densities of bear populations during 1975-1991 and 1991-2003. It means that the populations, which grew in 1975-1991, in the next period declined and vice versa. We can propose that a tendency of occupation by bears of new areas along the southern border of the range will remain.

70 – poster

AN ANALYSIS OF ORPHAN BEAR CUB REHABILITATION EFFORTS, 1970-2005

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In recent years, black bear (*Ursus americanus*) populations have increased in numbers and distribution across much of North America and brown bears (*U. arctos*) are expanding in Norway, Sweden and other parts of Europe. However, bears in many parts of the world have been eliminated from 50 – 75% of their historic range and population insularization due to habitat fragmentation continues to pose a threat in many countries. Protection of small isolated populations of bears is important, but their chances for long-term survival are diminished without intrusive management programs, which might include the release of orphaned or captive bears.

Biologists in the United States and Canada have been involved in releasing orphaned black bear cubs into occupied bear habitat in North America for more than 3 decades. More recently, biologists in several European, Asian, and South American countries have also experimented with releasing brown bears, Asiatic black bears (*U. thibetanus*), sun bears (*Helarctos malayanus*) and Andean bears (*Tremarctos ornatus*). Bears appear to be particularly good candidates for rehabilitation efforts, and it appears that many of the behaviors they need to survive in the wild are instinctive. Bears are known to survive in the wild after being orphaned at ages greater than 5 months. However, little is known about the critical care needed by orphaned bear cubs prior to their release. During the spring of 2005, we surveyed bear rehabilitation centers in North and South America, Europe and Asia to collect and summarize information about the methods they used to raise, release and monitor the survival of orphan bears cubs. We analyzed these data to identify problems that have occurred with bear releases, and to ascertain the critical components of a bear rehabilitation program that have contributed to the successful release of orphaned bears cubs.

We also discuss the short- and long-term implications of release programs on wild bear populations. A successful rehabilitation program has the potential to provide benefits not only to individual bears from a welfare perspective, but may contribute to conservation efforts for rare species. Reintroduction programs can be used to augment bear populations that have adequate habitat but exist in low numbers because of other controllable factors, increase genetic diversity in small, isolated populations, or to reintroduce bears into suitable, but unoccupied habitat.

71 – poster

THE *BEARS* PROJECT: BEAR EDUCATION, AWARENESS AND RESEARCH IN SLOVAKIA

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The BEARS Project – Bear Education, Awareness and Research in Slovakia – is an initiative of the Slovak Wildlife Society designed to reduce bear-human conflicts and hence support efforts to ensure the long-term survival of bears in the Western Carpathian Mountains. The main aim is to foster understanding and acceptance of bears, with an emphasis on providing information as well as practical help on how to prevent problems.

Since the project was launched in 2003, several activities have been completed or are underway. A teaching manual called "In the tracks of bears" has been published. It is printed on separate sheets of card within a removable colour binder, allowing teachers to easily photocopy pages to give to pupils. The manual is being distributed to those involved in working with children aged 6-16 years, at primary and secondary schools, youth clubs, centres for free time, scout groups and State Nature Conservancy staff across all regions of Slovakia with bears. A full-colour A2 wall calendar featuring "A year in the life of a bear 2005" has also been produced, along with various other educational materials. A photographic exhibition and seminars and lectures for pupils and teachers have been held.

A project website with both Slovak and English language versions has been set up at www.medvede.sk (medvede is the Slovak word for bears). The site is intended to be a tool to raise awareness of bears, reduce negative feelings and so promote better co-existence. In addition to basic information on the biology of the brown bear as well as of the other seven species of bears worldwide, the site offers the best available information based on scientific research in Slovakia and elsewhere, comparison with situations in other countries, proven methods to reduce or prevent problems with bears and much more. The main target groups are school children, students and young adults, teachers and journalists as well as others living, working or visiting areas with bears. Because reports on television and in newspapers are often sensationalised and present a distorted view of bears that influences public opinion and levels of acceptance, a section on news and comment has been included to provide a more complete and accurate picture.

In addition to further seminars, lectures, a "Bear Camp" and an art/literary competition for children, activities planned for 2005 include the installation of bear-proof refuse containers and the production of a Slovak version of the video "Staying safe in bear country".

The BEARS Project is financially supported by the World Wide Fund for Nature (WWF) and Alertis – fund for bear and nature conservation.

72 – poster

FEEDING HABITS OF HIMALAYAN BROWN BEAR IN KUGTI WILDLIFE SANCTUARY, HIMACHAL PRADESH, INDIA

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In Kugti Wildlife sanctuary, Himachal Pradesh, Himalayan brown bear (*Ursus arctos*) occurs in low densities in rolling up lands, alpine meadows, scrub and sub-alpine forests from 3,000m and above. Due to increasing human population, expansion of agricultural land, livestock grazing pressure and collection of medicinal plants, brown bear population is disturbed and threatened. Livestock killing and crop depredation by brown bear is on the increase. There is no information available on its ecology, habitat use, activity pattern and behaviour, which can help conservation and management of its population. We have studied the feeding habits of brown bear based on direct observations, and indirect parameters such as feeding and digging signs, presence of scats and stone uplifting along 22 linear transects, 1 km each, comprised of 110 sample plots were randomly laid in different vegetation and landuse classes in the study area during the years 2001-2004.

Brown bears were found to hibernate from mid-December to mid-April. Before and after hibernation, they consumed plenty of food. They used 12 habitats categories viz. Agricultural land, Himalayan moist temperate forest with conifers, Mixed forest with conifers, Grassland & forest blanks, Near water bodies, Exposed rocks, Moist sub-alpine scrub, Dry alpine scrub and Riverine forest for different activities. Bears exhibited digging, stone uplifting, moving and resting behaviour. Out of total 794 diggings recorded during 2001-2004, maximum diggings were observed during May (46.9%). During July and November, 14.6% and 14.9% diggings respectively were observed. In rest of the months, digging was much less. By directly sighting 32 brown bears, their activity pattern was also recorded. They were found mostly digging (58.7%), followed by moving (34.4%) and stone uplifting (6.9%). Feeding activity was found to be directly correlated with availability of food items in different seasons. Brown bears were found feed on the leaves, roots and/or seeds/fruits of 38 plants. They also feed on mushroom, ants, insects, goat and sheep. Among the food plants, there were mainly 6 fruit trees (2-8 %), 2 shrubs (1-4 %), 19 herbs (3-32 %), 7 grasses (1-8 %) and 5 agricultural crops (2-44 %) in their scats. Bear preferred fruits of *Prunus persica* (7.2 %). Shrub *Viburnum cotinifolium* constituted 4.5 %. Grass *Carex setigera* showed maximum frequency of occurrence. Scat analysis showed high frequency occurrence of *Fragaria nubicula* (32%), *Potentilla argyrophylla* (23%), *P. atrisanguinea* (17.6%), *Rumex nepalensis* (21.6%) and *Impatiens scabrida* (18.9%) among herbs. Depredation by brown bear on *Triticum aestivum* was exceptionally very high (43.7%) as the crop was available for 11 months in high altitude. Important recommendations for conservation and management of brown bear include 1. Reduction in biotic pressure, 2. restriction on livestock grazing, 3. Regulation of medicinal plants and non-timber forest produce, and 4. Mitigation of man-brown bear conflicts, habitat protection and improvement

73 – poster

STATUS AND DISTRIBUTION OF BROWN BEAR AND BLACK BEAR IN PIR PANJAL HIMALAYAN RANGE, INDIA

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We studied the status and distribution of the Himalayan brown bear (*Ursus arctos*) and Asiatic black bear (*Ursus thibetanus*) along the Pir Panjal range in lesser Himalayas, India. Both the bear species are endangered due to habitat degradation and fragmentation, poaching and livestock grazing. Information on occurrence of bears was collected by conducting informal interviews of people from randomly selected villages situated in 4 divisions of the study area during 2002-2003.

The Pir Panjal range has 2,340 km^2 forests and 1,980 km^2 of alpine pastures. Black bear occupied 5 broad habitat categories (Moist temperate forest with conifers, Mixed forest with conifers and broad leaves species, Grassland and forest blanks, Agricultural land and Near water bodies). Whereas brown bear occupied 10 habitat categories (Himalayan moist temperate forest with conifers, Mixed forest with conifers, Subalpine forests dominated by birch and fir species, Grassland and forest blanks, Near water bodies, Alpine exposed rocks, Moist sub-alpine scrub, Dry alpine scrub and Riverine forest and Agricultural land). Brown bear usually occur between 2,500m and above and Asiatic black bear 1,200-2,500m.

There were 17 villages in Chamba, 19 villages in Churah, 13 villages in Pangi and 15 villages in Bharmour divisions. A total of 231 respondents sighted 75 black bear and 31 brown bear in different habitat categories. In forests, pastures, crop fields and village area of Chamba division, black bear was sighted 43.3%, 0.0%, 26.6% and 6.6% respectively; whereas brown bear was sighted 3.3%, 20%, 0.0% and 0.0% respectively. The Churah forests, pastures, crop fields and village areas had 50%, 5.8%, 17.6%, and 8.8% sightings of black bear respectively, and 5.8%, 8.8%, 2.9% and 0% sightings of brown bear respectively. In forests, pastures, crop fields and villages of Pangi division, sighting of black bear was16.6%, 8.33%, 25% and 8.3% respectively; whereas sighting of brown bear was 16.6%, 25%, 0% and 0% respectively. Whereas in forests, pastures, crop fields and villages of Bharmour division, sighting of black bear was 33.3%, 10%, 6.6% and 6.6% respectively; whereas sighting of brown bear was 10%, 26.6%, 6.6% and 0% respectively. Based on the survey, we have evaluated status and developed distribution map of the two bear species. Management issues related to habitat restoration and protection of bear populations have been discussed. Public education and awareness towards conservation and natural history of black bear and brown bear is necessary.

74 – poster

ANDEAN BEAR HABITAT AVAILABILITY MODEL EXPANSION TO THE WESTERN PORTION OF THE CONDOR BIORESERVE, ECUADOR

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Andean bear has been considered a conservation target in several local and regional evaluation and planning processes. This can be attributed to its large home range, its great habitat requirements as well as its ecological role. In Ecuador there are many protected areas with bears population, still, they seem to be too small to maintain viable populations in the long term. In order to test the remaining

connectivity among the protected areas within the Condor Bioreserve (CB), we decided to expand the model developed for the Oyacachi river basin (72,000 ha within the CB) to the whole western portion of CB (1'051,749 ha).

The work was divided in two activities: field data gathering through the search of signals using transects and the analysis of the cartographic information in association with the field data. The transects were allocated randomly and proportionally to the extension of vegetal formation types. Each transect was 1.5 km long and 2 meter wide. Six variables were selected (altitude, slope, landform index, vegetation types, rivers distance and road density). The Mahalanobis Distance (d^2) was the multivariate statistic used for the analysis.

The model was generated with 498 transects in which we obtained 258 bear activity registries. 149 (57.75%) were feeding sites. The humid paramo grassland was the vegetal formation in which we obtained the bulk of registries, 130 (50.38%). The obtained d^2 values were distributed between 1.124 and 1,422.938 ($\bar{x}$ = 30.798; SD= 161.446). From the accumulated frequencies analysis of d^2 values, we obtained the ranks that define the four areas being zone I the most suitable habitat for Andean bear. The zone I ($1.124 \leq d^2 \leq 1.688$; SD= 0.145, $\bar{x}$ = 1.48) includes 249,239.75 ha (24%) while the zone II ($1.688 < d^2 \leq 4.430$; SD= 0.813, $\bar{x}$ = 2.486) has an extension of 381.428,25 ha (36.69%). The most frequent vegetation types in zones I and II are humid paramo (591,790 ha) and evergreen montane forest (105,539 ha). These two vegetation types combined represent 99% of both zones.

A fair amount of zones I and II overextend between the protected areas. The results allow us to use the model as a tool to understand the connections between protected areas inside the BRC and plan biological corridors. These results show the possibility to manage the protected areas in an integrally way and this is the concept that the CB trying to establish.

75 – poster

DEMOGRAPHY OF GRIZZLY BEARS IN A MOSAIC LANDSCAPE OF INDUSTRIAL AND PROTECTED AREAS IN THE FOOTHILLS OF ALBERTA

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The foothills of the Rocky Mountains in Alberta, Canada, have undergone rapid industrial development in the last 10 years. Primary development has been for forestry and mining. This has created a heavily roaded landscape of forestry areas, mines, and seismic exploration lines. This area is directly bordered by Jasper National Park, a pristine protected area. We use data from a 5 year study of grizzly bears in this area to contrast survival rates, cub survival rates, and reproductive rate parameters between these two diverse landscapes. During the Foothills Model Forest study, approximately 20 bears were equipped with GPS collars that returned fixes every 4 hours. This information, remote sensing data, and resource selection function modeling of habitat selection provided a rich data set of environmental and anthropogenic covariates. We use these covariates, and advanced modeling strategies to investigate how bear demography and distribution may be influenced by anthropogenic and environmental conditions.

Our results suggest that bear distribution is uneven across the landscape with older bears only found in protected areas especially for the male segment of the population. We found that adult survival was reduced as a function of road density. Multi-strata models show the influence of age on both survival and movement of bears between different landscape areas. Cub survival was influenced by the percent

of the mother's home range area that was protected. Reproductive rate was influenced by habitat productivity, which was higher in non-protected areas. This demographic situation suggests a source-sink relationship. Namely, bears are attracted to industrial landscapes due to high habitat productivity, but these areas also have higher mortality pressure. Association analyses further suggest that social interactions between male and female bears further influence distribution and demography. Implications of this scenario are discussed in the context of other studies of grizzly bear demography. This study illustrates the integrative use of new advances in GPS technology, remote sensing, and advanced demographic modeling strategies.

76 – poster

THE ANDEAN BEAR: VALUE AND OBJECT OF COMMUNICATION

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Hunting for illegal business or retaliation for attacks to animals and maize crops, deforestation, and forest fragmentation constitute the most relevant threats the Andean bear faces (*Tremarctos ornatus*) in Colombia. Moreover, this problematic position has not passed from the biological to the social milieu. Furthermore, there is a great disregard of this kind of species in many regions as for its essential value. Peasants recur to hunting in a country such as Colombia, which does not count on compensation mechanisms for damage caused by wild species. On facing this situation, both communication and the community's participation processes may contribute to dissuade such violent solutions by fostering respect for life and for the living together with the Andean bear.

The World Wide Fund For Nature (WWF), through the WWF Colombia Northern Andes Ecoregional Complex Program, along with other Latin American organizations, designed the "Ecoregional Strategy for the Conservation of the Andean Bear throughout the Northern Andes Mountains," which is oriented towards the long-term sustaining of feasible bear populations. This paper states four action lines, two of which are education and communication. In this sense, a pilot communication strategy for the ecoregion was designed and applied so it will permit the opening of spaces of community participation with multiple voices—institutions, communities, researchers—and thus permit the consensus and exchange of knowledge in face of the mankind-bear relationship problematic position. The Colombia National Natural Parks Unit contributed to this process.

The pilot strategy was applied in four villages located in the Departments of Santander and Norte de Santander, which in turn are located in Colombia's north-east. Peasants living in the influential zones of the Guanentá Alto Rio Fonce Flora and Animal Life Sanctuary (Department of Santander) and the Tamá National Natural Park (Department of Norte de Santander) took part of the strategy, as well as some environmental and regional authorities and institutions did with the purpose of defining strategical actions and allotting financial support. The IEC (Information, Education, Communication) method was used, which following a survey on perceptions to identify attitudes, *a priori* knowledge, gaps and needs in the mankind-bear relationship, permitted, as the next stage, the performing of communication activities (workshops, posters, videos) through the media suggested by the peasants and the institutions. Furthermore, a new game was successfully put into action: The Wildlife Boxes, which consists of pedagogical tools to build positive attitudes into the participants facing the protection of the bear and wild animals dwelling the Andean, high Andean and high barren plateau forest estates.

This communication process placed the Andean bear in a "platform" to observe it in the middle of a social problematic position and reflect on its non-consumption value and for the conservation of the Northern

Andes mountains. When facing new attacks, the communities have currently decided to offer the bears the opportunity to keep on living.

77 – poster

HUMAN CASUALTIES AND LIVESTOCK DEPREDATION BY ASIATIC BLACK BEAR IN UTTARANCHAL HILLS, INDIA

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We studied the human-Asiatic black bear (Ursus thibetanus) conflict in the hills of Uttaranchal state, India. Bear caused human casualties and livestock depredation which have adversely affected the local rural economy. Information on human casualties and livestock killing was collected from the forest department and by interviewing people in the 6 affected districts of the Uttaranchal during 2000-2004.

In total, 626 human killing and injury cases were caused by black bear and leopard in this region during 1991-2004. Black bear accounted for 177 human casualties (28.3%) and leopards were responsible for 449 (71.7%) cases. Maximum cases occurred in Pithoragarh (64, 36.2%), followed by 60 (33.9%) in Badrinath forest division, Nandadevi national park, Chamoli and Kedarnath wildlife sanctuary, 37 (20.9%) in Pauri, 10 (5.6%) Tehri, 5 (2.8%) in Uttarkashi and 1 (0.6%) in Nainital districts. Human injury cases were very high (88.1%) than killings cases (11.9%). Females were attacked more (58.8%) than males (41.2%). Bear attacks were recorded in all the seasons, but incidences were high during autumn season and winter months. During November and December, 17.5% and 15.3% casualties respectively occurred. Victims were mainly of 30-50 years age group. Bear accounted for 14.1% cases of 5-25 years of age, and 5.1% cases of old people of more than 60 years. For these attacks, 19.2% victims or relatives were paid compensation within 6 months; 26.6% between 6 to 9 months, and maximum 37.3% were paid relief money after one year only. Information on black bear attacks on human beings and circumstances are presented and discussed. From 1991 to 2004, a total of 258 livestock killings were caused by black bear. Sheep, goat, bull, cow, horse and mule constituted 28 (10.8%), 19 (7.4%), 66 (25.6%), 131 (50.8%), 11 (4.2%) and 3 (1.2%) casualties respectively. Maximum casualties occurred in forests. Highest number of casualties occurred in September (n=108), followed by May (n=31) and June (n=35). The monthly variations in livestock killings seem to be correlated with livestock seasonal movement from higher altitude forests to low altitude villages. Diurnal pattern of occurrence of cattle-lifting by black bear showed occurrence of maximum cases (n=163) between 1600-2200h followed by killings (n=94) between 2200-0400h.

Important recommendations for mitigation of black bear-human conflict include: 1. People should be alert and vigilant in forests, 2. People should avoid livestock grazing in forests in the morning and evening time, 3. Public education and awareness towards conservation and natural history of black bear is important, 4. Discouraging payment of compensation for human and livestock casualties in protected areas, and research on ecology and management of black bear is necessary.

78 – poster

IS MALAYAN SUN BEAR POPULATION RECOVERING IN INDIA: STATUS AND DISTRIBUTION?

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We carried out a field survey on the status and distribution of Malayan sun bear (*Helarctos malayanus*) in North-eastern region of India during 2004-2005. In eighties and nineties, sun bear population apparently declined and its occurrence became doubtful in north-eastern hilly region. With increase in human population, the forests in this region have degraded and fragmented. The objectives were to survey the status and distribution of sun bear, to study habitat use pattern, to evaluate conservation threats and to suggest conservation and management actions for sun bear population in this region.

Informal interviews were held with the people of randomly selected villages within Yangaoupokpi Lokchao wildlife sanctuary (Respondents 'n' = 118 from 19 villages), Chandel district (Respondents 'n' = 40 from 5 villages) and Ukhrul district (Respondents 'n' = 106 from 14 villages) to collect information on direct and indirect evidences such as faecal matter, foot prints etc. of sun bear in their areas, man-sun bear conflict, habitat use, poaching and illegal trade of their body parts etc. and to evaluate conservation threats. Out of 264 respondents, 17.4 % confirmed presence of sun bear by direct sighting, 34.8 % by indirect evidences, 10.2 % by both direct sighting and indirect evidences and 37.6 % could not tell about its presence or absence. A few cubs were kept in villages. Sun bear relative abundance seemed to be higher in Chandel forests than Ukhrul district. Direct and indirect evidences of sun bear in tropical rainforests of Namdapha Tiger reserve, Arunachal Pradesh have been recorded and documented. A comparison of the present survey results and past information on sun bear occurrence showed an increasing population trend. Extent of poaching (Respondents: Yes 90.2 %) for illegal trade of bear body parts was very high.

The current status and distribution of sun bears within the state is useful in the recovery process and management of the species. We have developed the distribution map of sun bear based on their direct sighting and indirect evidences. Recommendations for conservation and management of sun bear population in this region have been made. Public education and awareness towards conservation and natural history of sun bears is necessary.

79 – poster

METHODS AND EFFECTS OF BILE EXTRACTION FROM ASIATIC BLACK BEARS IN ASIA

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Numerous methods to extract bile from the live bear have been developed since the inception of bear farming in Asia in the early 1980s. Techniques include ultrasound-guided extraction, open surgical extraction, narrow latex catheter system, wide latex and corset system, stainless steel catheters, free-dripping fistulas and, most recently, the 'fake' free-dripping fistula. Procedures are frequently performed with improper surgical and unsterile techniques, which adds to the complications normally

associated with the creation of a fistula between the inside of a body cavity and the outside environment.

Of the 185 bears that we have examined, most show moderate to severe changes in the gall-bladder structure. We routinely remove the gall bladder of "tapped" bears that arrive at the Rescue Centre because of the inevitable pathology of the organ and because of complications that develop even after the extraction sites have healed. All gall bladders are dissected and samples taken for histopathology. Changes commonly observed in fistulated or catheterized gall bladders include polyps, abscesses, hemorrhagic and necrotic mucosa, healed (or patent) perforations, gall stones and sand (with associated bile duct obstruction) and foreign objects within the gall bladder and the surrounding mesentery.

80 – poster

SHEEP BEHAVIOR AND SIGNS OF BROWN BEAR PRESENCE: COMPARISON BETWEEN TWO BREEDS WITH A DIFFERENT COEXISTENCE STORY WITH THE BROWN BEAR

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The Alpine areas of Slovenia and Italy were recently offered to the expansion of large carnivores as the one of Brown Bear (*Ursus arctos*). In these areas, since the end of 1990s offences to livestock, mainly sheep flock, have increased dramatically. Two are the most popular systems of livestock breeding in these areas: In Slovenia a traditional small flocks (10-60 heads) system, where sheep of a local breed (Bovska breed) are kept fenced or free-ranging during summer in an alpine farm (malga) for milk production. In Italy, more recently, large transhumant flocks (>1,000 head) of the meat producing Bergamasca breed (the flock moves continuously during all the year for hundred km and during summer on many alpine pastures). The present livestock and agricultural policy aims at promoting the animal farming in the mountain areas and, at the same time, the expansion of Brown Bear from Slovenia to Italy. For these reasons it is important to suggest management solutions to reduce the risk of predation on domestic animals as fencing systems, use of shepherd dogs, and other less familiar, like the choice of breed and size of the flock. The aim of this work is to compare the behaviour of Bovska sheep (local endangered breed, well acquainted with carnivores) with that of the Bergamasca breed (worldwide diffuse, inexperienced from large carnivores) in face of Brown Bear scats. A different way of behaving could be associated to a primordial imprinting for surviving.

The study has been performed in the Alpine farm "Malga Coot " in Prealpi Giulie Natural Park with the Bovska breed and in the experimental farm of University of Udine with the Bergamasca breed. Sheep grazed inside an electric paddock of 4 hectares, virtually divided in 9 sectors. Three trials with Bovska Sheep (size of flock, n=16) and with the Bergamasca (n=16) were conducted; two with the Brown Bear scats and other one on the cow scats (control).
Each trial was divided in 2 periods: two days without scats followed by other two days in presence of scats (either Brown Bear or cow scats); the scats were only dispersed in 3 of the 9 sectors. The animal behavior was observed daily for 10 hours (6.30-10.30; 12.00-14.00; 16.00-20.00). Every 15 minutes the number of sheep present in each sector, their activities (walking, feeding, resting, alarms, sleeping) and their spatial disposition were recorded. Nearly 170 observations per trail have been conducted. Scats were cropped in "Parco Zoo Punta Verde" Lignano Sabbiadoro (UD) from two females and one male of Brown Bear fed a mixed diet with fish, fruits and vegetables. By the analysis of variance, for each sector and trial, the total presence of sheep and the number of animals dedicated to a single activity, before and after deposition of scats, were compared.

No significant effect was detected within trials with cow scats, either for Bergamasca or for Bovska breed. In trials with Brown Bear scats the total number of bovska sheep present in the sectors, where scats were deposed, decreased (5.78 to 0.75, P=0.0007), as the number of sheep feeding (3.22 to 0, P=0.0025) while, in the sectors without scats, the sheep that resting (0.59 to 4.19, P=0.0007) and grazing (7.1 to 8.6, P=0.03) increased. Remarkably, after deposition of bear scats, sheep disposition changed following a circular spatial pattern. In the long term the effect of scats seems to decrease (significative interaction between the order observations and period). The results seem to confirm that in the past the Bovska has already being negatively experienced with Brown Bear and preserve some kind of sheep breed memory towards carnivores. The observed behavior is also coherent with the outcomes of a previous works which showed that sheep reacts and move away from different predator's odors, evaluating at the same time the real risk associated to the specific smell. In that case and the animals tried to reduce predation risk by limiting time for grazing and reproducing.

81 – poster

BLACK BEAR HABITAT MODELS FOR CENTRAL GEORGIA (USA): INCORPORATING UNCERTAINTY IN IDENTIFICATION OF POTENTIAL HABITAT

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American black bear populations in the southeast United States are highly fragmented and currently occupy approximately 7.26 % of the Coastal Plain and Interior Highlands (Clark *et al*. in press). This research was a part of a study to assess the status of one of these southeastern US populations, the American black bear (*Ursus americanus*) population of central Georgia (CGP). Identification of potential habitat for black bears in central Georgia is a management objective because potentially suitable habitat may be limited for this game species. Almost 98% of the CGP range (1,200 km^2) exists on private land and the population may be isolated from the black bear populations in the north and south of Georgia. Development pressure exists on portions of 140 km^2 within the suspected core area of the CGP which is the only upland forest uninhabited by people. This is the first research on black bear habitat in central Georgia. The CGP borders 2 urban areas which are characterized by vegetation types native to the fall-line between the Piedmont and the upper coastal plain of Georgia; habitats distinct from those of other southeastern bear populations. As in many radio-telemetry based habitat studies, we were faced with the challenges of sampling uncertainty due to presence-only habitat data, telemetry error and limited sample size. To address these challenges we developed a Bayesian based model that employs MCMC simulation and incorporates telemetry error to predict habitat in central Georgia. The Bayesian framework allows for the incorporation of sampling uncertainty because parameters are modeled as random variables and small sample sizes can be augmented by model updating with additional data from future studies. Our models were also hierarchical with the aim of predicting black bear habitat at the location scale dependent on home range scale habitat variables. Model validation was conducted against an independent set of telemetry data. A total of 3,185 locations were collected on 23 wild-caught bears (9F:14M), and 2 nuisance females from May, 2003 to August, 2004. Home ranges generally followed the forested river corridor and heavily forested creeks. Five of 14 males periodically shifted their activity from more contiguous forest to agricultural areas in Fall and Winter. Agriculture adjoining forests may be important foraging areas for males during Fall and Winter. Habitat model results are discussed in addition to results for home range dynamics and overlap, road crossing and other movement behavior in relation to land use.

82 – poster

MANAGING BEARS AND HUMANS IN ALASKA'S NATIONAL PARKLANDS USING A REGIONAL DATA MANAGEMENT SYSTEM: THE POWER OF BHIMS (BEAR-HUMAN INFORMATION MANAGEMENT SYSTEM)

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In order to standardize data collection and to analyze regional patterns in bear-human interactions across Alaska's National Parklands, we have developed the NPS Alaska Region Bear-Human Information Management System (BHIMS). This Access database application allows for the easy entry, storage, and analysis of disparate data from across Alaska's National Parklands, and has applicability to bear management across North America. The BHIMS has the capability to store bear sighting, bear-human conflict, bear harvest, and bear natural history records. Scanned images (e.g., PDF's of original reports) and photographs can be linked to individual records. An extremely useful component of the BHIMS is the integration of the NPS Arc2Ax dynamic link tool. This tool allows for queries of records within BHIMS based on user-defined criteria; selected records are then linked to ArcGIS (or ArcView) enabling the spatial display of records which meet the specified criteria. A dynamic link can also display corresponding records in BHIMS based on a set of selected features from an ArcGIS (or ArcView) map. Altogether, this system represents a powerful resource management tool that allows easy data entry and analysis, and facilitates informed bear management decisions. The BHIMS enables managers to illuminate the variables which are the most important indicators of potential bear-human conflicts. The ability to determine spatial and temporal "hotspots" of historic and potential bear-human conflicts allows managers to better focus their management efforts in a systematic and cost-effective manner.

In summary, the BHIMS allows managers to consolidate all of their bear-management information into one dynamic system and identify those variables that are important indicators of potential conflicts; with resultant implications for management. Ultimately, this system can help improve bear management strategies, safeguard human safety, and contribute to the conservation of bears.

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THE BROWN BEAR IN BULGARIA: TOWARDS A MANAGEMENT POLICY

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Since January 2005 a new project in Bulgaria has been started to identify the key points for the contemporary distribution, trends and human dimension issues concerning the brown bear in the country. It is targeted:

1: To collect field data relevant to develop a sound national management plan for the Brown bear, specifically data on distribution of the Brown bear population and human attitude towards bears.

2: To form a bear working group which will involve all the relevant stakeholders to prepare a national Brown bear management plan for Bulgaria.

This project is an urgent step towards the conservation and proper management of the species in the country.

The Brown bear population in Bulgaria is divided into 2 sub-populations. They occur in the Central Balkan Mountain range and in the Rila-Rhodopean massif. The Balkan range subpopulation is isolated from the other populations. Currently, the Rila-Rhodopean sub-population is becoming more and more fragmented because of increasing human development in the area. Generally the exact distribution of bears is not known and the corridors between the core habitats, used by bears are not well studied. The official estimation of bear number for the last 15 years in the country is between 820 and 900 individuals but this estimation is not accurate because of unreliable counting methods. Most probably about 150-200 animals can be found in the Balkan range area and about 400-500 in the Rila-Rodopean massif. The primary data collection showed appearance of dispersal bears in many forestry units where they have not been reported earlier. It is not known if the population of bears is currently decreasing or increasing.

The project is conducted by experts from 3 different Bulgarian organizations with different backgrounds (the NGO "Balkani Wildlife Society", the Institute of Zoology/Bulgarian Academy of Science and the Environmental Education and Research Centre/Sofia Zoo) supported by their Dutch partner Alertis with the financial help of Pin Matra, The Netherlands.

The poster presents new data on the contemporary distribution, ecological corridors between the sub-population and human dimension issues to be solved towards a preparation of the bear management plan.

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THE FUTURE OF THE ABRUZZO BROWN BEAR: A PERSPECTIVE FROM THE PAST

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In Italy, bears were once distributed throughout the forested areas. By the 16th century, they had been exterminated from most of the country, due to deforestation, hunting, and habitat degradation. Nowadays, the bear is present in Italy only in three areas: south-eastern Alps, eastern Alps, and central Apennines.

The central Apennines population (hereafter Abruzzo brown bear) has been ascribed to the subspecies *Ursus arctos marsicanus* (Altobello 1921), that is endemic to central Italy. This population has seen a progressive reduction in its range starting from 1700s, due essentially to legal hunting (before the XXth century), poaching and habitat destruction.

Today, Abruzzo brown bears exist as a remnant, isolated population, restricted principally to the mountain areas of the Abruzzo National Park in a region of 1,500 km^2. Individual bears also frequent (rarely and with very low density) other 4,000 km^2 of the Apennine region. No ad hoc individual count has been done, so it is not possible to know the exact number of animals living in the region. However, different authors have estimated a population size between 40 and 80 individuals.

Even though very little is known on the ecology of the sub-species, it is clear that its conservation is heavily dependent on effective conservation strategies, because the subspecies is living in a landscape

dominated by human presence. For this reason we propose possible future conservation scenarios on the basis of the land cover change occurring in the distribution range of the Abruzzo brown bear.

Using three land cover maps (the map of land use by the National Research Council dated 1960, the CORINE Land Cover dated 1990, and the CORINE Land Cover dated 2000) we have built a cellular-automata Markov-chain land transition model to simulate possible alternative land covers. Then, we have used the three already existing land cover maps plus the simulated future land cover map (together with other ancillary data, like a digital terrain model) to build three deductive habitat suitability models (HSM). The HSM built for 2000 has been validated using field data on the presence of the species collected from the Abruzzo National Park field personnel; no validation was possible for the other models, since no data on species presence was available.

The HSMs have been used to individuate the areas of possible natural expansion for the sub-species as well as the areas that more than others have maintained high suitability from 1960 to 2000 (here considered core areas for the conservation of the Abruzzo brown bear). Also, we have used the HSMs to individuate the areas that more than others should be protected to ensure connectivity among different segments of the existing population as well as to ensure the possibility of natural recolonization of suitable areas not presently occupied.

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COUNTS OF FEMALE BROWN BEARS WITH CUBS: WHAT ARE WE TALKING ABOUT?

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Annual counts of brown bear females with cubs of the year (FWC) are used as an index in order to know population size and trends in small-sized populations in Europe and North America. Reasons cited to choose this population segment are: greater detectability of family groups, relative lengthy permanence of groups and the fact that they are relatively easy to individualize. Furthermore, the method is not too expensive and moderately few intrusive.

We have revised papers and reports that use FWC as estimators of population size and analyze population trends. We found that periods to gather data on FWC varied greatly: mating season in Sweden, spring surveys in Greece, total length of maternal care in the Cantabrian Range (approx 1.5 years), calendar year in Yellowstone. Sources of raw data are very different among populations (radiotracking data, direct observations, track measures, interviews), while the amount of data (number of registers / family group) varied greatly too among areas and populations: 2.0-8.67 in the Cantabrian Range; 1.5-1.8 in Yellowstone; 1.2-1.5 in Sweden; no data in Greece.

Furthermore, terms used to define somewhat similar (or not?) concepts varied greatly: “counts of unduplicated females with cubs of the year” (Yellowstone), “annual censuses of females with cubs” (Cantabrian Range), “observations of females with cubs” (Sweden), “presence of females with cubs of the year” (Greece). Methodological procedures and goals differed too, adding that methods are not usually standardized enough or clearly described and evaluated.

Methods and procedures used in the Cantabrian Range to count FWC are described in this paper: period to gather data and standardization, criteria to validate registers and discriminate groups (distances, dates, group composition and individual characteristics, track measures). Since the procedures have been changing since 1982, the standardization effort and results have not been

adequate enough: in 2003, for example, three estimates of FWC numbers in the western area were six, seven and eight unduplicated groups. The variation in the results could be important depending on the goals and pretended use of the index: How many years are necessary to define and analyze a population trend? What is the adequate variation in the index to determine that a change in the population has occurred?

In the case of the Cantabrian Range, we made some proposals to define terms and goals, standardize the gathering of data and defining criteria to validate and to discriminate groups, as well as to determine the sampling effort design.

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HABITAT OVERLAP BETWEEN ANDEAN BEAR AND PUMA IN PERU

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Since the last 4 years, a study was carried out on the interaction and habitat use by the andean bear (*Tremarctos ornatus*) and puma (*Puma concolor*). The study area included the dry forest of the Laquipampa Reserved Zone (Lambayeque, Peru), the mountain rainforests of the Yanachaga Chemillén National Park (Pasco), Megantoni Reserved Zone (Cuzco) and Manu National Park (Cuzco and Madre de Dios), and also the puma habitat in Manu National Park.

Laquipampa was studied during December, 2002 (raining season). A distance of 5.4 km between 1,270 and 1,630 m. of altitude was evaluated, finding signs of both species, with a relative abundance (RA = number of records per Km) of 3.89 for Andean bear and 0.19 for puma. The minimal distance among the signs of both species was 10.5 m. The signs of andean bear were mainly food leftovers of terrestrial bromeliads, whereas for puma were scratches in tree trunks.

Yanachaga Chemillén was studied during March, 2005 (transition between raining and dry seasons). A total distance of 6.5 Km. between 1,124 and 2,014 m. of altitude were evaluated. The RA of andean bear was higher than in Laquipampa, 11.54 and for puma was 0.46. Likewise, we found in two occasions old and fresh signs of andean bear and puma in the same tree, at 1,830 m. of altitude. The majority of andean bear signs were shelters, scratches and food leftovers of Cyclanthaceae and Arecaceae; and for the puma signs were scratches for climbing.

Manu was studied during May, 2003 (dry season). A distance of 4.0 Km. between 3,330 and 3,472 m. of altitude were evaluated. The RA for andean bear was 4.25 and for puma was 0.50. The minimal distance among the signs of these species was 15 m. The signs of andean bear were principally food leftovers of terrestrial bromeliads, whereas the signs for puma were scats.

Megantoni was studied in May, 2004 (dry season). A distance of 3.0 km between 2,107 and 2,138 m. of altitude were evaluated. The RA of andean bear was 0.98 and for puma was 0.33. The records of andean bear were food leftovers of Pteridophyta and Poaceae and for puma tracks. The minimal distance among the signs of these species were 1,150 m.

The results of this study showed that in all the evaluated areas a higher prevalence of signs and RA for andean bear than puma. This is maybe due to the facility to find signs of andean bear, since they are mainly food leftovers, are easy to be register, unlike the puma, that for being a strict carnivorous, leaves more inconspicuous evidences. Nevertheless, on the basis of the closeness of the signs found it is possible to suggest that both species use the same paths; and in the special case of the Yanachaga Chemillén National Park, even the same trunks to mark their territory.

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ATTACK OF THE ANDEAN BEAR TO THE CATTLE AND FARMS IN PERU

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With the intention of compiling information on the attacks of the Andean bear to the cattle and their entrance to the farms, 16 protected areas created to protect this species were visited between 2001 and 2005, interviews were made to communities inside or adjacent to this protected areas. The visited areas were: Wayllabelén and Huamanpata (Amazonas), Huascarán (Ancash), Cutervo (Cajamarca), Megantoni and Machu Picchu (Cusco), Manu (Cusco and Madre de Dios), Calipuy (La Libertad), Chaparrí and Laquipampa (Lambayeque), Yanachaga Chemillén and San Matías-San Carlos (Pasco), Alto Mayo (San Martín), El Sira (Ucayali, Pasco, San Martín and Loreto), Tingo María (Huánuco) and Ampay (Apurímac). Nevertheless, in the last two areas, we did not find any sign of the presence of the Andean bear, this finding was also confirmed by the local people, who said that for several years they have not seen signs of Andean bear around those areas.

A total of 200 interviews were made in the 14 areas with presence of Andean bear, 11 areas reported that the attack of the Andean bear to the cattle happened at least once. The protected areas that did not report any attack were Megantoni, San Matías-San Carlos and El Sira. Among the types of cattle attacked by the Andean bear, the bovine presented the 56% of the attacks, the ovine, goats, pigs and equine had 10.5% of the attacks each one. With respect to the cattle, the 58.8% of the people indicated that the bear attacked adult individuals and the 41.2% bull calves. Nevertheless, most of these attacks happened more than 10 years ago (80%), when the forests were less deforested. The 83.3% of the bears that attacked the cattle were hunted, this is because the farmers followed the tracks left by the bear when they hauled their prey. In their majority, the bears hunted were male adults, nevertheless, in Cutervo there is a report of a female with cub and in Manu and Machu Picchu two reports of females without cubs. In many cases the bears took their prey towards a platform built with branches, on a tree, to eat the prey there.

With respect to the entrance to the farms, 8 protected areas reported at least one case. The exceptions were Megantoni, Alto Mayo, Chaparrí, Calipuy, San Matías-San Carlos and Wayllabelén. Among the crops, most important it was the corn with the 61.5% of the cases, but also the sugar cane plantations reported (15.4%), pumpkin, avocado, and custard apple (7.7% each one). With respect to the entrance into the corn fields, we got reports of up to 10 individuals eating together in Yanachaga Chemillén and of 8 in Machu Picchu. These individuals were cubs, male and female adults and even lactating females with their cubs, all this information have been verified with the skins of the bears hunted. These entrances took place mainly between the months of March to July, months of the year where the corn is ready to harvest and mainly between 5:00 A.M. to 7:00 A.M. and between 4:00 P.M. to 6:00 P.M.. If the bears feed on immature corn this always cause the bears to vomit it. This it is the main reason why people hunt the Andean bear, because they see the bear as an animal prejudicial to their farms. The frequency of entrance into the crop fields at present is very high, this is because the farmers use the areas near to the forest to sow their plantations.

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RATE AND PATTERN OF EXPANSION OF THE BROWN BEAR FROM SLOVENIAN BORDER TO THE INNER ITALIAN ALPINE AREAS

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The Friuli Venezia Giulia is a border region between Italy and Slovenia. In the late sixties some individuals of Brown bear start to diffuse from Slovenia into the Italian Carst, the Prealpine and Alpine areas. The dispersal has carried out until the late 1990s and now seems to be reduced; in the meanwhile, the bears seem to establish in few areas of Friuli Venezia Giulia. The aim of the work was to study the intensity and the pattern of the Bear spreading out and the relationship between the ecological features of Natura 2000 network sites and the presence of the brown bear.

For a 35 years period (from 1968 to 2003), the distribution of signs (scats, tracks, predation,..) of Brown bear presence (n=332) were observed. Each event was geocoded on 1:25,000 map. The linear regression among the yearly mean value of Latitude and Longitude and the extreme Latitude (Southern) and Longitude (Western) values over the all period were evaluated. To evidence the areas where the apparent presence (Hot spots) of Brown bear is exalting a Cluster analysis was performed. For each cluster of signs of presence were estimated the average date (year), the seasonal presence, and indicated the centroid and the polygonal areas (Minimum Convex Polygon, MPC - Mapinfo®); the circular areas with 5 km e 10 km of radius from the centroid were also created. The centroids and the different areas have been overlapped with pSCIs (the proposed Sites of Community Importance - Council Directive 92/43/EEC, known as the Habitat Directive).

The average Latitude moves from North to South of 799 ($\pm$229) m/year (R^2=0,37, F=12,21, D.F.=21); the average position comes back to North after 1997.

The average Longitude shifts from East to West by 1183 ($\pm$281) m/year (R^2=0,46, F=18,15, D.F.=21) with an accelerating phase of 5404 ($\pm$949) m/year (R^2=0,82, F=32,39, D.F.=7) from 1992 to 2000; afterward the average position goes back to East.

The extreme Latitude of signs, moves from North to South, with a rate of 1771 ($\pm$416) m/year (R^2=0,46, F=7,52, D.F.=21) and an accelerating phase of 4923 ($\pm$1327) m/year (R^2=0,66, F=13,75, D.F.=7) from 1992 to 2000; from the year 2000 after the extreme position moves back to North.

The extreme Longitude moves from East to West, with a rate of 3,108 ($\pm$379) m/year (R^2=0,76, F=67,07, D.F.=21) and an accelerating phase of 8,681 m/year ($\pm$1,782) (R^2=0,77, F=23,74, D.F.=7) even from 1992 to 2000; after year 2000 the extreme position comes back to East.

The Cluster analysis (pseudo t2=30,0, R^2=0,97) discerns 12 areas (MPC), with an average surface of 12.908 ha. All the 12 areas (MPC) overlap pSCIs (n=20); the pSCIs extend over an average of 28% of that of MCP (2%-43%) and two centroids drop inside a pSCI. The areas with 5 and 10 km of radius are partly covered by pSCIs for the 18% and 15% of their extension, respectively. The clusters are manly distributed along two expansion lines, from East (1990) to West (1998) along the Northern Alps (2,273 m/year), and from the North-East (1995) to South-West (1999) on the Prealpine area (9,528 m/year).

During year 2004 Brown Bears went all over 9 clusters only, the Eastern ones; the presence of female with cubs was merely recorded inside two clusters.

The seasonal presence of all bears and of that of females with cubs support a permanent establishment in the 4 Eastern cluster.

The expansions of Brown Bear towards the Western Alps has shown an evident increase along with a growth of the Slovenian population which followed the Decree of the protection of endangered animal species in 1993. The trend was broken in from year 2000, when in Slovenia a higher hunt pressure was applied according to a different hunting plane. The direction of expansions of the brown bear mutated with time; during a first period (1970-1990) was the Northern Alps were preferred; more recently (from 1992) a weighty and faster move is observed towards the Prealpine area. The establishment of the Natura 2000 Network seems to have played a relevant role in supporting the expansion and the resettlement of the Brown Bear, mainly in the Prealps. From now, the agreement between Slovenia and Italy to support an integrated management plan is required to preserve the Brown Bear residence in our Region.

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MULTISCALE HABITAT RELATIONSHIPS OF BROWN BEAR IN THE NORTH-EAST OF ALPS - FRIULI VENEZIA GIULIA REGION

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The hair trap is one of the most recent promising non invasive methods used to study the Brown Bear (*Ursus arctos*) behavior. This sampling technique, followed by the DNA analysis, helps out in assessing size and structure of a population and its use of habitat resources. The correlation between some geographical and vegetational characteristics and the presence of Brown Bear in the Alpine and Prealpine areas of Friuli Venezia Giulia were studied, at different scale. In the area lives the extreme western moiety of the Dinaric bear population; some female with cubs are also present. In 2004, over 54 hair traps randomly distributed along 12 transects (2-4 km long) lying on 12 quadrants of 10 km^2 have been studied in two different seasons: spring (from May to July) and fall (from September to November). Traps, baited with fish, were biweekly renovated and checked; they were considered positively inspected if at least a sample of Brown Bear hair was found in the wire. Measures, on shield and shafts, from 9 known species have been taken (*Bos taurus, Meles meles, Felis silvestris, Lynx lynx, Canis familiaris, Felis catus, Apodemus spp., Ursus arctos, Ovies aries*) to distinguish the brown bear hair, using discriminant measures, from digital photos (software ImageJ). For each trap three dependent variables have been considered: the absolute number of visits (T) (T=n) and two specimens of classes of visits divided according the following criteria: the sites were divided into two classes (TUX) (visits $\geq$2, TUX=2; <2 visits, TUX=0) and in three classes (TU) (0 visit, TU=0; 1 visit, TU=1; $\geq$2 visits=2, TU=2). For each hair trap, within a radius of 25 m, we recorded some forestry (three different layers of cover, presence of dead wood, management type, density of trees, % of different main component of vegetation) and geomorphologic (elevation, exposure) parameters as well as food available (presence/absence of nuts, beech, ants, berries, etc…). Furthermore Corine Landscape Cover classes has been located within two different radiuses: 100 and 500 m. To portray the behavior of the Brown Bear, 10 infrared cameras were associated at turn with as many hair traps, for periods of 15 days each (a total of 150 trap/day). Data concerning bear's visits have been combined with the tracks founded along transects. Forestry and morphological parameters, Corine cover and food allowance have been related to the trap success (bear visiting the trap) and number of visits (T, TU, TUX) by stepwise regression, separately for spring and late summer-fall. By analysis of variance only the areas of the cuticolar cell of shaft was significant different from the other species. The stepwise discriminant analysis, on shafts, showed the importance of length of hair, the diameter of hair and medulla,

circularity and areas of cell. For the shield were the diameter of hair and medulla, length of hair, minimum best fitting ellipse axes, circularity. Brown Bear diversely came over the hair traps during the two seasons, some traps used in spring were not during fall. Even from tracks and photos came out that sometimes the Brown Bear moves nearby hair traps avoiding to drop in. As a consequence no evidence for a "conditioning effect"; anyway the option with three variables (T, TU, TUX) were adopted to overlap the eventual "conditioning effect". The results for spring were: 0 visit(v)=36 traps(t), 1v=14t, 2v=1t, 3v=1t, 4v=1t, 5v=1t, and as to fall: 0visit=31 traps, 1v=16t, 2v=4t, 3v=3t. Using regression data from spring, it is possible to identify the positive effect that the forest of intermediary age has towards all the dependent variables (regression for T, R^2=0.31, Cp=277, parameters selected 4). Two Corine classes (level 3) present within 100 meters of radius from the trap were correlated with the classes of visits; the "bare rock (3.3.2)" positively for TU (R^2=0.48, Cp=126, parameters selected 7), the "land with agricultural and natural vegetation (2.4.3)" negatively for TUX (R^2=0.53, Cp=199, parameters selected 7). During fall, in all three regressions considered, was evident: the positive effect of allowance of nuts and presence of watercourse and the negative effect caused by the presence of old forests, herbaceous associations and riparian woodlands. The same Corine class exerts a different effect depending upon its distance from the trap (radius). The regression for T of Corine classes (R^2=0.71, Cp=10.9, parameters selected 15) and TUX (R^2=0.49, Cp=2.8, parameters selected 9) showed the negative effect of the "broad leaved forest (3.1.1)" at 500 meters radius scale, but the positive one at 100 meters. An opposite trend (negative effect at 100 m positive at 500 m) has been observed in the case of "transitional woodland shrub (3.2.4)" and of "land with agricultural and natural vegetation (2.4.3)" for TU (R^2=0.63, Cp=19.4, parameters selected 14). The Brown Bear shows a multiscale use of habitat, more evident during fall, but with an apparent higher importance of the small scale. The effectiveness of hair traps technique depends upon the "success of visits", which is differently influenced by land cover and food allowance.

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HUMAN-CAUSED CHANGE OF WILDLIFE HABITAT POTENTIAL IN TANZAWA AND THE SURROUNDINGS

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In recent years human-caused change to wildlife habitats that leads to wildlife decrease and extinction has become an important concern. In my study area of nearly 40 ha in the Tanzawa mountains located in Kantou region, human-caused change of wildlife habitat, such as habitat fragmentation, is increasing the extinction risk of the Japanese black bear population (an umbrella species of the forests ecosystem). Based on the hypothesis concerning of the habitat scales of Japanese black bear populations within a habitat matrix, the Tanzawa mountains are one habitat patch and Mt.Fuji and Doushi mountains are neighboring habitat patches. Change of wildlife habitat potential in Tanzawa creates three changes: habitat decrease, habitat degradation, and habitat fragmentation & dissection. Habitat patch isolation is caused by the habitat decrease and habitat dissection. At the same time, habitat patch degradation is occurring. Thus, the two purposes of my study are to clarify the change of wildlife habitat potential in Tanzawa and suggest possibilities for future habitat conservation for human-cased habitat change. To examine the hypothesis, analysis was done of these three habitats changes. Indicators of habitat potential and suitable habitat potential and dissection were set according to the previous studies of the ecology of the Japanese black bear population's (Indicator species in Tanzawa wildlife). First, quantitative analysis based on GIS and topographical maps was done to clarify the three habitat changes. Second, qualitative analysis was done based on literature analysis of forest management and land utilization to clarify each human factor. The results showed that total forest area as wildlife habitats increased from 1930 to 1995 because of forestation on barren lands

(Kayaba) in the mountain surroundings and natural restoration after the Great Kantou Earthquake (1923) on the central mountains. However, deciduous forests suitable as habitats decreased after 1945, because of clear-cutting in the surroundings and the heart of the mountain. Especially in the Yoduku area of national forests located in the heart of Tanzawa, natural old growth forests were clear cut and this practice has continued from 1960 to 2003. Thus, habitat degradation was confirmed. The percentage of road area increased from 1945 to present because of sightseeing in the surroundings, clear-cutting of central forests and economic development of mountain villages. Thus, habitats dissection was confirmed. In conclusion, change of wildlife habitat potential in Tanzawa constitutes habitat degradation and dissection. Especially, since 1945, human-caused habitat change has been enormous. Thus, increasing habitat quality and networking is required for the future.

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NON-INVASIVE GENETIC STUDY OF BROWN BEAR (*URSUS ARCTOS*) IN CANTABRIAN CORDILLERA

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Brown bear (*Ursus arctos*) is one of the most endangered specie of the Iberian fauna, and is registered in the Endangered Species National Catalogue on the "In Extinction Risk" category (R.D. 439/1990, March 30th).

Main threatens are both the low individual number (100-130) and population fragmentation into three nuclei: two in Cantabrian Cordillera and one in Pyrenees.
Population decrease and nuclei isolation causes have been explained by habitat lose, hunting and poisoning. However, it has not been in account intrinsic factors like variability parameters and inbreeding, and the role of them on the viability of each nucleus has been subestimated.

Moreover, low individual number prevents population studies by bear capture to issue extraction or to radio-tracking projects.

Goal of this work was the genetic characterization of eastern Cantabrian brown bear nucleus to provide suitable tools for its conservation. We estimated variability parameters and size population, calculated sex-ratio and movement of some individuals was described.

To do it, DNA was extracted from feces and hairs collected in the field when bears were out of the area. Ten brown bear specific microsatellites were analyzed; these markers are highly variable and have been used in other brown bear populations successfully. Gender determination was carried out used the SRY gene, present in the Y chromosome of the mammals.

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EVALUATION OF MEDETOMIDINE/KETAMINE COMBINATION FOR CHEMICAL RESTRAINT OF CAPTIVE AND WILD BROWN BEARS

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In Abruzzo area, South-Central Italy, survives a small population of brown bear described as subspecies (*Ursus arctos marsicanus*) by Altobello (1921) and isolated since 400 years ago from the other bears (*Ursus arctos*) still present in Europe.

In 1990, a radio telemetry plan was activated as part of a study on ecology and population dynamics; so a safe and effective immobilizing agent was required to capture and handling the bears.

Preliminary field trials on free ranging and captive bears was conducted using different associations (Gentile *et al*., 1996). We preferred to continue the experimentation using the medetomidine HCL (Domitor, Centralvet) and ketamine HCL (Inoketam, Virbac) combination, especially for the use of atipamezole (Antisedan, Centralvet), an injectable antagonist.

Between November 1993 and November 1997 a total of 63 chemical immobilisation were done on Brown bears: 8 in nature on 5 wild marsican bears captured with Aldrich foot snare and 55 in captivity on 7 captive bears (4 marsican brown bears and 3 brown bears) darted directly without the previous use of traps.

We checked the bear immobilization status by orbital and ear reflexes; in case of reaction to these stimuli (head movements) a further dose was given. Each bear was sexed, measured and weighted; wild bears received plastic ear tags and trasponders and were fitted with a radio tag.

We collected a first pre-molar tooth for aging in wild marsican bears. During handling heart rates, respiratory rates and rectal temperatures were recorded for all animals every 30 minutes.

This paper give information on the effective dosage of medetomidine/ketamine (MH-KH), and its subsequent reversal with atipamezole (AT), for safe immobilization of wild and captive brown bears.

A t-test in combination with a f-test was used to determine the statistical differences among the various parameters analysed (induction time, anesthesia time and reversal time; rectal temperature, respiratory and heart rates) in the different groups of immobilization (subspecies, captivity, nature, age class) at the significance level of 0.05.

In 63 immobilization with the Medetomidine/ketamine combination there haven't been deaths, but there have been anaesthetic emergencies in 4 cases; we report the situations and related solutions.

Finally we report the management considerations to obtain an effective and safe anaesthesia to capture and handling brown bears using MH-KH and related reversal with AT.

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94 – poster

COST OF LOCOMOTION BY KENAI BROWN BEARS: APPLICATION OF GPS COLLECTED LOCATION DATA AND DIGITAL ELEVATION MODELS

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We used bear locations obtained with global positioning system collars and digital elevation models to examine whether cost of locomotion (COL) correlates with reproductive status and reproductive success in brown bears on the Kenai Peninsula in Alaska. Estimates of mean hourly distance moved increased slightly when elevation was incorporated into distance estimates, but decreased when locations were sampled at less frequent time intervals. No statistically significant differences were detected among bears of different reproductive status, reproductive success, or landscape inhabited. Our estimates of COL (1,656 kcal/ day) are around 10% of daily caloric intake for active bears. Thus, the influence of COL relative to overall metabolic costs may still be important. Research on how COL is affected by the topography is necessary.

95 – poster

THE UTILITY OF CARBON AND NITROGEN ISOTOPIC ANALYSES IN ESTIMATING DIETARY PATTERNS OF BLACK BEARS IN YOSEMITE VALLEY, YOSEMITE NATIONAL PARK, CALIFORNIA, USA 2001-2003

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Information on food habits of black bears in Yosemite National Park is important to Park managers. Human food has long served as a common denominator in human-bear conflicts, and substantial Park resources have been dedicated to limiting its availability to bears. I used fecal analysis to estimate food habits of bears in Yosemite Valley in 2001-2002 and found the proportion of human foods in bears' diets was reduced by 77% from figures reported in the late 1970's. While this information is encouraging, it provides only a population-level assessment without information on individual bears. Such individual-level information would be valuable to wildlife managers seeking to target specific animals for behavior modification or removal from the population. The utility of using stable isotopes of carbon and nitrogen to estimate the dietary patterns of individual bears in Yosemite Valley was investigated in this study.

Major plant foods consumed by black bears in Yosemite Valley were determined through fecal analysis, collected, and analyzed to develop an isotopic 'baseline' of natural forage items. Hair was collected from 21 adult and 4 subadult bears in and around Yosemite Valley during capture events, and isotopic ratios were measured using mass spectrometry. Bears were classified as 'food-conditioned' and 'non food-conditioned' based on their tendencies to frequent or avoid human-dominated areas of Yosemite Valley in 2001-2003, as determined through analysis of radio-telemetry data.

After applying a fractionation correction factor of 6.0‰ to carbon ratios, the mean carbon isotopic ratios of bears and their diet items differed by only 0.02‰. This difference was found to be insignificant, indicating either an imprecision in using carbon to trace dietary items, or an agreement

between the diets of bears and natural forage items in Yosemite Valley. A review of the literature suggests that the trophic level shift of carbon isotopic ratios from producers to consumers may be variable enough to confound the use of this element in tracing dietary items. Isotopic ratios of nitrogen indicated two distinct groups of bears in Yosemite Valley, those that were classified as 'food-conditioned' and those classified as 'non food-conditioned'. These results indicated that bears frequenting human-dominated areas of Yosemite Valley consumed greater amounts of animal protein than bears avoiding such areas. Multiple logistic regression demonstrated that nitrogen is an important variable in predicting management status of bears in Yosemite Valley. The best model according to Akaike's Information Criteria (AICc for small sample size) included the variables: age, gender, nitrogen ratio, and carbon ratio of individual bears. Park managers were encouraged to further investigate the use of nitrogen isotopes in targeting specific animals for management actions, such as aversive conditioning practices or removal of individual bears.

96 – poster

DISTRIBUTION AND SITUATION OF THE BROWN BEAR (*URSUS ARCTOS*) AND THE ASIATIC BLACK BEAR (*U. THIBETANUS*) IN IRAN

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A few years ago the status of the Brown Bear (*Ursus arctos*) and the Asiatic Black Bear (*Ursus thibetanus*) in Iran was almost unknown. With two Bevins Grant Award Projects on behalf of the International Association for Bear Research and Management IBA with additional financial contribution from CANOPY it was possible for the authors to collect data from Iranian sources and to visit about 75 % of the possible area of this two bear species in Iran in overall 3 month field work between 1997 and 2004.

BROWN BEAR (*URSUS ARCTOS*)
In 1990 it was estimated that only small numbers of Brown Bears may have remained in the Zagros and Elburz mountain ranges. However, the present status was unknown. Especially in protected areas the recent situation of the brown bear is much more promising. The core areas for Brown Bears are Protected Areas in general, especially the Golestan National Park east of the town Gonbad-e-Kavus, Protected Area Jahan-Namah and Wildlife Refuge Dodangeh south of the town Gorgan, the Wildlife Refuge Kosh Yeylagh southeast of Gorgan, the Protected Areas Central Elburz and Lar north of Tehran in the Elburz mountains, the Protected Area Arazbaran in the Caucasus at the border area with Armenia, the Protected Area Oshterankuh south of the town of Khorramabad, and the Protected Area Dena between Shiraz and Esfahan, in the Zagros mountains.

Taking in account the long distances between the core areas for bears in Iran, density of human population, migration obstacles like high mountains, deserts etc. and last but not least the vegetation it seems justifiable to speak of three distinct brown bear populations in Iran: the Elburz population (1,300 +/- 300 bears on about 19,000 km²), the Azerbaijan or Caucasus population (max. 100 bears on about 3,500 km²) and the Central Zagros population (max. 100 bears on about 5,000 km²). Exchange of individuals within these populations is not very likely, even the two Central Zagros core areas seem to be only connected by occasional migrating individuals.

The Brown Bear is protected by law and "Haram" (forbidden to eat for Muslims); nevertheless, they are sometimes killed by poachers or by farmers when they attack sheep or goats.

In regard of the small and less productive habitat and small number of bears together with a certain degree of isolation and therefore risk of inbreeding over the long term the Caucasus and Zagros population is classified as vulnerable, whereas for the Elburz population no actual risk can be seen.

ASIATIC BLACK BEAR (*URSUS THIBETANUS*)
The Asiatic Black Bear was thought to have become extinct in Southeast Iran in the late 1960's, but was "re-discovered" in 1973. In 1975, scats, hairs and bones of Black Bears were found in a cave on the northern slopes of the Sarbaz mountains, together with fresh tracks of a female with a cub. In 1983, tracks were found near the River Kaju. In 1985, a young Black Bear was captured on the mountain Kushad, north of the town Ghasr-e-Ghand, and in the spring of 1986, a one month old cub was captured by a poacher on the Ahuran mountain north of the River Kaju. All these records are from the Sarbaz mountains – Makran range (Southeast Iran). Former known to occur in nine areas in the provinces Baluchestan (mountains of Sarbaz, Zaboli, Geserghand and Birk), Hormozgan (mountains of Beshagard) and South Kerman (mountains of Gebal Bares, Dolfart, Bahre Azeman and Kochnutsch) within this project Asiatic Black Bear presence could also only be proofed in this Sarbaz mountains in the Province of Baluchestan. A small part of the province Homozgan and especially Kerman could not be checked because of the big earthquake there in November 2003, but it's very unlikely to find bears there. The present Asiatic Black Bear range is about 20,000 km² where 30 – 50 individuals have survived in the remaining forested areas and near permanent water supplies. They feed on buds of the Mazari palm (local called Daz) (*Nannorrhops ritchiana*) and insects and agricultural products like olives, figs, dates and sometimes goats. This leads to conflicts with the Baluch people, but the bear meat is of no value ("Haram" - forbidden to eat for Muslims) and they have rather positive attitudes towards bears. They never directly hunt the black bear but they sometimes shoot one if they observe him killing goats and when they have guns with them and sometimes capture cubs and keep them for some month as a pet.

This westernmost population of *Ursus thibetanus* is endangered or even critically endangered due to the low number of individuals in a suboptimal habitat, under these circumstances even the rare illegal shots of bears might be too much.

97 – poster

REMOTE CAMERA MONITORING OF BROWN BEARS IN ASTURIAS

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FAPAS is involved in bear conservation and applied bear research in the Cantabrian Mountains in Spain since more than 20 years. Since 2001 we are using a system of permanently and temporarily installed remote cameras as a non invasive method to monitor the bear population in Asturias.

Since the early 1990s Fapas is implementing a comprehensive bear survey in Asturias on the base of the transect method. This approach is still ongoing, but since 2001 combined with remote camera monitoring. The study area is covering the provinces of Cangas de Narcea, Somiedo, Belomonte, Proaza, Ibias and Ponga in Asturias. In the study area up to 12 cameras are used at the same time. The sites for setting the remote cameras were selected on the base of the knowledge gained through the transect monitoring and through accidental observations. Three different types of shutter release systems for the cameras were used: pressure-sensitive plates, motion detectors or infrared detectors. For the permanently installed remote cameras no attractants are used. In some cases remote cameras are temporarily installed at attractants like beehives or carrions.

The main objectives of the study are: estimation of bear abundance, estimation of the population size, identification of the number of females with cubs, identification of individuals through natural feature as pelage characteristics, identification of the state of individuals and the population, describing the behaviour of individual males and females especially in the mating season, identification of the importance of carrions as a food resource.

One example: in the area of Proaza with a size of 15,000 ha we detected eight different bears with the combination of transect and remote camera monitoring from April 2004 to May 2005. One of them is a female with two cubs born in 2004. The precise knowledge where the female with cubs is present, enabled us to prevent wild boar battue hunting in that area. With the camera monitoring we identified in the area of Proaza two different females followed directly by males in spring 2005. One could assume that in winter 2006 these females will give birth.

Remote camera monitoring is a valuable complementary method to transect monitoring. It allows to identify precisely the numbers and locations of females with cubs. Remote camera monitoring enables to detect bear movements and behaviour and it is the base for conservation decisions such as the prevention of wild boar hunting in areas where females with cubs are present. If negative physical conditions of individual bears are identified by camera monitoring one could think about offering temporary some supplementary nourishment.

98 – poster

EFFECTS OF AUTUMN FOOD AVAILABILITY ON REPRODUCTION BY FEMALE ASIATIC BLACK BEARS

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The effects of nut production on reproduction by female Asiatic black bears (*Ursus thibetanus*) were examined in the Pacific and Japan Sea forest types. In the Pacific forest type, beech forest is composed of various species and acorns of *Quercus crispula* are the most important autumn food for the Asiatic black bear, whereas nuts of *Fagus crenata* and *F. japonica* are less important.

We examined the effects of the abundance of nuts of the three tree species on female reproduction in the Chichibu Mountains, an example of the Pacific forest type. The logistic regression analysis showed that the probability of parturition of female bears was marginally correlated with nut production by *Q. crispula* ($G^2 = 4.67$, $df = 1$, $P = 0.056$), but not significantly correlated with the production of nuts by *F. crenata* ($G^2 = 2.88$, $df = 1$, $P = 0.11$) or *F. japonica* ($G^2 = 0.05$, $df = 1$, $P = 0.82$).

In the Japan Sea forest type, beech forests are usually composed of only beech *F. crenata,* and the nuts of *F. crenata* were the staple autumn food while acorns of *Q. crispula* were alternative foods for the bears. The number of newly born cubs was estimated by assuming a constant mortality rate and by using the age-specific number of bears that were control-killed in northern Gunma Prefecture. The number of cubs was positively correlated with nut abundance in Yamagata Prefecture at a survival rate of 0.80 ($R^2 = 0.685$, $P<0.05$), and marginally correlated with nut abundance at a survival rate of 0.90 ($R^2 = 0.510$, $P = 0.07$).

Thus, the most influential foods for reproduction by female bears differed between the Pacific and Japan Sea forest types.

99 – poster

MCNEIL RIVER BROWN BEARS: USING LONGITUDINAL DATA TO EXAMINE DEMOGRAPHIC CHANGE

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The primary management purpose for McNeil River State Game Sanctuary (MRSGS) is to protect and maintain the seasonal population of brown bears (*Ursus arctos*) that uses the area. Until recently there were no formalized guidelines for quantifying acceptable population levels or specifying management actions to take to address changes. Although salmon runs at MRSGS are heavily utilized by bears as well as subject to commercial fishing, there has never been a specific allocation of salmon for bears. Managing on salmon escapement basis alone without monitoring the ursine population and its use of this resource may have implications well beyond the commercial fishery. Annual observations at MRSGS suggest that overall bear use of the area has declined over the last decade, after increasing in the late 1970s and through most of the 1980s. As part of a study in which I examined chum salmon (*Oncorhynchus keta*) consumption by bears at MRSGS, bears were observed, identified, and classified (gender, age class) during summers from 1976 through 2003. The overall number of bears using MRSGS has doubled in 28 years, although ratios of different classes have changed. In particular, the

ratio of adult females to adult males has declined 14% over the period of these observations. I discuss changes in the different classes of bears and their implications for MRSGS management.

101 – poster

EVALUATING SPECIFIC ECOLOGICAL CONDITIONS AROUND THREE TYPES OF BLACK BEAR DENS IN NORTH-CENTRAL BRITISH COLUMBIA

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We examined American Black Bear dens in north-central British Columbia, Canada to determine specific site ecological conditions that might influence den site selection. We examined samples of excavated (n=15), rock cavity (n=15) and tree (n=8) dens. At each site we collected ecological information that consisted of the following; slope, aspect, vegetation type, elevation, forest age, slope position, site series, forest disturbance, soil type, and bedrock type. We sought to determine if bears selected different types of dens under different ecological conditions. Dens were located using a variety of field techniques including spring backtracking, local aboriginal knowledge, reports from forestry field crews, and field reconnaissance surveys. When locally available, we found that bears appeared to select rock cavities and tree dens while in areas where these conditions were not available bears selected excavated dens. Rock cavities and tree dens are more permanent features on the landscape and black bears are known to reuse these at a higher rate than excavated dens. We make recommendations to resource managers to consider these ecological conditions a priority for management.

102 – poster

EFFECT OF CRUDE FIBRE ON THE NUTRITION OF CAPTIVE MALAYAN SUN BEARS (*HELARCTOS MALAYANUS*) – PRELIMINARY RESULTS

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Captive sun bears tend to be permanently obese. The weight of captive animals range from 50 to 123 kg with the majority above 65 kg whereas weight data of wild bears between 27-65 kg are reported. Obesity is most likely a result of the low level of activity performed by captive individuals and in particular of differences in quality and quantity of zoo diets compared the diets in the wild. The main source of energy for wild sun bears are tropical fruits, which contain a much higher amount of fibre but less soluble carbohydrates than the domestic fruits regularly fed in zoos. Under natural conditions mast periods characterized by high abundance of energy rich and low fibre fruits are brief. Fibre, which is indigestible for monogastric species like bears, is thought to decrease nutrient and energy digestibility. Thus diets high in fibre should decrease the assimilation of energy and should result in weight reduction. In the course of a study on sun bear nutrition and nutrition related diseases in captivity the effect of dietary crude fibre on digestibility and weight development in captive sun bears was investigated. The crude fibre content was increased from 12% (DM) which is typical for zoo diets to 30% (DM) which approaches fibre content of diets in the wild.

Food consumption, nutrient intake and the body weight of four adult female sun bears - twins with their daughters - kept on individually adjusted maintenance diets, was recorded during a period of 10 months in 2003/04. During this time the crude fibre content of the diet was varied systematically (12%; 20%, 25%, 30%) by adding a crude fibre concentrate. In summer 2004 a four weeks "mast period" was included mimicking the natural situation with respect to sugar and fibre content of typical mast fruits. The diet consisted of fruits and vegetables and dog pellets. The fibre was added to a curd cheese gruel, which was offered three times a day. Each individual received simultaneously a colour marker to identify the faeces. After at least one week of adjustment to each new crude fibre level a sampling period of seven days followed. The intake of main meals was recorded by weighing the offered food and the leftovers individually. The intake of scatter feed items was estimated for each individual. The faeces of each individual were collected. The nutrient content of food and faeces was determined by Weende analysis.

Results of food digestibility with increasing fibre content, individual energy intake and the weight development will be presented. Energy intake and weight development differed considerably between the individuals despite the same keeping conditions and close genetic relatedness. Potential causes for the individual variation and its consequences for designing diets in captivity will be discussed. The digestibility results will also be discussed with respect to diet quality in natural habitats.

104 – poster

WOUND HEALING IS A PRIORITY FOR THE DENNING BLACK BEAR

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Black bears (*Ursus americanus*) can remain in their winter dens for 5–7 months and during this period of time they: 1) are mildly hypothermic, 2) do not eat, drink, urinate or defecate, but 3) elicit profound abilities to resolve injuries. During 1999–2005, we observed and investigated the abilities of free-ranging overwintering black bears (in Colorado, Wyoming and Minnesota, USA) to respond to foreign bodies and/or resolve wounds. In animals found to have varying degrees of cutaneous injuries in early denning, all were observed to be totally resolved several months latter. In planned studies employing cutaneous incisions or punch biopsies, sites that were closed with Dacron sutures elicited greater inflammatory responses than those left to resolve on their own. All sites healed with remodeling of the dermal layers (including new hair follicles), reduced expression of scarring, and with limited regrowth of integumentary appendages (hair). The ability to resolve a wound that occurred before overwintering is a clear survival advantage for bears, as those unable to do so over the long winter period could suffer loss of body fluids, greatly increased metabolic demands, and toxicity from infection. Curiously, though, bears are the only overwintering/hibernating mammals known to possess this adaptation. We speculate that their greater mass, higher body temperature, and adaptation to winter birthing (which itself requires wound healing) contributes to their unique overwintering wound healing abilities. Insights gained from studying the wound healing abilities of hibernating bears may provide new insights or even new biological materials for treating wounds in humans, especially those who are malnourished or hypothermic (e.g., diabetic patients with chronic ulcers, elderly).

105 – poster

DANCING BEARS PARK PROJECT, BELITSA, BULGARIA. A BROWN BEAR IN THE STREET OR IN THE FOREST?!?

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THE PROBLEM
Each living creature has senses and it suffers when they are hurt. Bears are not an exception. According to scientists they are among the most intelligent mammals abreast of apes and dolphins. Brown bear is a protected species by the law in Bulgaria. Unfortunately, this fact cannot prevent us – humans, from endangering their existence.

In the beginning of the 21st century, the precedent of "dancing" bear still exists.
Bear cubs are separated from their mother at 7-month age. After this they are subjected to cruel training. First step towards slavery is piercing of the nose and upper lip and fixing a ring with chain. Then the nails and cuspids of the bear cub are cut in order not to hurt his owner. Put on a hot iron plate, with his paws greased with Vaseline and under the sound of music, the animal "dances", trying to avoid the unbearable pain. Thereby, during his whole life, when the bear hears the sound of rebeck, he does these particular movements as reminiscence of previous pain.

According to modern science, "dancing" bear that has been living in an extrinsical environment cannot revert to its normal, wild life.

THE SOLUTION
DANCING BEARS PARK project is the logic solution of this problem. DANCING BEARS PARK is a long-term project, co-financed by VIER PFOTEN/FOUR PAWS and Fondation Brigitte Bardot that has several main goals:
To shelter all officially registered "dancing" bears and to provide the closest to nature living environment and professional human cares.
To raise social and political awareness of animal protection problems.
To habituate young people to positive attitude and interest in bears and animals in general.
To organize scientific seminars, symposiums, field observations and discussions on national and international level.
To create jobs in the region.
Our country to become part of the world struggle for animal right protection.

DANCING BEARS PARK is situated in South Rila Mountain, at 1,345 m above sea level, 11 km away from the Town of Belitsa and 180 km from the capital of Bulgaria – Sofia. It covers 120,000 m^2. It is constructed in accordance with the requirements of the latest scientific standards and in cooperation with world acknowledged experts studying behaviour and habits of brown bear. DANCING BEARS PARK offers to its inhabitants dense forests and hills for walk and seclusion, meadows and specially designed sunny places for rest, different in size and form pools and dens. By this way we can provide to bears environment and safe place that is closest to their natural habitat. Here for first time they can feel and demonstrate their instincts of wild animal and inborn behaviour that have been suppressed during their slavery. The park is the appropriate solution of the "dancing bear" problem and is a guideline for new projects in the field of animal protection.

106 – poster

KARYOTYPIC PROFILE OF INDIAN SLOTH BEARS (*MELURSUS URSINUS*)

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The display of chromosomes at the stage of cell division, mitosis, is and their banding patterns constitute karyotype of a species (Ref. 1). The number of chromosomes for any species for any species is specific and important for cytogeneticists. They use karyotypic alterations to detect chromosome abnormalities associated with inherited defects or with certain types of cancer that arise through the rearrangement of chromosomes in somatic cells and in establishment evolutionary relationship.

Sloth bear (*Melursus ursinus*) is an endangered species on the IUCN red list and protected under Schedule I of the Indian Wildlife Protection Act 1972. The habitat of the sloth bear which was once peninsular is equally endangered and is now fragmented into pockets. The species itself is under threat, causes of decline being poaching of bear cubs for dancing bear trade, bear baiting, poaching of adult bears for parts, habitat destruction etc) *(Ref: Report on Dancing Bears of India by Geeta Seshamani & Kartick Satyanarayan 1997)*. Agra Bear Rescue Facility was established as a conservation measure to address the poaching of bear cubs carried out in the garb of dancing bears. ABRF houses presently a total of 77 sloth bears (wild caught) rescued from precisely this trade.

Hard (1968) was the first author to study the chromosomes a female sloth bear; he found 2n=74. The comparative karyotypes of the Malayan sun bear, and some "related species", have recently been studied in some detail by Tian *et al*. (2004). As previous investigators, they found all Ursidae (except the South American spectacled bear with 2n=52) to possess 74 chromosomes, as was also published by Nash & O'Brien, 1987 and Nash *et al*., 1998). The present study being carried out in ABRF involves the setting up karyotypic profile of individual sloth bears housed in the facility, taking into account various parameters of comparison with other species of bears and specific banding patterns of individual chromosomes. The study will help to evaluate the shaping of unique history of seemingly random genetic events, acted on by selection pressures in the nature. There are instances of Hybrids amongst bears, and at maturity, they are mostly fertile (Kowalska, 1969 and Wurster-Hill & Bush, 1980). The sloth bear was listed to have made hybrids with a Malayan sun bear in Tokyo, and with an Asiatic black bear (*Selenarctos thibetanus*) (Gray, 1972; Asakura, 1969; Scherren, 1907). The study will be able to establish, and evaluate the gene pool of the wild caught rescued (sloth bears) individuals housed presently in the ABRF and investigate aberrations in the gene pool if any. This will be first study of its kind in India which will reflect the selection pressures in the nature and the direction of genetic drift.

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107 – poster

THE PROTECTION OF BEAR ON THE POLISH SIDE OF THE TATRA MOUNTAINS

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There are approximately 50 to 60 bears living in the Tatras, and it is a region where this kind of species has lived continuously. It is estimated that there are currently 12 to 17 bears living today on the Polish side of the Tatras. The Tatras National Part (1,200 hectares) is visited yearly by approximately 3 million tourists, and this is why the issue of bear synanthropisation has become a main concern in the protection of this type of bear.

Synanthropisation of animals was established in the early 1980's. From that time onwards this occurrence has been unremitting and with each year has continued to worsen. In 1998 a program for the protection of bears was initiated. This program is based on: monitoring the bears (in particularly the ones which have experienced synanthropised), experimentation with various methods of deterring bears from human settlements (inclusive of using rubber bullets), the organization of a system of collecting, gathering and removing garbage and the use of electric fences as a means of protecting from the bears buildings and garbage disposals. Since 2001, the use of rings has been employed in order to mark synanthropised young bears, as well as from 2002 a telemetry researches take place.

All of the above have helped to establish the extent of the territory where synanthropised bears live, typical behaviours of these bears as well as methods of protection and procedures of conduct. Currently the problem of synanthropised bears in the Polish Tatras is monitored, has been restricted to accidental incidents, and is under constant supervision.

108 – poster

TRANSPORTATION-RELATED MORTALITY OF BROWN BEARS IN SLOVENIA

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Problems related with negative influences of traffic on brown bears increased markedly during last 15 years in Slovenia. In order to mitigate them efficiently, several studies directed to gaining of background knowledge of this issue have been carried out. They showed that among all negative effects of traffic (e.g. habitat fragmentation, barrier effect) direct mortality of bears due to collisions with vehicles is probably the most important. Therefore the priority mitigation measure of mentioned problems in Slovenia is to diminish vehicle-collision-caused mortality of bears (e.g. by fixing electric fence along particular traffic axes). All past domestic studies analyzed only smaller areas. On their bases it was therefore - for the level of entire country - impossible to fix the traffic axes that should be mitigated first. That is why we analyzed spatial distribution of bears killed by traffic in the entire country in the present study. We also compared importance, gender and age structure of vehicle-collision-caused bear mortality with other sources of bear mortality. Present study analyses the period 1997-2002.

In this period at least 58 bears have been killed due to traffic accidents in Slovenia. That equals to 15 % of all registered cases of brown bear mortality. Frequency of traffic accidents with bears was increasing (Kendall's tau-b correlation r = 1**; n = 7) rapidly. In 1997 five bears have been killed, in 2002 fifteen. Traffic accidents with bears were un-homogenously distributed almost over the entire population range on bear in Slovenia. Hunting districts with at least one registered case of traffic accident with bear cumulatively cover more than 10 % of Slovenia. However there are only few districts with high density of traffic accidents. Their common characteristics are: 1) high density of high speed, high volume traffic axes (highways, motorways, railways), and 2) they are situated on the corridors between larger blocks of bear habitat. Among all the registered cases of vehicle-collision-caused bear mortality, 41 % took place on railways, 14 % on highways and 44 % on motorways and other roads; 68 % of killed bears were males. Share of males killed by traffic is larger than expected 50 % ($\chi^2 = 7.7$**; df = 1). Mean age of bears killed by traffic (23 months) is smaller than mean age of bears extracted by other causes like trophy and exceptional hunting, perished animals (Mann-Whitney U test; p = 0.044*; n = 245). Since younger males represent above-average share of bears that were killed by traffic, we believe that bears are more exposed for traffic mortality during their juvenile dispersal. The frequency of vehicle-collision-caused mortality of brown bears in Slovenia is probably increasing due to mutual effect of several factors: 1) increasing of density of transport axes and vehicles, 2) geographical expansion of bear population into the areas with higher density of traffic, 3) increased habituation of bears on human presence, and 4) increasing of bear population size. Because the magnitude of listed factors will likely not change in the future, we expect that frequency of bears killed due to traffic will continue to increase if proper mitigation measures are not carried out.

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MODELS OF COLLABORATION BETWEEN AGENCIES AND NON-GOVERNMENT ORGANIZATIONS TO REDUCE CONFLICTS BETWEEN BROWN BEARS AND HUMANS IN THE NORTHERN ROCKIES, USA

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Too often relationships between state, federal, and tribal wildlife management agencies and private conservation groups (non-governmental organizations or NGOs) and private landowners are characterized by mistrust and suspicion in all directions. This is unfortunate because the objectives of these groups are broadly similar. In this paper we present examples of cooperative projects that have used the combined strengths of 2 NGOs and government agencies that have provided tangible benefits to brown bears in the northern Rockies, USA. Increasing populations of brown bears creates a greater likelihood of conflict between bears and humans, often resulting in bear mortality. Our NGOs have cooperated in the purchase of bear-resistant dumpsters and containers for campsites, recreation areas, and rural communities to prevent bear habituation to garbage, we have acquired bear-resistant panniers for loan to guides and outfitters to enable them to keep a clean hunting camp, constructed "meat poles" at remote sites so hunters can hang their quarry or recreationists can store their food beyond the reach of bears; built electric fences around calving grounds or sheep bedding grounds to protect livestock when they are most vulnerable; erected permanent electric fence around beeyards with a history of damage by bears; provided financial incentives to livestock growers to move their sheep or cattle from public land allotments with chronic predation problems to areas with fewer predators; and created educational materials - like brochures and television ads - to provide guidance to residents on simple steps they can take to reduce their chances of having problems with bears. These projects have reduced human-caused mortality of bears and have increased local acceptance of brown bears by private landowners. NGOs can enhance bear recovery by building partnerships with agencies, corporations, landowners and other groups to prevent bear/human conflicts before they occur.

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HUMAN DIMENSIONS OF BROWN BEARS IN THE OSHIMA PENINSULA, HOKKAIDO, JAPAN

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In 1989, the local government in Hokkaido, Japan declared for changing its Brown bear (*Ursus arctos)* policy from one of extermination to peaceful coexistence of bears and humans. The change was embodied in a brown bear management plan for the Oshima Peninsula region, in southern Hokkaido in 2000. However, the plan has not necessarily been successful as far as involving the local people in the decision-making process and appropriating a sufficient budget.

In 2001, we conducted a mail survey for the local people, with the aim of making clear what needed to happen regarding bear management. The initial results were (1) 59% of the respondents overestimated human victims of bears, while 88% underestimated bear victims of humans, (2) although 31% were tolerant of the existence of brown bears, 30% were intolerant, (3) 55% entered forests with defensive preparations, but more than 40% without any, (4) the residents expected their local governments to encourage public education, enrich forests and implement a compensation program. These results

indicated that the people were being left with fear and hostility, without opportunities of being accurately informed or educated regarding coexistence with the bears. Further interviews with local people in 2004 suggested that the majority of them were unlikely to know the government's policies concerning bear management. In this context, public involvement, education and outreach should be top priorities of a comprehensive bear management policy.

In recent years NGOs including the Brown Bear Society (an Hokkaido group founded in 1976 dedicated to bear-management issues), have helped the local government with the implementation of projects such as the setting electric fences around borders of fields, supplying some parks with bear-proof dumpsters, mowing grass along roads and borders of residential areas, as well as developing an educational video. The Hokkaido government is expected to work with the local people and NGOs more closely to take further steps toward the peaceful coexistence of Brown bears and humans.

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MARKING BEHAVIOUR OF BROWN BEARS IN GREECE

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INTRODUCTION

The brown bear (*Ursus arctos*) is considered to be endangered in Greece and therefore understanding the behaviour of the species is of paramount importance when suggesting and implementing effective conservation measures. Marking and rubbing appears to be an important behavioural aspect of all bear species. The function however of and motivation for it, is still poorly understood and most hypotheses have not been tested extensively enough, so that no explanation currently seems to be satisfactory for all types of this kind of behaviour. The aims of the present study were to:

1. Estimate the temporal activity of marking and rubbing behaviour of brown bears (*Ursus arctos*) on natural (e.g. trees) and artificial objects (e.g. electricity and telephone poles)
2. Record preferences in the spatial distribution of artificial marking objects and create a predictive model that will enable the identification of bear-suitable habitat in Greece
3. Identify the gender involved in brown bear marking and rubbing behaviour in Greece

MATERIALS AND METHODS

The study area extended over approximately 1,000km^2 of a mixed forest and agricultural ecosystem in the prefecture of Grevena in northern Greece. Temporal marking activity was estimated through the selection of 65 electricity poles in May 2003 and their inspection once a month ever since. Temporal marking activity on natural objects was recorded through regular forest surveys throughout the same time period. In order to identify preferences in the spatial distribution of artificial marking objects an extensive sampling of 1,000 electricity poles was carried out from October 2004 – March 2005. Sampling was carried out according to a protocol developed by Karamanlidis *et al*. (2004), which was modified according to Kendall (pers. Comm. 2004) and Green & Mattson (1999, pers. Comm. 2004). A predictive model was created using logistic regression (SPSS 12.0 for Windows). In order to identify the gender responsible for the marking and rubbing behaviour, hair collected from the power poles was genetically analysed. DNA isolations were performed using the QIAamp DNA and Micro DNA Mini Kits (Qiagen). The SRY gene was used as a molecular marker and PCR-amplified using the primers and protocols described by Taberlet *et al*. (1997).

RESULTS AND CONCLUSIONS

Significant differences were found in the temporal occurrence of marking and rubbing behaviour on artificial as well as natural objects. Although this type of activity was recorded throughout the entire

year it occurred more often and with a greater intensity right before and after hibernation. There were also significant differences in the intensity and frequency of marking and rubbing behaviour between both types of marking objects. Analysis of the spatial data revealed increased marking activity on electricity poles located on game paths, with medium visibility and medium human disturbance. The model created, identified 60% of the poles sampled and 75% of the poles used for cross-validation correctly. Only 26 of the 65 samples collected, yielded enough DNA for further genetic analysis. All hair samples analysed were from male brown bears and appeared to originate from different individuals (Vittas *et al*. pers Comm. 2005).
The results of the present shed new light on the behaviour of the brown bear in Greece. They indicate furthermore the importance of using power poles as a tool in estimating distribution and abundance of the species in the country.

ACKNOWLEDGEMENTS
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112 – poster

EVALUATING LIVESTOCK DEPREDATION AND CROP DAMAGE BY BROWN BEARS IN GREECE

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INTRODUCTION
The effective conservation of endangered species depends to a great extent on public perception of the species. One of the main reasons contributing towards the often negative image of the brown bear (*Ursus arctos*) in Greece is the damage inflicted upon livestock and crops. The resulting human – bear conflicts are considered to be a major threat for the survival of the species in the country. Understanding the patterns of bear induced damage is the first step in resolving the problem. The aims of the present study were to:
1. Evaluate the temporal and spatial intensity and frequency of livestock depredation and crop damage in the country
2. Create a detailed damage profile for each municipality where bear damage has occurred and define bear damage zones in the country
3. Considering the present compensation system and management plans for the brown bear in Greece to propose specific actions that will contribute towards a better protection of the species in the country.

MATERIALS AND METHODS
We analysed all bear-damage claims that have been registered by the Hellenic Agricultural Insurances (ELGA) from 1998 – 2003. Upon arrival of such a claim, a qualified representative of ELGA carries out on site an autopsy and evaluates the claim. Information from the on-site autopsy and evaluation from all over the country are gathered at a central database at the ELGA headquarters in Athens. All non spatial statistical analysis were carried out using SPSS 12.0 for Windows. In addition, we

regarded the georeferencing of bear damage claims as a substantial part in the effort to draw valid conclusions on bear behaviour and damages prediction. Thus, bear damage claims were visualised in a Geographical Information System (based on ArcView 3.x (ESRI)) and connected to readily available hypsometric and Remote Sensing data (land cover) in order to draw typologies for the affected municipalities in the country.

RESULTS AND CONCLUSIONS

We analysed 3,050 bear damage claims that spread over the entire species range in the country. Significant differences were found in regard to the temporal and spatial distribution of both livestock depredation and crop damages as well as the frequency and intensity levels between the two types of damage. Based on information related to size, population, mean altitude, distance from major settlements and major infrastructure projects, habitat type, forest coverage and land use we created a detailed damage profile for all municipalities as well as all major livestock groups and crops affected. This information enabled us to define four bear damage categories and create a bear damage map of the country. The results of the study have been used in order to formulate guidelines that could improve the existing bear-damage monitoring and compensation system. Specific actions towards increased acceptance by local communities and the better protection of the species in the country are recommended.

ACKNOWLEDGEMENTS

We would like to express our outmost gratitude towards B. Gravalos for providing access to the ELGA bear damage database and assisting us in the evaluation of our results

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KERNEL-BASED HOME RANGE METHOD FOR DATA WITH IRREGULAR SAMPLING INTERVAL

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Studies of habitat selection often use radio-tracking data for defining animal home ranges. In practice radio-tracking data contain periods of frequent autocorrelated observations interspersed with temporally more independent observations. Using such data directly may result in biased home range estimates, because areas that have been sampled intensively receive too much weight. The problem of autocorrelation has been tackled by resampling data with an appropriate time interval. However, resampling may cause a large reduction in the data set size along with a loss of information.

We introduce a new method for estimating home ranges with temporally irregular data. The proposed method, called the time kernel, allows the user to define how much relative weight temporally autocorrelated observations receive in the computation of a utilization distribution (UD), which is calculated using the standard kernel method. Understanding the differential use of space within the home range may be important in spatially heterogeneous environments; valuable information is lost when using information about the home range borders only. We therefore suggest using directly the UD instead of assuming uniform use of areas inside the home range.

We exemplify the time kernel method by applying it to a data set of brown bear locations.

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GRIZZLY BEAR POPULATION STATUS IN GLACIER NATIONAL PARK, MONTANA, USA

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We estimated the size and distribution of the grizzly bear (*Ursus arctos*) population in the greater Glacier National Park (GNP) area in 1998 and 2000 using hair sampling and microsatellite analysis to identify individual bears. The study area encompassed 8,362 km^2 in and around GNP in northwestern Montana, USA. GNP comprises 49% of area and is managed primarily as wilderness. The study area consists of National Park, National and State Forest, Blackfeet Indian reservation, and private lands. Waterton Lakes National Park bordered part of the study area to the north, with the remainder being managed for multiple-use and private ownership.

We employed two methods concurrently to sample bear hair. We distributed baited hair snag stations on an 8x8 km grid to systematically sample the study area during 5 14-day sample sessions. Hair snags were moved to a new location within cells after each session to decrease the likelihood of a behavioral response to snag sites. The second sampling method used repeated hair collection visits at 2-4 week intervals to a network of unbaited bear rub trees along trails. Hair sampling rates were lower in areas where cattle occurred on the BIR due to trampling of snag stations. For effective bear hair snaring on grazed lands, we recommend building fences around snag stations to prevent cattle damage.

Rub tree and hair snag sampling datasets were jointly analyzed using the closed Huggins (Huggins 1991) mixture models (Pledger 2000) in program MARK (White and Burnham 1999). The assumption of geographic closure was tested using methods proposed by Otis *et al* (1978), Stanley and Burnham (1999), and Boulanger and McLellan (2001). The core-extrapolation method of (Boulanger and McLellan 2001) was used to correct for closure violation and estimate density.

Population size in GNP was last estimated in 1971 using sightings of unmarked bears. Trend has not been monitored. We compare the density of grizzly bears in GNP with other populations and discuss the implications. This study provides baseline information important for managing one of the few remaining populations in the contiguous United States. Grizzly bear density was highest within GNP and lower outside the park where the majority of mortality occurred.

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SAMPLING BEARS USING RUB TREES

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Hair deposited when bears rub on a variety of objects can used for estimating population size, determining presence, and, potentially, for monitoring population trend through genetic determination of the species, gender and individual identity. We collected bear hair from trees and other objects that bears naturally rub against in two studies in an area occupied by both grizzly bears (*Ursus arctos*) and black bears (*U. americanus*) in northwestern Montana, USA. To locate bear rub objects (rubs), we surveyed trails, forest roads, power lines, and fences to identify trees, posts, and poles that had bear hair on them. Collection of hair was facilitated by placing short pieces of barbed wire on the rub surfaces. Hair samples from barbed wire are larger, have more follicles, require less time to collect than hair deposited on original rub surfaces, and define discrete samples that help prevent getting samples from more than one individual. No attractant was used to attract bears to rubs. Concurrent with the sampling at rub objects, we collected hair at barbed wire hair snag stations. Snag stations were off-trail and baited with a scent lure.

From 1998-2000, we collected 10,453 hair samples from 1,016 rub trees along trails in and around Glacier National Park May-October. During June- September 2004, we collected 13,000 bear hair samples from 5,115 rub objects (86% trees) in the Northern Continental Divide Ecosystem, including the area sampled in the earlier study. A higher proportion of grizzly bears than black bears were sampled at rubs than at snag stations. The ratio of grizzly bear to black bear hair samples averaged 67:33 at rub trees compared to 32:68 at hair snags in the same area. Male grizzly bears either rubbed more vigorously or shed more freely. The number of hair samples genotyped to individual males averaged 10.3 (range 1-54) compared to an average of 3.8 (1-15) for individual females. Among individual grizzly bears, males were 1.7 times more likely to leave hair at rub sites than females.

Rub tree sampling detected 58% of the grizzly bears identified through rub and snag sampling and 26% of the bears were detected only at rubs. We found bear rub objects wherever we knew bears occurred: on national park, multiple use, ranch and industrial forest lands. However because we relied on trails and roads for rub survey routes, the distribution of rubs was limited to those features and was irregular. Potential uses of rub data to estimate population size include using it in combination with snag data as marks and recaptures in a Lincoln-Petersen model or using a joint dataset in the Pledger closed models.

We summarize characteristics of bear rubs including species and diameter of tree, amount and type of bear use, distance from trail, and maximum and minimum height of rubbing. Bear trails led to many of the rub trees, posts, and poles. In areas with high levels of pack animal use, approximately 60% of the bear rub trees were also bumped by stock packs. To protect horses and riders, we used a double strand of smooth wire mounted vertically to snag hair on these trees. Bear hair collected on the split ends of the wire and posed minimal risk to people and livestock.

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RELATIONSHIP BETWEEN PHENOLOGY OF *PRUNUS JAMASAKURA* FRUITS AND ASIATIC BLACK BEAR, *URSUS THIBETANUS*, AS SEED DISPERSER

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The purpose of this study is to examine the relationship between the phenology of *Prunus jamazakura* fruits and the fruit-eating period of Asiatic black bear (*Ursus thibetanus*), and clarify its role in the propagation process of *P. jamasakura*.

The study covers three inter-related aspects: the maturation process of *P. jamasakura* fruits (the change in size and color of fruits, the number of seed-bearing fruits, the change in germination rate, and the condition of nutrition), the feeding time of bears, and the germination rate of bear-ingested seeds.

As a result, the growth pattern of *P. jamasakura* fruits size has shown a double sigmoid growth curve that consists of three stages: the first growth stage, the non-growth stage and the second growth stage. The second growth stage has appeared from the 50th to the 58th day after the bloom. During this stage, as the size of fruits have increased, the color of fruit has changed from green to red and then to black; and the germination rate has become higher. After the 60th day, the number of seed-bearing has started decreasing rapidly. Measuring the amount of energies and the rate of dried food, it has turned out that energy efficiency of black fruits has been efficiency better than one of others. The feeding time of the bears has been also observed between the 50th and the 66th day with the special intensity between the 58th and 60th day.

The time when seed-bearing fruits rate is high, fruit is large, germination rate is high, and the condition of nutrition is good has overlapped with the feeding time of bears. Compared with the control germination test, ingested seed observed in the bears have not shown the significant differences in germination rate. From the above, it is clear that Asian black bear has gained high energy from *P. jamasakura* fruit and then has dispersed matured seeds away from the parent trees in the propagation process of *P. Jamasakura*, and this study makes it clear that there is a strong interaction between bears and *P. jamasakura.*

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STRUCTURE OF EXPANDED BROWN BEAR POPULATION AT RANGE EDGE IN FINLAND

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We evaluated the hypothesis that regional differences in population structure in peripheral brown bear (*Ursus arctos*) population is associated with harvesting rates. During 1968 – 1995, population growth rate was strikingly higher in the southern than northern part of Finland. Sex ratio of bears shot in 1993 – 2003 was more male-biased in the northern than southern Finland, and both subadult and adult males were found in more northern locations than subadult or adult females. Higher harvesting rate obviously was the main reason for the lower proportion of females in the north. In 1993 – 2003

subadult males (2 – 4 years of age) were shot in more western locations the bears belonging to other categories of age and sex. Our results provided evidence that the peripheral nature of the Finnish brown bear population increases both toward north and west, which may be owing to both harvesting rates and recent expansion from east.

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BROWN BEAR OBSERVATIONS BY MOOSE HUNTERS AND POPULATION ESTIMATION IN FINLAND

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We used brown bear observations made by moose hunters in 2002 – 2004 and calculated an observation index, which is similar to the index used in the Scandinavian Brown Bear Project. By using results obtained in Sweden on the relationship between indices and bear densities we constructed population estimates for different provinces and compared these estimates to the official minimum estimates that are based on litter observations. Usually there is little difference between these two estimates.

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EVALUATION OF GPS COLLAR WITH ACTIVITY SENSOR FOR ANALYSIS OF DAILY ACTIVITY OF JAPANESE BLACK BEARS (*URSUS THIBETANUS JAPONICUS*)

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The recent development of the investigative technique of wild animals using Global Positioning System (GPS) is remarkable. However, studies where GPS collar with activity sensor (collar) is fitted to Japanese black bears (*Ursus thibetanus japonicus*) with short fix intervals is very few. It is necessary to increase the number of such study cases and to evaluate the usefulness of collar and sensor.

We captured two free-ranging Japanese black bears (male and female) and fitted collar (GPS3300, Loteck) in the Ashio Mountains, central Japan. GPS and activity sensor recorded data every 5 minutes between 13th and 25th June 2004. We also carried out direct observation of the collared bears and validated the relation between bear behaviors and the figures recorded by activity sensor (i.e. activity value). Then, we evaluated the influence of bear behavior to the GPS fix rate. In addition, we analysis daily activity pattern of two bears and evaluate the usefulness of collars in Japanese black bear research.

We managed to do a direct observation of a female bear for 7-days, 429minuets in total. Activity value tended to be high when she was moving actively, and was extremely low when she was rested.

From this result, we classified all GPS locations of two bears (male: n=2901, female: n=2993) into 'active', 'moderate' and 'inactive'. Fix rate was very high (male: 90.2%, female: 97.3%) when 'active', but was low (male: 62.7%, female: 77.0%) when 'inactive'. Factors such as orientation on collar or habitat selection when the bears were asleep may have affected the fix rate. By defining the bear behavior for each GPS locations using activity value, we were able to achieve various information about their daily activity. We could calculate the ratio of 'active' time for each time zone. For the female bear, the percentage was the highest before sunset (16:00-18:00 PM) and very low at night. For the male bear, on the other hand, there was no apparent peak in 'active' percentage and the percentage was relatively high at night. Characteristic of daily movement pattern was different between male and female. Such as detailed information is very useful for understanding the ecology of bears.

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BEARS MISSING! GENETIC MONITORING OF THE BROWN BEAR (*URSUS ARCTOS*) POPULATION IN CENTRAL AUSTRIA

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The small population of brown bears in central Austria goes back to the release of 3 bears in the range of a single migrant bear that had settled in the area in 1972. Two females and one male were introduced in the years 1989 – 1993 The population has been monitored by radio-tracking and collecting data on bear signs and observations. In 2000 we started a genetic analysis using microsatellites and sex specific PCR markers to characterise the brown bear population in central Austria. The aim of the study was to improve our knowledge of population size and sex ratio, and to reveal the relationships between individuals.

From 2000 to 2004, 816 hair and faeces samples were gathered in an area of >3,000 km², most of them in the core area of <1,000 km². Furthermore we analysed blood samples from captured individuals, among them the three introduced bears and three of their offspring. Eight different microsatellite loci were used for genetic characterisation. Sex was determined with two different primer sets, one for the *sdf* locus and one for the *amelogenin* gene.

We present results from five years of genetic monitoring, which were combined with the field observations. During this time only one male and three females (mother and 2 daughters) of the population took part in the reproduction and in 2004 only one of these females was still present. Four bears are the offspring of a male bear that mated with his daughter. As a consequence of inbreeding heterozygosity in the small population decreased during the years of monitoring. Despite the fact that 27 bears were born in this region since 1991, the number of individuals has remained surprisingly low, ranging from 7-8 per year. Our results suggest that subadult bears migrate from the core area. However, indices of bear occurrence outside the core area are rare and migration could be proved only for two young males. Undetected illegal killing may be another explanation for the low number of bears.

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MODELLING AND EVALUATING WILDLIFE CORRIDORS IN AUSTRIA

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In Europe nowadays, migration and genetic interchange for wildlife species crucially depend on the location and distribution of barriers such as infrastructures and settlements. This is especially crucial for the Austrian bear population, currently estimated at 15 to 25 individuals. The population is divided into two core area of occurrence, one in the north-eastern limestone Alps and the other along the borders towards Italy and Slovenia. Austria is a highly developed country on the eastern end of the Alps. Its landscape is in many places charakterized by settlements, industry, infrastructure, tourism and agriculture. Especially in Alpine valley regions, these land-use practices are concentrated, and they often irreversibly prohibit wildlife passage.

In order to provide an overview about potential migration corridors in Austria, a GIS-model was developed. A nationwide resistance-model was built based on landscape data (M. Hollaus *et al*. 2004) with 30 meters spatial solution. The resistance values are the sum of all positive and negative influences, which affect wildlife. The resistance-values are defined by spatial adjustment and extension of the different landscape elements. Low values mean high migration and describe landscape areas with high potential connections. High resistance values describe landscape areas that act as barriers like settlements or open wide landscape areas with little or no vegetation providing cover. Based on the resistance-model the potential migration areas in Austria are calculated. For the calculation of the potential migration areas different cost distance-functions were used. To visualize critical regions in these calculated migration routes, the resistance values are displayed inside the migration areas (see Figure 1).

Major infrastructure (highways and railways) usually constitutes the major barriers for wildlife movement, but under- or overpasses can provide can provide possibilities for crossings. Such local structural conditions could not be differentiated from the landscape data used in the modelling. To determine on small scale whether a potential barrier could possibly be crossed by bears we used terrestrial surveys to investigate corridors along intensively used major valley-systems in the Austrian Alps.

Results will be available in the form of cartographies, web-GIS-illustrations (http://metageo.boku.ac.at/website/wildtierkorridore) and GIS-data, in order to make sure that significant, still existing and potential national connections are considered in ways of spatial planning. Consequently, the results are to be considered in the RVS (Rahmenrichtline Verkehr, framework directive about traffic), which is currently being adapted.

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122 – poster

CARDIAC FUNCTION IN HIBERNATING BLACK BEARS: LACK OF REMODELING AND EXTREME HEART RATE VARIABILITY

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INTRODUCTION

Field research was performed on free-ranging over-wintering black bears (*Ursus americanus*) in Colorado, Wyoming, and Minnesota to study the impact of extended periods of hypotension and starvation on cardiac performance and electrophysiology.

METHODS

Radio-collared bears were tracked to their dens and tranquilized. Chronic data recorders (CDRs) were implanted in early winter and used to record broad-band electrical data: electrocardiograms (EGMs), electromyograms (EMGs), and respiratory frequencies during the over-wintering period (n=4). Early and late winter (paired) data sets were recorded at the den site for cardiac electrical parameters (n=15; 12-lead ECG on a LIFEPAK® 12, Medtronic;) and cardiac dimensions from ultrasound (n=22; Acuson Cypress™, Siemens). The bears ranged in age from 1-20 years and their weights were between 10-200 kg. The recorded 12-lead and echo parameters are thought to represent autonomic activation.

RESULTS

These data showed dramatic variations in heart rate associated with the respiratory cycle. The heart rates accelerated during inspiration and low rates, with long sinus pauses, were seen between breaths. The maximum/minimum heart rates recorded during the over-wintering period were 110 bpm and 2.3 bpm, respectively. Over a 68-day period one bear's average heart rate was 13.5 $\pm$ 3.6 bpm, with average maximum/minimum heart rates associated with each respiratory cycle of 15.0 $\pm$ 6.4 bpm and 4.7 $\pm$ 1.3 bpm. No ectopic beats were detected even with these long R-R intervals. No changes in QRS durations were observed either in the data obtained from the CDRs or the 12-lead recordings. The echocardiographic images confirmed that cardiac dimensions were preserved. See Table 1.

DISCUSSION

These data sets have identified a unique model of cardio-respiratory physiology. Dramatic respiratory sinus activity is thought to aid in survival during hibernation and is likely associated with a novel control via the autonomic nervous system. One would have predicted that at such low heart rates that the heart itself would be somewhat underperfused, yet no changes were observed in ECG morphologies. The unique conservation of cardiac dimension and performance is likely adaptive, maintaining the animal's ability to defend itself and/or its young throughout the over-wintering period.

	QRS Width (msec)	QT Interval (msec)	QTc (msec)	LV ED Wall Thickness (cm)	LV ES Wall Thickness (cm)	LV EDD MP (cm)
Early Winter	0.081 $\pm$ 0.011	0.302 $\pm$ 0.021	0.423 $\pm$ 0.021	1.39 $\pm$ 0.35	1.68 $\pm$ 0.52	6.57 $\pm$ 1.33
Late Winter	0.077 $\pm$ 0.018	0.283 $\pm$ 0.022	0.411 $\pm$ 0.030	1.29 $\pm$ 0.23	1.58 $\pm$ 0.34	6.15 $\pm$ 1.06
P-Value	N.S. (0.52)	0.025	N.S. (0.24)	N.S. (0.45)	N.S. (0.57)	N.S. (0.40)

Table 1. Summary of cardiac electrical parameters and left ventricular dimensions. N=14 for electrical parameters; N=12 for dimensional. (HR=heart rate; QTc=QT corrected for heart rate =QT/Sqrt(60/HR); ED=end diastolic; ES=end systolic; LV EDD MP=left ventricle end diastolic diameter mid-papillary).

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TUBE TRAPS, RUBBER-PADDED SNARES, CUSTOM SHOCK-ABSORBERS, AND EXPANDABLE RADIOCOLLARS FOR BEARS

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Black bears (*Ursus americanus*) are commonly captured with Aldridge foot-snares. Disadvantages of this method include the possibility of non-target species setting of traps or being captured, long installation time, the possibility of bears being captured by the toes, and the risk of hind-foot captures. Here we describe the RL04 trap designed to address all of these issues. The trap is built from a PVC tube that is closed at one end, and is set up approximately 1 meter off the ground between 2 trees. Bait is placed behind a screen fastened near the closed end of the tube. The snare, placed near the open end of the tube, is triggered when the bear pulls on the screen to reach the bait. A spring tightens the snare around the bears paw before it can withdraw it from the tube. This trap can only be triggered by a bear, requires 20 minutes of installation time for 2 people, rarely results in toe captures due to the distance between the trigger and the snare, and eliminates the possibility of hind-foot captures. This design also makes it impossible for a bear to set off the snare with its head and be snared by the neck. Twenty six bears were captured using this technique in the fall of 2004 and further tests will take place during the summer of 2005. Every trap approached by a bear resulted in a capture and all snares were tightened above the interdigital pads. Between 2001 and 2005, 304 bears were trapped using rubber-padded snares in an effort to reduce cuts and swelling often caused by bare wire snares. Snare features included rubber bits of different diameters placed around the snare loop, rounded 120° locks, 2 swivels, and rubberized rough edges. The rubber bits were designed to reduce cuts and swelling while allowing for better circulation than conventional snares due to a smaller surface area being pinched. These snares were used with 5 different trap designs including ground sets and only 12 bears had surface cuts smaller than 1cm where the lock rubbed against the paw. An additional advantage of these snares is the ability to adjust the minimum snare size and therefore prevent the capture of cubs. Snares were attached to custom designed shock-absorbers in an effort to reduce potential shoulder injuries. Once immobilized, bears were fitted with collars modified with stainless-steel expandable plates allowing bears an extra 2'' of growth around the neck. A rubber elastic on the inside of the collar keeps the circumference at the smaller size unless stretched. If the neck expands beyond the initial size, the rubber stretches and slowly rots away, resulting in a larger collar size. These collars were used on 159 individual bears and none exhibited chaffing around the neck. We recommend using this type of device with all radiocollars placed on bears, particularly when working in areas where hunting occurs.

124 – poster

BEARS AND BORDERS: THE TRANSBOUNDARY NATURE OF BROWN BEAR CONSERVATION IN EUROPE

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The long term conservation of brown bears in Europe requires international cooperation. This is motivated by the facts that many countries are too small, or have too little habitat, to contain viable populations in the future, and that the vast majority of present populations straddle international borders. This presentation has several objectives. Firstly, we shall briefly summarise the distribution of

bears with respect to international borders, calculating how large a proportion of the European bear distribution is within a border zone. Secondly, we shall summarize the extent to which the counties that host these transboundary populations are bound by international agreements (Bern Convention and Habitat Directive). Thirdly, the degree of consistency in national legislation and management practice within the countries that make up a transboundary population will be summarized. The material for bears will be compared and contrasted with that for wolves and Eurasian lynx. Finally, we shall identify key gaps in international policy coordination that are needed to ensure the conservation of European bear populations into the future.

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USE OF INTRAPERITONEAL RADIOTRANSMITTERS IN YEARLING FEMALE BROWN BEARS. ANESTHETIC AND SURGICAL PROCEDURES

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A surgical technique for implantation of intraperitoneal radiotransmitters in brown bears (*Ursus arctos*) is described and biochemical values are evaluated.

A total of 20 yearling female brown bears captured in Orsa Finnmark, Sweden in spring 2003 and 2004 by The Scandinavian Brown Bear Project (SBBP), received intraabdominal radiotransmitters that were implanted under field conditions. We describe a reliable technique for implantation through a ventral midline celiotomy. In addition to surgery, the bears were sampled for blood plasma pre-and postoperatively. We recorded levels of the following parameters: cortisol, creatinine kinase (CK), potassium (K) and lactic dehydrogenase (LD). A significant reduction in the cortisol level postoperative was found, whereas the other enzymes showed minor and statistically nonsignificant changes. Based on these results, we conclude that the ventral midline incision is a reliable surgical technique. Hence, it can be recommended for intraperitoneal implantation of radiotransmitters in brown bears, as have several others (Hoover (1984), Philo (1981) and Ranheim (2004)).

However, possible complications of implants could be adhesions between abdominal organs, peritonitis, obstruction for intestinal flow and a foreign body reaction in the omentum. Fundamental changes in radiotelemetry will be the result if these side effects occur frequently in bears with intraabdominal implants.

More research is necessary to evaluate the long-term effects of intraabdominal implants.

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PUBLIC ATTITUDES TOWARD BROWN BEAR AND BROWN BEAR MANAGEMENT IN CROATIA

Majic Skrbinsek A[1], Skrbinsek T[2], Huber D[3]

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Wildlife managers are increasingly trying to incorporate public opinions in their decision-making processes. The main aim of this study was to provide the decision-makers with scientific information on public attitudes toward brown bears and brown bear management. Quantitative survey research methods were used to collect data presented in this paper. The research instrument was a questionnaire that consisted of 59 items, most of which were of closed structure and offered responses on a 5-point Likert response scale. The questionnaires were mailed out with a prepaid return postage to random samples of general public and foresters in the bear range. Response rate of the general public and foresters was 37.9% (N=531) and 34.4% (N=186), respectively. The general public was represented by two samples, which correspond geographically with the central bear area (bears are hunted, N=299) and the peripheral bear area (no bear hunting, N=232).

A principal components analysis of the attitudinal items extracted 4 interpretable factors described as (1) pro-bear attitudes, (2) wanting more bears, (3) perception of bears as frightening pests and (4) pro-hunting of bears. "Knowledge about bears" and "experience with bears" scores were calculated by summing up correct and affirmative responses, respectively.

ANOVA revealed that the residents of the central bear area and foresters had both stronger pro-bear attitudes and pro-hunting of bears attitudes than the residents of the peripheral area. However, both general public groups equally supported an increase in number of bears, while foresters scored negatively on that factor. Perception of bears as frightening pests was significantly different among all three groups, with respondents from the peripheral areas scoring the highest and foresters scoring the lowest. The three groups showed different levels of knowledge about bears. The foresters had the best knowledge, and the residents of the peripheral bear areas the worst. A similar pattern was observed for the level of personal experience with bears.

Multiple regression analysis of the general public data showed that pro-bear attitudes can be predicted by a better knowledge about bears, tolerance for an increase in the number of bears and the fact that the person is a registered hunter. Acceptance of an increase in the number of bears was predicted by pro-bear attitudes, fewer experiences with bears, not being a hunter, approval of hunting of bears and the perception that bears do not cause considerable damages and are not to be feared. Key variables for predicting the perception of bears as frightening pests were lack of knowledge, not being a hunter, fewer experiences with bears, support for hunting of bears, disagreement with a potential increase in bear numbers and residence in the peripheral bear area. Support for hunting of bears can be expected from registered hunters, the residents of the central bear area, persons with more experience with bears and from those that would tolerate more bears, as well as from people that are afraid of bears and perceive them as pests.

127 – poster

CHARACTERISTICS OF BROWN BEAR KILL DISTRIBUTION ON THE OSHIMA PENINSULA, HOKKAIDO, JAPAN

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I investigated characteristics of brown bear (*Ursus arctos*) kill distribution on the Oshima Peninsula, Hokkaido from 1983 through 2003 comparing fixed kernel density distribution of brown bear kills calculated by the Arc View (©ESRI) and by Animal Movement (Hooge and Eichenlaub 1998). A total of 1,412 brown bear kill locations were available for analysis. During the mid 1980's, when the spring bear hunt had been carried out, cores of bear kills were located in the central and south-western parts of the peninsula. Spring kills were distributed relatively widely, occurring along ridges in the interior of the peninsula while summer and autumn kills were located in coastal areas and were concentrated in the Matsumae region. After abolishment of the spring bear hunt in 1990, brown bear kills expanded from the southwest into the north and eastern parts of the peninsula. Total harvests were lowest around 1988 and increased gradually during the 1990's. Total harvest increased with the expanding distribution of harvests. After the abolishment of spring hunt, almost all bear kills were management actions, usually occurring near agricultural or residential areas. Areas with a high density of kills may reflect a greater vulnerability to crop or other damage from bears. Further refinements of kill density distribution mapping would be useful for setting priorities for damage prevention measures.

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A RISK-ASSESSMENT MODEL FOR EVALUATING THE LIKELIHOOD OF GRIZZLY BEAR ENCOUNTERS, TO MANAGE PUBLIC SAFETY ON HIKING TRAILS AND IN CAMPING AREAS

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Grizzly bear habitat quality and its use proximal to hiking trails and campsites has traditionally been used as the primary method to rank the risk of encounters with grizzly bears (*Ursus arctos*) in Canadian parks in the mountains. To provide an expanded method for evaluating the risk of an encounter, Parks Canada, engaging the knowledge of a panel of experts, developed a Geographic Information System-based grizzly bear encounter risk model. The model uses a weighted (Eigen vector) value system of seven key variables for a hiking area in Yoho National Park. The need for a better risk-assessment method was made clear when grizzly bears injured 3 hikers in the Yoho area. The variables include: habitat capability, large mammal carcass availability, grizzly bear movement potential, mark trees, visibility, noise and tread design of the trail. The Parks Canada study was constrained by a small study area, a small number of grizzly bears and the small number of grizzly bear movements (n = 16) documented.

The authors followed the Parks Canada study and model development with a 4-year field study in remote Kakwa Provincial Park, British Columbia, where the grizzly bear population appeared to be at capacity. We used non-intrusive study methods including detailed habitat maps, remote camera monitors, tracking dogs, track records with associated sign (feeding and scats) and hair collection.

Of the 103 on-trail grizzly movements recorded, bear use was found to be relatively high on only some trails (7 – 12+ movements per month) with late June and July being the most active period. The majority (92%) of grizzlies using hiking trails and park access routes for travel were in the cohorts (single adults or single/pair young adults) least likely to be aggressive and harm people. The more dangerous cohort, female grizzlies with young, accounted for only 8% of all of the on-trail movements. This cohort appeared to prefer higher elevation areas away from the majority of trails and campsites; although little data was gathered on their preferred habitats and travel routes. Of 137 grizzly bear mark trees catalogued the majority (99%) were along hiking trails. Mark trees were considered a good index to determine the importance for bear travel in association with hiking trails and camping areas.

The information was used to modify and refine the values used in the original GIS grizzly bear encounter risk model. The refined model was used to rank the bear hazard of 35 different hiking trails/routes/access roads and 11 rustic campsites for each of the three bear seasons (green vegetation, berry and post-berry). The results were incorporated into a B.C. Parks management plan for Kakwa Provincial Park (170,732 ha) to minimize bear-human conflicts as well as to protect bear travel features in a major trans-mountain wildlife corridor across the Continental Divide. The risk model results are adaptable to other areas in the western mountains where people pursue outdoor recreation in occupied grizzly bear habitat.

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BEAR MOVEMENTS AND BEAR HABITAT USE IN PINDOS MOUNTAIN RANGE, NW GREECE: APPLICATION FOR THE EVALUATION OF HIGHWAY "VIA EGNATIA" MITIGATION MEASURES

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Bear habitat fragmentation versus transportation infrastructure becomes a major and preoccupying issue in the EU and lately in southeastern Europe with the fast development of a highway network known as TENT (Trans European Network). This paper presents the results of a two-year monitoring project aiming at the evaluation, prior to construction, of the efficiency and reliability of the planned mitigation measures over a 34km stretch, of the "Via Egnatia" highway. This, part of TENT, highway cuts through core bear habitat in Pindos mountain range, in northwestern Greece. Minimum bear population size in the targeted area is estimated to 44 individuals.

Over a 2 year monitoring period (from July 2003 to May 2005), five (5) adult brown bears (3 males and two females) were fitted with GPS collars. Telemetry data have yielded up to 3,300 locations whereas 1,410 bear signs of presence and activity from the overall bear sub-population in the study area have been recorded during yearly ground field surveys.

Bear movements were spatially correlated to the highway alignment with emphasis on the locations of the highway planned mitigation measures such as: tunnels, underpasses and bridges. Environmental Factor Analysis (ENFA) as performed by the Biomapper package was additionally used to compile and analyze both data sets in relation to key bear habitat factors.

Bear habitat suitability maps were produced and compared to highway alignment and locations of mitigation measures.

Using the habitat suitability map as a cost matrix, we estimated the least cost distance for bears for every point in the study area versus the highway alignment and the locations of mitigations measures. Results were used to refine the proposals addressing the highway constructor for spatial, qualitative and quantitative improvement of certain mitigation measures.

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NATURAL AMENITIES AS A DRIVER FOR ECONOMIC DEVELOPMENT: PARALLELS BETWEEN THE MONTANA CHALLENGE AND EUROPEAN BROWN BEARS

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Efforts to restore brown bears (*Ursus arctos*) in northern Italy and Austria as well as the efforts to preserve and grow small populations in central Italy, Spain and France represent a recognition of the importance of maintaining large carnivores and natural areas from both ecological and economic perspectives. The European efforts have a parallel in a cooperative project in Montana, USA - *The Montana Challenge* (web site http://fwp.mt.gov/tmc). The challenge for Montana is to "remain the last best place for fish and wildlife in a changing west." To meet this challenge, the Montana Department of Fish, Wildlife, and Parks, the US Forest Service, and other partners have compiled economic and social data on the historical importance of wildlife resources and the associated amenities of wildlands, clean rivers, and uncluttered landscapes to Montana's development in the past. *The Montana Challenge* recognizes that that these same amenities are critically important components of Montana's future; components that need to be maintained and enhanced and not lost in shortsighted developmental schemes that undercut Montana's uniqueness and future prospects. As in most places, Montana has different economic challenges and prospects in different regions including some regions with fast growth and challenges from overdevelopment and other areas with declining industries based on agriculture and extractive industries. Both regions face distinct challenges and future based on amenities that are in short supply and in high and increasing demand. The challenge identified in Montana is the same as in Europe, to protect our cherished relationship with natural resources as we harvest their full economic benefit. In this paper we explore the challenge in Montana and draw parallels to the situation with brown bears in Europe.

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A STUDY BY CARBON AND NITROGEN STABLE ISOTOPES ON THE TURN OVER TIME OF HAIR AND BLOOD IN ASIATIC BLACK BEAR

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Carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope signatures of animal body tissue provide information about the diet. This analysis overcomes some of the disadvantages in usual analysis for wildlife food habits, such as direct feeding observations, scat analyses, and stomach content examinations. Stable isotope

studies on animal food habit have generally focused its attention on the whole hair. However, this reveals little about the characteristics of hair growth cycle in Asiatic black bear; when does it start to grow, when and how long it grows, or when does it molt. Here we investigated these hair growth cycles by the growth section analysis (GSA) method, in which sectioned samples from the root to the tip were subjected to isotopic analysis. Six captive bears in the Ani Bear Park in Akita, Japan, were fed alternately with corn (C_3 plant) and barley (C_4 plant). Hair samples were cut from the root to tip into 5 mm sections and analyzed for $\delta^{13}C$ and $\delta^{15}N$. Results indicated that (1) the hair starts to grow early in June, (2) the growth stops before November and no more growth is seen thereafter, (3) the hair from the previous year molts in summer, and (4) the hair shows relatively constant growth from June to October. These results show that the bear hair reflects feeding habits and enables reconstruction of its feeding history during the hair growth season. Hair growth cycle covers the season when bears are active, but not the season shortly before or after hibernation. We therefore examined the blood, the turnover time of which may be shorter. Hilderbrand *et al*. 1996 reported in American black bear that the half-lives of plasma and red blood cells are ~4 days and ~28 days, respectively. We are now looking into it in Asiatic black bear and would like to present the most recent data.

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FRUIT HABITS OF SPECTACLED BEAR (*TREMARCTOS ORNATUS*) IN THE MAMAPACHA HIGHLANDS, CHINAVITA (BOYACÁ - COLOMBIA)

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The frugivory of *T. ornatus* was characterized on the base of the evacuation rate for finding seeds principally for endozoochorous syndrome fruits. During six months (October-2001 to March-2002) including the distinctive seasons in the study zone with 1 “dry” and 2 transition rain periods, 40 feces were collected within 1,016.6 ha of paramo (28), subparamo (8) and little forests (4) zones from about 3,000 m altitude up to 3,500 m. The availability was evaluated for endozoochorous syndrome fruits with the phonological observation of 2,014 individuals of vascular plants arranged into 14 plots, 7 of 50 m^2 in paramo and 7 of 150 m^2 in subparamo. First, the seeds´ arrival manner (by feeding or random) was determined by digestion marks observed on the seed coats and by comparison with the vegetation around of the collection place. The 717 defecated seeds were continuously found in the 76.2% fecal samples, these were clustered into 29 species of 14 families: 11 induced dispersal species which *Gaultheria anastomosans* (Ericaceae) was the most frequently found with a 55% finding rate; 11 active dispersal species which *Rhynchospora* sp (Poaceae) and *Puya santosii* (Bromeliaceae) had the highest finding rates with 15% and 10% respectively; 3 passive dispersal species with low finding rates. There wasn’t a specific pattern between the found manner of evacuated seeds and precipitation for these dispersal mechanisms. A high and homogeneous quantity of species and a high finding rate of seeds with induced (67.5%) and active (57.5%) dispersal mechanisms were evidence of the frequent feeding of their fruits in comparison to passive dispersal seeds. The grape, lilac, red and white colors constituted the color spectral of the *T. ornatus* eating fruits but there wasn’t statistically significant correlation between the feeding of fruits and their availability. Although, the continuous and high finding of the grape (67.5%) and lilac (15%) colors point out the predominance of grape tonalities. Nevertheless, in the paramo zone during the dry season a direct relation was observed between the eating grape fruits and their availability. The monthly frequency and high finding of evacuated seeds point out that the *T. ornatus* frugivory was permanent but not constant during the climatic variation because of it had preference by a wide kind of fruits during the rainy season. Even so, only access to a narrow diversity of fleshy fruits found in the paramo. The consumption of fleshy fruits and their availability in the paramo might indicate that *T. ornatus* doesn’t get a particular specie when there are big crops, so that the fleshy fruit´s seasonally doesn’t probably affect the bear fruit habits and

consequently the use of fleshy fruit crops is limited. Although, the spectacled bear eats a few species and colors of fleshy fruits in relation to their availability, the abundance of the family Ericaceae and grape fruits governs the bear freshly fruit diet. A high flexibility was observed in the *T. ornatus* fruit habits due to his low specificity in the consumption for a particular kind of fruits. Despite of that, during "dry" season a directional feeding to *G. anastomosans* was observed as a result of its great availability in the paramo and a preferential feeding of *Miconia plethorica* was observed during the rainy season. For last, the fleshy fruits probably aren't a govern vector in *T. ornatus* movement behavior, so his fruit habits described the typical behavior of an opportunistic frugivore because of it doesn't depends on any particular crop, while the fleshy fruit feeding is a complement for the spectacled bear diet in the Mamapacha highlands.

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SHOULD THE RELATIONSHIP BETWEEN POPULATION VIABILITY AND HABITAT QUALITY PROMPT A PARADIGM SHIFT IN CARNIVORE CONSERVATION – A CASE STUDY WITH BEARS

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For many species, reliable evaluation of foraging habitat requires measurement of a multitude of variables. Bears, however, provide a unique opportunity to integrate all these variables into a single measure: salmon consumption. As with Van Horne's measure of habitat quality (Qj), consumption of salmon affects fecundity, age at first reproduction and survival probability. Our analysis revealed a highly significant ($p=0.005$) negative relationship between minimum viable population and food availability/habitat quality lending empirical support to the conceptual form of this relationship proposed by Van Horne. Understanding the relationship between habitat quality and minimum viable population has important implications for conservation area design and the dominant paradigm of carnivore conservation, which emphasizes large areas with little or no human access, may in fact be a poor model for conservation efforts.

The historic emphasis on the need for large areas has led to the protection of low productivity sites. This study shows that changes in habitat quality have the greatest impact on the viability of populations in poor or marginal habitat. We therefore suggest that pursuit of the current paradigm through the preservation of large, low productivity areas will be insufficient to ensure the long-term viability of populations of large carnivores.

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CHARACTERISTICS OF LATE SUMMER MOVEMENTS OF AMERICAN BLACK BEARS (*URSUS AMERICANUS*) IN MINNESOTA AND RELATIONSHIP TO INDIVIDUAL FITNESS

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Animals expose themselves to risk when they travel outside familiar territory without knowledge of the whereabouts of food and refuge nor the habits of potentially aggressive resident animals. However, travel to new areas also provides opportunity to discover places where resources are more plentiful and/or competition for them is less. American black bears (*Ursus americanus*) in many parts of North America leave their home ranges each year in late summer to search for high quality feeding sites. The wide occurrence of this behavioral tendency suggests that it has provided overall more benefit than risk to bears, at least historically. This may or may not be the case today, when the greatest threats to bears involve recent phenomena, such as hunting seasons and motor vehicles.

We followed the seasonal movements of 243 different radiocollared American black bears (83 F, 160 M), age 1 – 19, in northcentral Minnesota during 1981 – 1990. About half were tracked for >1 year, providing >500 bear-years of data. We defined late summer movements as any forays extending >2 km beyond the perimeter of the bear's early summer home range (minimum convex polygon) for females (>5 km for males). By definition, travel had to start after 1 July and last until at least 1 August. We summarize here the characteristics of these seasonal movements, including frequency of occurrence, distance and direction of travel, and the timing of travels relative to natural food abundance. We compare movement characteristics between sexes and ages, females with and without cubs, and bears in different habitats. We compare mortality and weight gain between bears that did and did not move.

Female bears made 102 late summer forays during 297 bear-years of observation. Direction of travel, distance, duration, and departure and return dates did not differ among yearlings, juveniles (2-3 years old), and adults with and without cubs. Median departure date was 17 August, with median duration of 23 days. Females traveled a median 9.8 km, typically in a southerly direction (median 174°). The percent of females choosing to move did vary, however. In years of poor food, more bears moved and movements were longer than in years when food was plentiful. Yearlings were the least likely to leave home during summer (19%) and juveniles the most likely (45%; $P = 0.01$). Females with cubs were more likely to move than those without cubs (44% vs. 28%; $P = 0.03$) and cubs that accompanied their mothers on forays were more likely to move again as yearlings (43% vs. 13%; $P = 0.03$); this effect disappeared by age 2. Analysis for males is not yet complete but will be discussed.

We detected no difference in the spring weights of yearlings that traveled as cubs relative to those that did not. In 95 instances when females were away from their home ranges during the hunting season, there were 5 bears shot by hunters (5%), versus 44 deaths among 195 bears that did not move (23%; $P = 0.001$). Results suggest that females with the most to gain from extra nutrition are the most likely to move and that instinctual wariness of unfamiliar surroundings may provide protection for wandering bears from even modern dangers.

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THE INFLUENCE OF REPRODUCTIVE STATUS ON HOME RANGE DYNAMICS OF ADULT FEMALE AMERICAN BLACK BEARS

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How the reproductive status of an adult female American black bear (*Ursus americanus*) affects her movements throughout the year is not well understood. Short-term studies with low sample size may be data poor, thus conclusions made about the affect of reproductive status on a female's movements have been contradictory from studies that have examined this question. During 1995-2002, we monitored 56 individual adult female black bears for 105 bear years on 2 study areas of the Cooperative Alleghany Bear Study (CABS) in Virginia, USA. Annual home ranges of female bears with and without cubs of the year (COY) differed little, even when examining among age classes and years ($P > 0.05$). However, results from the 2 study areas conflicted when examining seasonal home ranges. In the northern study area, seasonal home range size of females with and without COY did not differ, while in the southern study area, solitary females had larger spring home ranges than females with COY (P=0.03). In both study areas, females with COY increased their range size as the year progressed, possibly reflecting the increased mobility of the cubs over time. The lack of difference in annual home range size between bears with and without COY, and the lack of difference in seasonal home range size in the northern study area, indicates that if cubs do restrict a female's movement, they do so only in the time period immediately after den emergence, and not throughout the year.

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THE IMPACT OF ENVIRONMENTAL NOISE ON MATERNAL BEHAVIOR IN A BORNEAN SUN BEAR

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Bear cubs are highly altricial at birth, and sun bears (*Helarctos malayanus*) are no exception. Dams are responsible for all aspects of cub survival and previous studies have shown that bear mothers spend the majority of their active time attending to the nutritional, thermoregulatory and excretory needs of offspring. Behavioral responses to aversive stimuli are costly and redirect attention and energy away from offspring maintenance. Redirection of energy can reduce well-being of mother and cub and threaten offspring survival.

Zoo animals are exposed to anthropogenic noises from various sources. Noise sources vary considerably and include (but are not limited to): maintenance machinery, construction activities, crowds and transient noises from daily keeper activities. Noise exposure can be stressful to captive animals but the degree to which environmental noise is stressful varies from species to species. Previous study on the giant panda (*Ailuropoda melanoleuca*) showed that during the post-partum/ maternal care period the female responded to loud noises with significantly increased levels of behaviors indicative of agitation. Additionally these behaviors were documented in the absence of a concomitant physiological response.

Beginning in February 2004, we initiated study on the behavioral response of a Bornean sun bear dam and neonate to environmental noise. We mounted a Casella/CEL 537 sound meter near the bedroom denning area of the sunbear dam and cub. We recorded L-weighted noise levels during the day (from

0600 to 1400) and in the evening (from 1800 to 0200). These data were recorded as 1-minute averages of ambient noise. Behavioral data were collected for four hours daily, from 0730 to 0930, and 1200 to 1400. During these observation periods detailed behavioral data were collected on mother and cub. The female's activity budget, with regard to maternal care and self-directed maintenance behaviors, was correlated with noise levels in the denning area. Additionally specific noise disturbances were noted and characterized as regards source, duration and intensity. These data will allow us to correlate maternal care behavior with sounds that differ both in source, physical characteristics and duration.

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THE MORPHOLOGY OF BROWN BEAR (*URSUS ARCTOS ARCTOS*) STOMACH

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Brown bear (*Ursus arctos*) is a species belonging to Carnivora order, but it presents omnivorous food habits. Although its natural food habits have been extensively studied, in literature very few information are available on digestive system anatomy. In this study macro and microscopic anatomical features of stomach of brown bear has been investigated, compared to other species of the same order and related to possible functional aspects.

Whole digestive systems of two brown bears coming from Slovenia were used. Stomach (*Ventriculus s. gaster*) was isolated after the ligaments evaluation. The mucous membranes of the stomach were first observed by naked eyes for the collection for light microscopy and tissue blocks (n.14) were then excised and fixed in 10% formalin buffered solution, treated with usual histological procedures and embedded in paraffin. The blocks were sectioned at 5µm and the sections were stained with haematoxylin-eosin, Masson's trichrome and PAS. Anatomical nomenclature agreed with Nomina Anatomica Veterinaria III ed. – Nomina Histologica II ed. (1983) and according with Schaller "Nomenclatura Veterinaria Illustrata" (1999).

In moderate filling status, the brown bear stomach is reniform in shape. Pyloric antrum (*Antrum pyloricum*) is globular in appearance and is quite similar in volume to the middle part of stomach (*Corpus ventriculi*) and to the fundus (*Fundus v.*). Along the lesser curvature, the *incisura angolaris* is well-marked notch. The thickness of stomach wall varies a lot due to a different development of muscular coat, pars pylorica is thicker (mean thickness: 20±5 mm.; max th.: 28 mm) and also pyloric orifice (*Pylorus*). The mucosal lining of the stomach is arranged in well-developed rugae (*Plicae gastricae*) that are very irregular, cerebral-like in the fundus and with parallel and longitudinal direction towards the pyloric region. Gastric groove (*Sulcus v.*) is very well developed. The greater curvature (*Curvatura ventriculi major*) gives a strong attachment to the great omentum (*Omentum majus*). *Ligamentum gastrophrenicum* is short and finger-like in shape and makes adherence with the diaphragm. It is joint to the gastrolienal ligament (*L. gastrolienale*) that appears short (40 mm.) but strong. The very tick hepatogastric (*L. hepatogastricum*) and hepatoduodenal (*L. epato-duodenale*) ligaments, together constitute the lesser omentum (*Omentum minus*). The mucous membrane (*Tunica mucosa*) is entirely glandular. This epithelium commences very abruptly at the cardiac orifice, where there is a sudden transition from the stratified epithelium of the esophagus. The glandular epithelium of the cardiac part is a thin ring surrounding the cardias. In the large mucous membrane of the body and fundus and also in the gastric groove until incisura angolaris, proper gastric glands (*Glandulae gastricae propriae*) are present; pyloric glands (*Glandulae pyloricae*) are observed only in pyloric part.

The stomach of the brown bear differs from the basic carnivore pattern, most of all for the high muscular development of pyloric part. It could related to the "gastric pump" function and maybe also

to the insectivorous habit of this species. The strong attachment of the stomach to the liver and diaphragm could be due to the high weight of replete stomach and its traction exerted during bipedal or sitting posture. The large extension of fundic mucosa, similarly to the carnivorous species typically faunivores, could be related to importance of the maintenance of an elevated gastric acidity. This plays a crucial role in the digestion of animal proteins but also in the digestion of hemicellulose. These results contribute to understand the bear 's ability to utilize food.

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STATUS, MANAGEMENT AND CONSERVATION OF BROWN BEAR IN SERBIA

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Serbia is a very central country with respect to brown bear distribution in southeastern Europe. Parts of four mountain ranges that contain bear populations extend into Serbia - these include the Carpathian, Dinaric, Stara Planina and Rila Rodope mountains. Despite this, there has been very little research focused on bears in Serbia.

Bears are mainly found in the forest covered hills and mountains of western, southwestern, and southern Serbia (including the province of Kosovo-Metohija), with a few individuals also occurring in central and eastern Serbia. The only existing estimate of 160 individuals stems from before 1998.

For a long time the species legislative status was under hunting and forestry governmental bodies, protected by a closed season. However, legal shooting was allowed only with the special permission of the responsible authority. During 2002, after raising of the scientific interest and awareness in bears, as well as the lack of recent data, the species protection by the closed season was extended to the whole year. Current threat status is considered as vulnerable, population trend as decreasing, and the species has been proposed to be included on the Red List and Red Book of Serbia. Main threat factors are disappearance and fragmentation of habitats, poaching, keeping of captured specimens (especially as dancing bear). Priority actions for the conservation of brown bears in Serbia are research of population status and range, legislation development and implementation, strengthening, refreshing and highlighting the articles on sanctions against poaching and keeping in captivity, expansion of current protected areas, establishment of a national action plan and a strategy for sustainable management. First steps on public awareness were done at the NGO level during last 10 years, but it is necessary to establish broader governmental actions. The capacity building of the local authorities on theoretical and practical aspects of wildlife management could also be of great importance.

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RELEASE OF BROWN BEAR CUBS BORN IN ZOO INTO NATURE

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Ontogenesis of brown bear behavior was studied from 1975 to 1990 (Pazhetnov, 1990). This study provided basis for developing method of preparing orphan bear cubs raised in captivity for release into the wild nature (Pazhetnov *et al*., 1995). From 1990 to 2004 86 cubs have been released by this method. All cubs were provided with ear tags with number and tag return address. No cases of conflict encounters between released cubs with humans have been even reported. Some of released bears were taken by hunters (in course of legal licensed hunting) after 4-5 years since release. Successful release of man-raised orphan cubs suggested possibility for releasing cubs born in Zoos after treatment by the same method. Two directions of this method were developed with account of specifics of complex behavioral patterns development. It was found that reaction of following is formed in cubs when they are older than 3 months through the imprinting of the stimulus-object. The basis of feeding behavior is forming at age from 4 to 5 months and is tuned through the learning during following 3-4 years of life. The basis of defensive behavior is formed at age of 5 months. Territorial behavior is formed during cub acquaintance with objects of the surrounding environment at age from 4 months and on, through learning. In the behavior aimed to construction of dens (10 months of age) innate components are prevailing. This allows young bears to successfully construct shelter during their first year of life even without learning from their mother.

First direction of our work with captive (Zoo) born brown bear cubs is using the method developed for rehabilitation of orphan brown bear cubs (Pazhetnov *et al*., 1995). For this we accept from Zoos cubs not older than 3 months of age. Maintenance of orphan bear cubs aged one to 100 days (early postnatal period) is character as den period, because of that cubs need special method of charring.

The second direction is acceptance for keeping and preparing for release of brown bears cubs kept in Zoos with their mothers until 4 months of age and older. In this case cubs are imprinted on their mother as on stimulus-object. Re-direction of reaction of following from bear-mother to man-keeper is un-probable and was not observed in our experiment. Preparing of such cubs for later release does not suggest necessity to exclude exposure of bear family (group of cubs) to humans. However, direct tactile contacts of cubs with humans must be excluded. In captivity, for move to release place, cubs are captured right before transportation. For transportation cubs are put in full-covered boxes with ventilation. In hot weather we recommend to enclose piece of ice into the box for cooling. At release place cubs are kept in the cage during 10 days providing feeding to them. Service is provided by only one person. After 10 days the cage is opened and food is put near its entrance. No humans, including the keeper are allowed to stay near the cage at this time without special necessity. Cubs return to the cage for feeding in the absence of the keeper. After 8-15 days after release from the cage cubs get acquainted with the surrounding territory, skip taking man-provided food and leave for the forest switching to independent life. We recommend to use this method with a group of 2-3 cubs, for providing opportunity to maintain social bonds equal to those within the bear family (litter) unit. Using this method with only one cub is not recommended for avoiding re-direction of the reaction of following in the cub to man.

This work was carried out with the support of the International Fund for Animal Welfare (IFAW).

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DELINEATION OF THE GEOGRAPHICAL CO-OCCURRENCE OF THE COASTAL AND CONTINENTAL LINEAGES OF AMERICAN BLACK BEARS (*URSUS AMERICANUS*)

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Thousands of black bears occur on the islands and mainland of coastal Southeast Alaska. Distinguishing distinct population units is an important consideration for their long term management. We used nuclear microsatellite markers and program STRUCTURE to observe genetic structure of black bears *Ursus americanus* in Southeast Alaska. We determined that the signal of the co-occurrence in Southeast Alaska of the two ancient mitochondrial DNA lineages of black bears – which diverged 1.8 million years ago – is retained in the more rapidly evolving nuclear genome (Figure 1). Using tissue samples from 283 black bears we delineated, and corroborated with higher sample size, the contact zone between these groups on the central southern mainland of Southeast Alaska. Individuals sampled from the central mainland northward clustered to the mainland group with average proportional memberships ranging from 0.80 to 0.98. Black bears sampled from the islands of Southeast Alaska clustered to the island group with average proportional memberships ranged from 0.72 to 0.97. Delineating further, however, the most likely number of genetic clusters of black bears that occur in Southeast Alaska is nine, indicating genetic mixing of bears that belong to either mtDNA lineage, since their recolonization. We also suggest that the mainland "genetic type" of bears is currently expanding southward through Southeast Alaska, whereas the smaller island cluster, which is consistent with the coastal mtDNA lineage, has not recently expanded further northward.

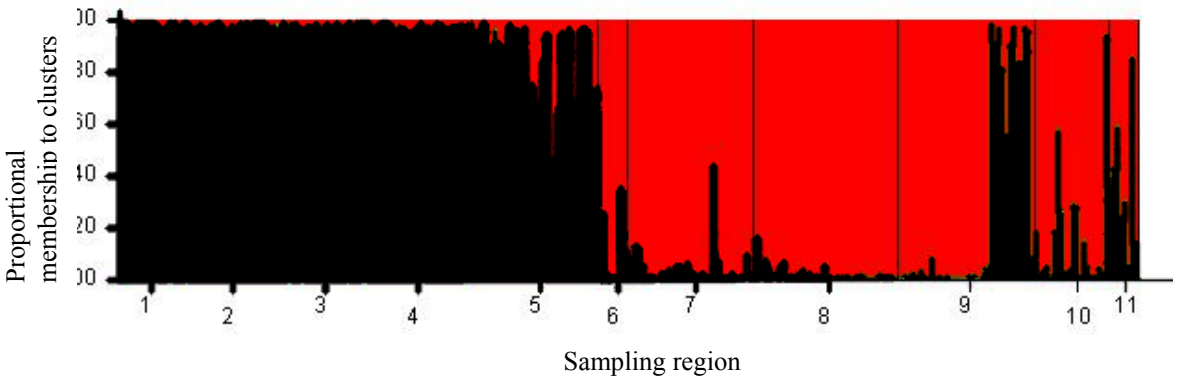

Figure 1. STRUCTURE plot for the two genetic clusters of black bears in Southeast Alaska, USA. Individual samples (each represented by a single vertical line) are organized on the X-axis according to the region in which they were sampled: 1 – Yakutat; 2 – Chilkat Peninsula; 3 – Skagway; 4 – Juneau; 5 – Central mainland; 6 – Mitkof Island; 7– Kupreanof Island; 8 – Kuiu Island; 9 – Prince of Wales Island; 10 – Revillagigedo Island; 11 – Southern mainland. The Y-axis is probability of an individual assigning to the two clusters: red, *Island Cluster* and black, *Mainland Cluster*.

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THE DISTRIBUTION OF THE SLOTH BEAR *(MELURSUS URSINUS INORNATUS)* IN SRI LANKA

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The sloth bear (*Melursus ursinus*) is a myrmecophagous ursid confined to the Indian subcontinent and Sri Lanka. Little is known regarding the status and distribution of sloth bears in Sri Lanka. In 2004, we initiated a study to map the island-wide distribution of sloth bears in Sri Lanka to provide an important benchmark for assessing future changes in the range and status of sloth bears. Our survey covered forested areas within historic range of the sloth bear in Sri Lanka. We used 1:50,000 land-use maps and a 10- x10-km grid system to systematically survey those areas. We used structured interviews with villagers who regularly visit forests in their locality to document bear presence or absence. We also documented perceptions and attitudes towards sloth bears during interviews. Based on 287 interviews, we delineated the distribution of sloth bears in Sri Lanka. The largest contiguous area with extant bear populations was in northern Sri Lanka, including large extents of unprotected forests. In other portions of the country, sloth bear populations were confined to national parks and nature reserves, with a few isolated, and possibly relict, populations outside protected areas. Our surveys indicate that existing sloth bear range is fragmented with populations outside protected areas facing the greatest threat of imminent extirpation. There were no reports of bear nuisance behavior in villages or agricultural fields, but most survey respondents that regularly used forest areas perceived sloth bears as a threat. Many respondents did not support the protection of sloth bears. Self-defense and fear of being attacked were cited as the most common reason for killing bears. Trade in bear parts was not cited as a reason for killing bears. Efforts to establish protected areas in the northern portion of the island will be crucial for the conservation of sloth bears in Sri Lanka. Unprotected areas with isolated populations will require regulation of human activity to prevent extirpation of remaining bears.

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BEAR FOOD SURVEY: VISUAL ESTIMATES *VS.* TOTAL COUNT OF FRUIT

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Abundance and availability of food do influence bear habitat selection. An evaluation of food abundance represents 1) a practical tool to define location-sensitive short term and urgent conservation interventions, 2) an habitat parameter that could be related to bear demography and distribution and hence it is of conservation relevance. To maximize the number of areas investigated, *taxa* and individual plants surveyed it is useful to produce abundance estimates which should be biologically meaningful but achievable in a reasonable fast and less expensive way. This, we aimed at comparing two methods to estimate fruit abundance: total count of fruits vs. visually estimation of fruit in 4 abundance classes. The first option should produce more accurate and precise food estimates, while requiring a disproportionate amount of time to be implemented over wide areas; estimation according to abundance classes, will require fewer resources but will be less accurate and precise. Accordingly we tested if soft-mast production visually estimated in abundance classes could represent a consistent evaluation of biomass with respect to actual numbers of produced fruits.

We sampled 1,937 plants (from 1999 to 2000) belonging to 18 *taxa*, in a mountain area (>900 km^2) within a European Union Life project. Samplings have been carried out in both circular plots along a 500 m grid, opportunistically in scattered shrub patches and along a fixed trail system. Field personnel independently assessed fruit production as abundance classes (from 0: no fruit to 3: above average production) and total counts on 10 randomly chosen twigs for each individual plant. We grouped all individuals/species by class and than we tested by one-way ANOVA if the total number of fruits/species significantly differed among classes.

For every *taxa* ANOVA showed that the total number of fruits is significantly different among abundance classes, and *post hoc* Duncan test detected significant difference for each bivariate comparison. Accordingly, a statistically and biologically meaningful difference do exist in the number of fruits produced by plants ranked within different abundance classes. Thus, monitoring of fruit abundance based on visual estimation sounds reasonable and feasible, especially when it should be worked out over large territories, as it is often the case for bears, saving resources for other management activities relevant to bear conservation.

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HABITAT MODELLING FOR BROWN BEAR CONSERVATION: HOW FAR IT TAKES IN THE CENTRAL APENNINES?

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As many habitat parameters cannot be measured directly or they need to be extrapolated outside study areas in which habitat relationships have been studied, wildlife conservation extensively relies on modelling to evaluate, for instance, habitat suitability/potential distribution, critical and conflict areas, mortality risk, denning habitat. However, models sometimes fail to provide better insights or predictions than it would be available without such an exercise, giving an immediate benefit to the researcher without further contributing, or erroneously driving, the conservation process. At least 5 models based on 4 different data sets and with a both stochastic or deterministic approach have been formulated to predict potential distribution/habitat suitability for the brown bear in the central Apennines. Thus, surprisingly, a tendency exists towards producing models as opposite to the implementation or a more appropriate evaluation of existing paradigms (defined as the assessment of a model's usefulness for its intended application). This conflicts with the need for a proactive approach in bear conservation, could unnecessarily duplicate efforts, and deflect resources from other urgent measures without a substantial improvement in models and hence in conservation, as long as no other more useful population data are available. Thus, we recommend to use existing modeling exercises to assess habitat suitability providing practical suggestions and tools to be incorporated in management decision by relevant authorities. Evaluation of models with multiple independent sources of relevant and appropriate information on bear distribution and ecology and with appropriate procedures, taking into account their specific purposes, will provide a better understanding of model limitations, sensitivity, weakness and pitfalls as to local/general implementation. The implementation of existing models through a comprehensive evaluation, and, finally, the use of a model's results, will benefit brown bear conservation filling the gap between research and conscious management.

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LANDSCAPE PERMEABILITY AND BROWN BEAR (*URSUS ARCTOS*) CONSERVATION IN THE APENNINES, CENTRAL ITALY

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Biotic and abiotic characteristics of landscape could influence the access to resources and hence wildlife movement patterns and wildlife long term survival, in terms of daily resource use, dispersal, and gene flow. Thus providing opportunities for bears to move between habitat patches is important for their long time conservation. We analysed landscape permeability with respect to intra- and extra-home range movements of brown bears. Though habitat selection of bears during long distance movements are not well known, especially in central Italy, some landscape features are related to bear habitat use so, we modelled permeability according to landcover type, distance to roads and settlements, slope and elevation through the central Apennines. Permeability has been estimated by weighted-distance and least-cost analysis, calculating the cumulative cost of moving from origin areas (e.g. actual distribution of brown bear, suitable habitat in which bears are present) to destination areas (areas formerly inhabited by bears or where bears occur sporadically, suitable areas in which bears do not occur. For areas in which cumulative cost of moving (km) exceeded the maximum known intra- and extra-home range movement length (km) we identified least cost paths.

Through bear core distribution range at the intra-home range scale, landscape permeability was low in Roveto valley, towards Majella National Park and Sirente Regional Park. These areas are adjacent to bear core range and provide straight connection to suitable areas. Accordingly they could be considered of paramount importance according to colonisation dynamics and population expansion across its potential range. At the intra-home range scale, many least cost path overlap with areas for which infrastructure development has been scheduled, determining a potential high impact on bears movement suitability.

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SOFT- AND HARD-MAST BIOMASS PRODUCTION AND BROWN BEAR CARRYING CAPACITY IN THE CENTRAL APENNINES

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To evaluate the relative importance of fruit abundance and availability as a limiting factor for brown bear conservation, we analyzed the distribution and the abundance of brown bear fruit food resources in central Apennines, Italy (>900 km^2), from 1999 to 2003 within a European Union Life project. We defined two fruit categories: a) hard-mast, and b) soft-mast, divided, with respect to phenology in summer and fall soft-mast.

We sampled species distribution within systematically arranged circular plots along a 500 m grid. Hard-mast have been collected from September to November within Ø= 40 m plot (between 277-457/year); the abundance of soft-mast producing small trees and shrubs (N= 32 *taxa*) has been estimated within 2,362 plots (Ø= 20 m). Fruits have been collected within 17 *sub*-plots (1 m^2) for hard-mast, and from 10 randomly chosen branches-twigs for soft-mast producing species in both plots along the grid and opportunistically through the study area. We counted and weighed fruits with a 0.0001 g resolution scale. We estimated yearly carrying capacity of the study area with respect to

estimated number of bears drawn from non-invasive DNA monitoring. The average biomass ingested by bears has been estimated from information referred to captive bears at the Abruzzo National Park enclosures.

Our findings, referred to 3 species of hard mast producing trees and to 18 species of soft mast shrubs, estimated a yearly average mast production equal to 43,000 q (57,925 – 20,172 q). The biomass of both hard and soft-mast resulted rather constant with respect to each other, varying (hard-mast) between 53.7% (2001) and 47.5% (2003); however, fruit biomass of single species underwent pronounced variations from year to year, as exemplified by beechnuts (21,365 q in 2001; 1,462 q in 2002) and wild apples (16,132 q in 2001; 819 q in 2003).

Mast biomass produced far exceeds the estimated biomass ingested by bears within the study area, even considering that bears should consume an amount of food equal to the 34% of their total body weight. On average bears should not be able to ingest more than the 6% of produced mast biomass. From our results, though referred to 5 years, we could not exclude that in years of generalized crop failure, bears could experience a certain food shortage, even if animal protein and forbs-grasses food sources should also be considered while estimating carrying capacity. Though we doubt that mast abundance could be a limiting factor for bears in central Italy, we suggest that other factors should be comprehensively accounted for, such as availability and particularly human interference with foraging.

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STUDY METHODS OF COMMUNICATIVE SYSTEMS OF BROWN BEAR'S POPULATIONS

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The modern study and monitoring methods of brown bear *Ursus arctos* and other species of *Ursidae* family populations are used in many states of the world. These methods are expensive unfortunately. Besides the brown bear's areal in Russia is very great now. It is not foundations to wait the broad practice for the brown bear's population learning and monitoring in Russia in the near future years of expensive methods: a radiomarking, a satellite radiolocation, mass DNA analysis etc.

It is more promising while to develop the real methods, which are in Russia for the named objectives. We study the communicative systems of brown bear populations, have the some useful experience of tradition methods modes utilization, modify the several modes. We brought in our working some original modes, the part of them was commuted by the more new modes. We had worked on Yar research station (Udmurt Republic) ten years (from 1984). We are studying the brown bear's populations communicative systems of the forest ecosystems in Pechoro-Ilichsky zapovednik and nearby unprotected territory from 2002 year.

The field investigations of recent years are effected by us in the second half of summer. The forest territory by 150-200 km^2 is surveyed by 4 investigators in 1.5-2 calendar months. The investigators trail the routes on every places of expected bears removing: it is the forest roads and the anthropogenic paths, the forest compartment and others cut-throughs, the animals paths, the natural borders (forest - meadow, forest - bog, river shore), the valley terraces and the river's valley shores. The found signs of bear's activity (bear trees, bear paths, remnant of prey or feed remains, footprints, digging signs etc.) are registered and charted.

The bear's trees are described accordingly of protocol. The tree species (or genus), locality, a path or a cut-through presence, a biotope, traumas of anthropogenic origin are registered. The signs of damaging marking (scratches: slotting, superficial, dotty; spelling (without bark), sign of a nibble (by cuspids), nipped branches); abrasion signs, dirt, hair of past years; hair of investigation year (solitary hairs, mass hair, hair locks) are placed in category of "marks". The trees diameter, a height of replace of marks and marking zone on trees are recorded. The signs on a moss, a soil and a ground (a trampled place, a wallow, foot marks, traumas on tree roots) are described. Bear's hair probes are collected.

A density of recorded bear's trees, a bear's trees frequency on 10 km of a route, a marking intensity, a marking selectivity are defined. It is supposed that the abbreviated basic methods may be recommended for the monitoring on protected and unprotected territories.

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ANESTHESIA OF BLACK BEARS USING XYLAZINE, ZOLAZEPAM, AND TILETAMINE AND ITS REVERSAL USING YOHIMBINE

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Wildlife managers and research biologists are continuously looking to improve their field methods and reduce stress to study animals during capture. This is especially true when handling individual bears from isolated, declining populations. Bear researchers require an anesthetic that is not dangerous to humans, provides a wide safety margin for bears, requires a low volume dose for efficient delivery, maintains physiological homeostasis, and is reversible. No one chemical can meet all these requirements. We tested the use of Xylazine, Zolazepam and Tiletamine (XZT) in combination on black bears (Ursus americanus) to determine the quality of anesthesia it produces and its potential to be reversed. We captured black bears as part of management actions or on going research in western Montana, northern Idaho, and southeast British Columbia. Bears were captured in culvert traps, foot snares, or were 'free ranged' and delivery systems varied according to capture episode. Bears anesthetized with XZT required smaller dose volume, showed similar induction rates, were able to maintain physical parameters close to homeostasis, and recovered from anesthesia faster than bears anesthetized with Ketamine/Xylazine or Tiletamine/Zolazepam combinations. The XZT combination we tested is a viable option for safe, effective handling of black bears, and literature demonstrates the same for grizzly bears (*Ursus arctos*). The synergistic effects of these three drugs offer promise to meet many if not all of the conditions listed above. Having such an anesthetic agent is critical to the safe handling of rare individuals within vulnerable populations throughout the world.

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RETARDED BEAR CUB ABANDONED

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An abandoned wild brown bear cub was found on May 25, 1999 in central Austria and was subsequently placed in a zoo. On its arrival it was in bad nutritional condition, weighing only 5 kg and showing minor locomotive deficiencies (i.e. coordination of the hind legs). The cub gained weight but a behavioural and physical handicap became more and more apparent over time. At the age of 1 year the cub was not able to move its hind legs anymore, showed aggression against itself and others and was therefore euthanized. At necropsy the brain was almost lissencephal missing almost all physiological gyri and sulci. There was a profound enlargement of both lateral ventricles. Septum pellucidum and hippocampus appeared atrophic. The fourth ventricle, cerebellum, Aqueductus mesencephali and whole spinal cord appeared normal. No obstruction of normal drainage was obvious. Injuries of the skeletal system were not observed. All other organs appeared without notable pathomorphologic changes. DNA analysis showed that the retarded cub was the offspring of a 10-year-old male, released in a restocking program in 1993, and a 3-year-old female born in the area. The released male was also the father of the female who gave birth to the retarded cub. The same female successfully raised 2 cubs in 2001, again with the same male as father.

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PREDATION ON SHEEP BY BROWN BEARS (*URSUS ARCTOS*) IN SLOVAKIA

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According to official data, >78% of all sheep in Slovakia are in regions with bears. The extent and patterns of predation on sheep by bears in 2001-03 were studied at the national, regional and local levels. Eighteen out of 20 administrative regions (90%) with regular presence of bears (as well as *Canis lupus* and *Lynx lynx* in most cases) were visited in order to assess farm conditions and anti-predator measures. Reports of losses to large carnivores were gathered by semi-structured interviews with farmers/shepherds at a stratified random sample of 154 flocks. Surveyed flocks contained a total of c.74,000 sheep, c.22% of all sheep in Slovakia. An effort was made to include flocks grazed in a representative variety of locations at different altitudes and distances from main roads and settlements.

Overall, 48.0% of flocks were not affected by large carnivore predation at all during the study. In each year, ≤ 14.0% of surveyed flocks were allegedly affected by bear predation. On the basis of farmers' and shepherds' reports, the total national loss to bear predation was estimated to range from 169 to 397 sheep/year, a mean loss of 0.2-0.7 sheep/bear/year. This represents 0.06-0.15% of all sheep in regions with bears or 0.05-0.12% of all sheep in Slovakia. The annual damage allegedly caused by bears to the sheep industry in terms of replacement value (i.e. excluding lost production, loss of earnings, etc.) was estimated as c.€8,450-19,850, equivalent to c.€10-35/bear/year.

Reported losses were unevenly distributed among regions. Variation among regions in the number of sheep reported lost in 2002 correlated slightly more strongly with number of sheep than with number

of bears as estimated by hunters (r_s=0.733, P=0.001 versus r_s=0.697, P=0.001). Significant correlations were also found between number of sheep and percentage of flocks affected by bear predation (r_s=0.736, P=0.001) and percentage of all sheep reported lost to bears (r_s=0.723, P=0.001), indicating a marked relationship between sheep available and bear predation.

The mean reported number of sheep lost and the mean percentage of flock lost to bear predation ranged from 0.6 to 0.9 sheep/flock/year (max.=35) and from 0.1 to 0.2% (max.=6.1%) respectively. In 87.0% of reported attacks (20/23), 0-3 sheep were lost. Most attacks occurred between dusk and dawn. Losses peaked in August-October. Flocks that reportedly suffered some losses to bears/wolves in 2002 were significantly more likely than expected to allegedly suffer losses in 2003 (n=131, χ^2=27.01, d.f.=1, P<0.001). Flocks that reportedly suffered some losses to bears during the period 2001-2003 were significantly more likely than expected to allegedly suffer losses to wolves (χ^2=10.23, d.f.=1, P<0.001). These results suggest that some aspect(s) of individual flocks or their location rendered them more vulnerable to predation. High losses were generally associated with poor husbandry and/or inadequate preventive measures.

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DIET OF EUROPEAN BROWN BEARS (*URSUS ARCTOS*) IN AGRICULTURAL REGIONS AND ADJOINING NATIONAL PARKS OF SLOVAKIA

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Increased incidence of human habituated and food-conditioned bears in Slovakia following population recovery has often been perceived by hunters and the general public as the result of an "over-population" of bears. A variety of common phenomena, e.g. seasonal congregations of bears in maize (*Zea mays*) fields, and less frequent events, e.g. predation on livestock and defensive attacks on humans, have been similarly explained. This has led to mounting pressure to relax restrictions on hunting and has promoted a passive outlook on bear-human conflicts and thus failure to use appropriate preventive measures. In order to assess the degree to which bears use anthropogenic food sources, a total of 373 bear scats were collected in the Tatranský, Nízke Tatry and Veľká Fatra National Parks and surrounding agricultural areas from March to November 2001-03. Diet was quantified using correction factors to convert the total percentage volume of items identified in scats (%V) into estimates of percentage dry matter ingested (%D).

Overall, plant material constituted 90.8% of %V and 83.5% of %D. Green vegetation, mainly grasses/sedges and herbs, dominated in spring and early summer, with a shift to fruits (primarily *Vaccinium myrtillus*, *Rubus idaeus*, *Vaccinium vitis-idaea* and *Sorbus aucuparia*) in July-October. Animal material comprised 7.5% of %V and 14.7% of %D. No domesticated vertebrates were identified in any of the 373 bear scats analysed, although predation on sheep and cattle was known to have occurred during the study. Juvenile Cervidae and wild boar (*Sus scrofa*) were identified in scats from May-July. The total proportion of wild ungulates in the diet was estimated as %D=5.8%. Invertebrates (mostly Hymenoptera) occurred significantly more frequently (%F=26.8% versus %F=9.1%, χ^2=39.63, d.f.=1, P<0.001) and in greater quantities (%V=5.0% versus %V=2.2%, Wilcoxon's signed ranks test, P<0.001) than large mammals.

All anthropogenic food items combined were estimated to account for ≥ 23.3% of %V and ≥ 39.2% of %D. Refuse occurred in ≥ 7.2% of scats (%D ≥ 1.8%). It was significantly more frequently consumed in spring than in any other season (chi-square test of association using actual frequencies of occurrence, χ^2=11.47, d.f.=2, P=0.003). Use of anthropogenic food was least in June-August, when

bears fed mainly on green vegetation, berries and Formicoidea. Fruits (%D=30.3%), hard mast (%D=6.2%) and Vespidae (%D=5.0%) were important food sources in September-November. Overall, however, the autumnal diet of bears in the study area was found to be dominated by cultivated grains (%V=31.5%, %D=47.0%), obtained at hunters' ungulate feeding stations and in fields as pre-harvest crops. Implications for bear conservation and management are discussed.

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PRELIMINARY CHARACTERIZATION OF SPECTACLED BEAR (*TREMARCTOS ORNATUS*) DIET, BY SCAT ANALYSIS IN A SECTION OF ANDEAN FOREST REGION OF PISBA NATIONAL NATURAL PARK, COLOMBIA

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Tremarctos ornatus, is the only representative Ursid in South America. It's condition of "Vulnerable" (UICN, 2002) deserves our intention in getting local and specific information attending its biology and ecology in order to increase the preservation measures in specific places, such as the Pisba Natural National Park, where there is a lack of investigation in this matter. For this reason, and taking in consideration the feeding habits of great beast such as bear in its habitat, we realized the present investigation in three stages: First. Sect and localize four bear's transects reported by local people and complemented by direct observation of tracks. Second referent to monthly collection (eight field expeditions between February and November) of scat and feeding trail habits. Third – washing the scats, separation and weighting of its component to be studied and compared with referent feeding materials. The last is referent to data analysis of relative frequency of existence of materials and its specific weight in the samples in order to determine significant differences in the participation of items and climatic season of the year. For this purpose the statistic significance test Kruskal Wallis, was employed.

The scat analysis showed that spectacled bear, in the PNN Pisba (2,200 – 2,900 m. asl), consumes in its diet *Puya sp*., and *Tillandsia sp.* marrow and parts of leaves; *Symplocos sp1* and *sp2*, *Cecropia sp., Puya sp*., and *Passiflora sp*. fruits, bees (*Apis mellifera*) whose presence in scat shows honey consumption. Bromeliaceae´s family was the more abundant (82%) and frequent (in 95% of the scat) in bear's diet independent of climatic season, indicating a net preference of bear towards these taxa. Maximum fruit bear consumption occurred in transition between dry to rainy period (35.55%). This fact makes us conclude that fructification and bear's consumption occurs in the same period of time. By observing composition and measuring quantities in this study we can also conclude that *T. ornatus* diet varies according to transect and climatic conditions.

We finally suggest continue and complement the present investigation on the following matters refereed to habitat's characteristics: Nourishing potential, accessibility, availability, phenological patron, etc. of its species food of the Andean bear in the Pisba Natural National Park.

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PATTERN ANALYSIS AND SPACE USE TRENDS FOR ONE FEMALE BEAR, IN THE FIRST ATTEMPT OF REHABILITATION, LIBERATION AND MONITORING OF SPECTACLED BEAR IN THE REGION OF MAMAPACHA, BOYACÁ, COLOMBIA

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The first attempt of rehabilitation, liberation and tracking of a spectacled bear in Colombia allowed evaluating the recovery process of this species for the environmental authorities. The tracking lasted three and a half months. The use of the space was monitoring for a female individual. The bear was liberated in a paramo and andean forest zone, in the Mamapacha massif, Boyacá, Colombia. The tracking was carried out using a conventional system of telemetry. The specimen location was determined by the triangulation and homing techniques. The data were evaluated to find the occupied area by the animal during the tracking time.

The area used by the bear was 350 ha approximately throughout four months. Fortnightly analyses show that the size of the used area tends to diminish. This area was center in a defined point, the house of the reserve where the animal was rehabilitated. This is a consequence of food, refuge and safety offer in the Reserva Privada El Secreto while the bear was in captivity. The bear lost two of it canines during the time that it remained free. The reasons of this event are unknown, the possible causes are diet deficiencies and adaptation exercises. The loss of the canines affected the adjustment behavior to the wild life, and the bear was force to look for support in her keepers.

The liberated animal lost the natural fear of the wild bears for contact with humans, because she was supported in captivity by more time that the necessary and the continuity got lost between the processes of rehabilitation and liberation. In this case the administrative disability of the state entities obstructed the necessary advance in the technical procedures. Besides, in the rehabilitation process, the bear was not kept isolated from visitors in the reserve. Even though the bear searched and consumed natural foods in wildlife, she learned that near the house the food was easier to obtain and she need less time and effort. The rehabilitation procedures developed with the animal did not achieve to eliminate the behavior charges as the artificial diet, the affection and to the safety dependence. That turned out to limit her performance during her return and establishment into wildlife.

Due to the new guidelines in the Environmental Ministry it is recommended that non-governmental organizations assume the processes of rehabilitation, liberation and tracking of spectacled bears for which is necessary a protocol of management in these cases.

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HISTORICAL ANALYSIS ABOUT THE FINAL ORIGIN AND DESTINY OF BEAR CUBS CAPTURED IN COLOMBIA

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The presence of Andean Bear (*Tremarctos ornatus* F. Cuvier, 1825) specimens in Colombian Zoos is very common and is the answer to the final location of wild specimens extracted from the Forests when young or cubs. At first instance, to alter recovery by the Colombian environmental authorities, animals wait for an opportunity to go back to the Forest but generally finish at places like Zoos, rehabilitation centers, and animal refuges, from which only 2 of 13 offered proper conditions for care and management. This situation is mainly because of the lack of human, technical and economic resources that allow developing projects of rehabilitation, liberation and monitoring.

There are not exact numbers about the magnitude of the extraction of wild Andean bears in Colombia, but a good number of bear cubs under 4 months of age, 28 altogether, were voluntarily seized or given in the last 10 years originating of 24 different litters, from 14 of the 75 patches in which Colombian bear population is fragmented. These individuals were obtained causing always the death of the mothers.

Although at this moment is seen an interest by the conservation of the population in wildlife and by the handling of the young individuals of bear recovered by the Government's environmental organizations, a long history of errors and inadequate handling, added to the lack of tools to develop rehabilitation processes have prevented to truly know the contribution of these processes to the conservation of species.

The capture of bear cubs and his final disposition has been handled as a conjunctural problem and does not appear a clear directive on its final disposition although it is counted on handling protocol post seizure of wild fauna developed by the Colombian Ministry of the Environment, House and Territorial Development, thus like with a strong legislation that prohibits and penalizes the possession, commercialization and traffic of units of species threatened of extinction as it is the case of the Andean bear, but until now there is nobody processed by this fact, which demonstrates that the promulgated laws have not been executed. Bear cubs that have been recovered have finished locked up, died or escaped from the imprisonment places where they were maintained, without knowledge of its situation; only 5 individuals have been released conscientiously to the wild, of which two failed and of rest 3 its present state is not known. On the other hand, the centers that have been designed and implemented in the country with intentions to offer an way out to this problem, as it is the case of La Planada (Nariño), La Pastora (Risaralda), Parque Jaime Duke (Bogotá), Garagoa (Boyacá), has been clearly inoperative and non is working at this moment. Only at the present time the CREAM center (Guasca), a private alternative, could offer a viable alternative, but it lacks the support necessary to assure his continued functionality and technique.

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COMMUNICATION AND PUBLICATION AS A STRATEGIC METHOD FOR THE *IN SITU* CONSERVATION OF THE ANDEAN BEAR (*TREMARCTOS ORNATUS*) IN COLOMBIA

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Hunting and loss of habitat are the main factors that threaten the survival of the Andean Bear population in Colombia. These are human intervention factors that indicate the problem of conserving a species in a social context. Thus, the need to strengthen research projects in the field and conservation initiatives has been identified. This can be done through the implementation of communication activities that allow the development and results of these processes to be reported to the local communities, scientists and the general public.

For approximately twenty years scientific research has been carried out on the Andean Bear in Colombia. One effort has focused on the collection of information on the species biology while another focused on those social aspects that put pressure on the species. In both cases the two facets were disconnected from the general problem. Linking the community to the scientific task is basic to moving ahead on concrete actions in regards to the conservation of the Andean Bear.

During the period of time from January 2004 to February 2005, efforts were carried out to document not only the reintroduction and monitoring projects but also the interaction between the species and the rural communities in the Colombian Andes in difficult access areas. As a result, records of biological aspects and species management that had never been filmed before were acquired. The level of expectation and attention generated by the presence of cameras and the projecting of the film that had been obtained through daily work activities for the whole community generated the need to set up training courses in the use and handling of video cameras for the population in the region as well as in production techniques for making audiovisuals and photography. Thanks to this, hunters do not go out into the mountains to hunt prey any more. They have exchanged their guns for cameras and animals taken from the forests for pictures of fauna and flora that is unknown to many.

The expansion of communication and reporting activities has not only linked the scientific component to the social one in the areas where the studies are being carried out but also contributed to opening up the possibility for community participation in conserving the Andean Bear. At the same time by making audiovisual products, the purpose of which is to inform, educate, and sensitize, it has been possible to do broadcasting on television channels with both local and national coverage and make Andean Bear the symbol of the conservation of Colombian biodiversity in the opinion of the public.

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DNA ANALYSIS OF BITE MARKS ON CROPS BY ASIATIC BLACK BEAR, *URSUS THIBETANUS*

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In Japan, conflicts between humans and bears have been reported, such as agricultural damage, prowling around residential areas and occasional attacks on people. Local governments permit killing of bears as a pest control measure, but it is difficult to discern the captive bears' culpability in such

incidents. Conflicts must be minimized to the greatest extent possible to lower culling pressure on the bear population. In this study, we developed a method for DNA extraction and amplification from bite marks on crops to identify nuisance bears.

We collected 110 crop samples from dent corn fields in Shizukuishi-village, Iwate Prefecture. First, their surfaces were wiped using a cotton swab. The swab was then inserted into a microtube and suspended in 1 ml of DNA extraction buffer. Proteinase K lysis was added to each sample, which was then incubated at 37°C for 1 h. We extracted DNA with phenol/chloroform method and obtained a precipitate with ethanol. In cases where the pellet was fouled at that stage, we eluted it using CTAB solution to remove polysaccharides from crops. After incubation at 65°C for 2 h, we reprecipitated the solution with ethanol. The pellet was eluted with DW, then subjected to PCR. For individual identification, each sample was typed with alleles at eight microsatellite loci (Paetkau *et al.,* 1998). Subsequently, the amelogenin gene was amplified for sex determination. We combined a two-step PCR amplification method with multiplex PCR in a total volume of 15 µl of a reaction mixture. The PCR products were electrophoresed on ABI 310 machines, and results were analyzed using Genescan software. This process yielded PCR products from bite marks on dent corns. Future efforts are intended to reduce errors in DNA analysis.

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FOOD HABITS OF THE ASIATIC BLACK BEAR (*URSUS THIBETANUS*) IN THE OHU MOUNTAINS, JAPAN

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Habitat loss and conflicts between human and bear are reported throughout Asiatic black bear (*Ursus thibetanus*) range. Understanding of Asiatic black bear food habits is one of the fundamental study. So our objective in this study is to understand present situations between human and bear, and to develop effective management policies.

I studied food habits of Asiatic black bears in the Ohu Mountains in northeast Japan. From April 20 to December 10 in 2003, I collected total 136 scats, 28 in Morioka-city and 108 in Shizukuishi-town, respectively. I, however, excluded the 22 scats from analysis because they were collected in some place where cannibalism was occurred.

The percent importance value of each food item was estimated based on the frequency of its occurrence and the volume of all food items (Mealy, 1980). The primary bear's food items in spring were beech (*Fagus crenata*), leaves and/or shoots of dwarf bamboo (*Sasa* sp.); succulent forbs, soft masts, and animal materials, especially parsley (*Umbelliferae* sp.) in summer; and hard mast, acorns in autumn. Bear ate insects, mainly ants (*Formicidae* sp.) and bees (*Vespidae* sp.), in summer and fall. Bears also ate meat of Japanese serow (*Capricornis crispus*) on at least 2 occasions, and Asiatic black bear, too. Eaten rate of crop is not so high in total. But in August, bear ate them, mainly corn, intensively. The bear's diet changed so clearly by the seasons, also the area provides foods, for example, beech forest in spring; around stream in summer; and broadleaved forests in autumn. It may be important to preserve their habitat to coexist with human and bear.

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OBSERVATIONS IN THE LIBERATION PROCESS AND SPACE USE OF A SPECTACLED BEAR IN THE SERRANÍA DE LAS QUINCHAS, BOYACÁ, COLOMBIA

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In the year 2002, environmental authorities did the confiscation of an orphan male cub in the Serranía de Las Quinchas (Boyacá department). The bear was set free in his original habitat after 19 months of captivity. This case is the second attempt of rehabilitation, liberation and tracking of a spectacled bear in Colombia.

The tracking was realized using a telemetry system for 52 days. The triangulation and homing techniques were used for determine the position of the individual. The bear occupied an approximate area of 190 ha, parallel to a small stream course. Initially the bear explored the liberation zone. Later, he expanded the used area and takes advantage of new nourishing resources. After five weeks, the bear enters a zone used for illicit crops, in which he consumes a poison. As effect of the symptoms the bear reduced its area of action remarkably.

The first weeks of activity in freedom, the bear shows fear for human presence and he consumed wild nourishing resources. After the event of poisoning, the response of the individual was to look for refuge and food in a neighbor house. The animal associated the food and the refuge with the human being as result of the captivity management. The recovery of the individual after giving him a wild di*et al*lowed him to feed himself and use again a bigger area.

One month after finished the tracking, the bear dies for unknown reasons. The animal needed more time of accompaniment in the process of adjustment to the new environmental. The political decisions of the institution in charge delay the activities of rehabilitation, liberation and tracking. The hunt, deforestation, lack of statal presence and illicit crops are the major threats to the survival of the spectacled bear in the Serranía de Las Quinchas.

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MAKING LIFE IN THE FIELD EASIER: DEVELOPMENT OF A LOW-END GIS-BASED TOOL FOR THE ASSISTANCE IN BEAR FIELD RESEARCH

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INTRODUCTION -Spatial modelling is a powerful tool in the hands of Geographical Information Systems (GIS). Biology and nature conservation are disciplines that have a spatial dimension and benefit from the deployment of GIS. Insufficient familiarisation with spatial analysis principles and cumbersome interfaces pose obstacles in the utilisation of GIS. This situation is problematic in the case of teams working in the field where there is a strong demand for rapid assessment and interpretation of evidences collected. Overcoming such obstacles would increase effectiveness and enhance understanding and protection of endangered species, such as the brown bear (*Ursus arctos*) in Greece. The aim of the present study was to define a common “language” between biologists studying

brown bears in the field and headquarter GIS experts through visual modelling. In addition the development of a low-end and adjustable tool for rapid assessment of field work results under the existing resource constraints was attempted.

MATERIALS AND METHODS - ArcView 3.x (ESRI), Spatial Analyst and MapModels (L. Riedl, Vienna University of Technology) software was used. Hardware was a regular portable PC and input came from various data sources (e.g. maps from the Hellenic Army Geographical Service, vector data from public authorities and NGOs, field observations with GPS location etc.). Three Models were developed: The aim of the Location Definition Model was to suggest location definitions and enable field researchers to adjust the "sharpness" of definitions using fuzzy functions. The Habitat Assessment Model aimed at the assessment of brown bear habitat quality. The Electricity Poles Selection Model was developed in order to evaluate brown bear marking behaviour in the country.

RESULTS AND CONCLUSIONS - The first model functioned as a mediator when solving disputes about brown bear evidence location classification. The habitat assessment model assisted researchers in the coordination of field work through the evaluation of influential biotic and abiotic factors and the visualisation of underrepresented areas monitored. Finally, the electricity poles model offered a flexible tool for the concentration on the best ranking locations, thus ensuring optimal utilisation of resources. The results of the models created and the comparison with available field data offered promising results and further testing and adaptation are expected. Within a short period and with a modest budget, it was possible to create a decision support system, while enabling bear researchers to assess the effort, cost and implication of field activities according to changing conditions and assumptions.

ACKNOWLEDGEMENTS - We would like to express our outmost gratitude towards L. Riedl for enabling the use of MapModels and his assistance in the development of the models. The help of I. Aravidis and Y. Mertzanis was substantial during the initial phases of the project.

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STATUS AND DISTRIBUTION OF HIMALAYAN BROWN BEAR (*URSUS ARCTOS ISABELLINUS*) IN INDIA – AN ASSESSMENT OF CHANGES OVER TEN YEARS

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In India, the Himalayan Brown Bear (*Ursus arctos isabellinus*) inhabits the subalpine and alpine regions (>3,300m) of the Greater Himalaya and some parts of the Trans-Himalaya. It occurs in the states of Jammu & Kashmir, Himachal Pradesh, Uttaranchal, and Sikkim (probably the subspecies *U.a.prunosis*). I evaluated the status and distribution of brown bear in India during the period 1994-95 through a questionnaire survey and expert knowledge. Results of that survey indicated presence of brown bear in 23 Protected Areas and 18 other areas. After 10 years, I assess the change in the status and distribution of brown bear in India through questionnaire survey (n=30), results of recent field surveys and expert knowledge. Based on the status information acquired recently and rule-based modeling in the GIS, the potential brown bear habitat range in India has been estimated and that is significantly higher than estimate made in the 1994-95 survey. A comparison of the brown bear status in the different Protected Areas of India between the mid 1990s survey and the present (2005) will be presented and discussed.

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TREE RUBBING BY HOKKAIDO BROWN BEARS: SEASONAL CHANGES IN FREQUENCY, DIFFERENCES BETWEEN GENDERS, AND A ROLE OF IMMIGRANTS

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Tree rubbing by brown bears are well known behavior throughout the distribution. Though some studies have reported the characteristics of trees rubbed by bears, the studies about the behavioral description for tree rubbing by bears and function of the behavior are not sufficient. Speculations about this behavior by previous studies are divided into 2 main branches; "communication among bears" and "stretching or massage for themselves".

In this study, we described seasonal changes in frequency of tree rubbing by brown bear, the differences between genders, and the contribution of immigrant males from adjacent areas for the increased frequency of tree rubbing behavior. We analyzed bear hair remained on the trunk of rubbed trees by using genetic markers to identify individual animals in Urahoro district, eastern Hokkaido, Japan.

We observed the evidence of tree rubbing by bears throughout the active season, and increased frequency of rubbing during May and July. Based on the individual and gender identification by using microsatellite and amerogenin gene marker, we found that same bears rubbed several trees, and several bears rubbed same trees. Though tree-rubbing behavior was observed for both genders, the frequency by males was higher than females since the number of tree rubbing males and the frequency of rubbing per a male were larger than female. Male bears used more trees for tree rubbing than females.

We estimated immigrant bears who had the haplotype that female bears did not have in our study area by using polymorphism analysis for mtDNA control region. In our study area, we found that most of the tree rubbing by males were by immigrants.

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STIMULATION OF FORAGING BEHAVIOUR IN CAPTIVE MALAYAN SUN BEARS *(HELARCTOS MALAYANUS)*

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In their natural habitat Malayan sun bears mainly feed on fruits high in fibre and insects. In order to meet their nutritional and energy demands they have devote large proportions of time to acquire food in sufficient quantities. Due to the fact that most invertebrates are small scattered and hidden sun bears have to spend a lot of time in foraging activities. Thus a major part of their natural behaviour consists of search for food and food processing. Wild sun bears are active, mainly with foraging, during 90% of daylight hours (Fredricksson, pers. comm.). Sun bears in zoos have time budgets that differ markedly from those of their wild counterparts who should be a guideline for captive animals. The daily activity of zoo-housed sun bears is reported to be about 30-35 % (Riese, unpubl. data). Only 6 – 8% are spent in foraging activities, mainly immediate consumption of food. Other activities are restless walking or even stereotypic pacing. Compared to free-ranging bears, bears in zoos have easy

access to their food and the spatial and temporal availability of food is highly predictable and searching for food is not stimulated and can – according to the predictions of the optimal foraging strategy - not be expected. In order to increase the proportion of explorative and manipulative behaviours related to foraging spatial unpredictability was implemented in the feeding technique increasing the range of scatter feeds and by changing hiding places for food daily and by laying scent tracks to filled and empty feeding places.

Data from four adult sun bears were used to assess changes in behaviour in each experimental condition compared to baseline data (just three scatter feeds daily). To minimise the effects of confounding variables, such as weather condition or endogenously controlled seasonality, the feeding method was switched daily between the conventional and the experimental condition. Activities of all animals – walking, stereotypic walking, standing, lying, foraging – were recorded by scan sampling each five minutes during nine hours per day for a total of 360 hours. The activity budgets of each bear were compared between the different conditions, focusing on activity levels and foraging activity.

The tested feeding methods significantly increased the time bears spent foraging and decreased the time of walking or stereotypic behaviour, but no significant increase in total daily activity was found. This finding is in accordance with predictions of the optimal foraging strategy. The results varied markedly between the individuals. The variation could be assigned to age effects. The results of this study lead to the conclusion that the bears display functional behaviours which require some energy investment only if they are forced to. Results are discussed with respect to methods to improve daily routines, so that functional foraging and feeding behaviour is stimulated in captive bears.

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SHIFT FROM DIURNAL TO NOCTURNAL BEHAVIOUR: INFLUENCE OF MINIMUM TEMPERATURE ON NIGHT ACTIVITY

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Brown bears are mostly diurnal but many factors (human impact, food availability, weather etc.) can influence their activity pattern. In order to determine the influence of the minimum temperature two adult female brown bears at the Bearpark Orsa Grönklitt in Sweden were fitted with a radio collar (Telonics: MOD-500 (HC)). The transmitters had motion-sensitive tip switches with 57 signals/min in the active mode and 34 signals/min in the passive mode and a 2 min reset mechanism. A computer program was designed to collect data. Data was collected from August, 28th 2003 until October, 15th 2003 for one minute every two minutes. The data consisted of the number of significant fluctuations in signal strength. Besides the minimum temperature for each day was measured.

Comparing the night activity of the two bears (measured from sunset until one minute before sunrise) to the minimum temperature, a significant positive correlation was found (Spearman Rank Order Correlation: bear 1: correlation coefficient 0.655, $P<0.001$, $N=49$, bear 2: correlation coefficient 0.610, $P<0.001$, $N=49$).
Most striking was a shift from diurnal to nocturnal behaviour following a sudden rise in temperature. From August, 28th until September, 2nd the minimum temperature slowly decreased from 5°C to –1.9°C. On September, 3rd it suddenly rose to 6.7°C and stayed between 4.4°C and 12.5°C for the next 12 days (median: 7.2°C) before it dropped again. In the night when the temperature rose the night activity of bear 1 increased significantly. For the period from August, 28th until September, 2nd the median of her night activity was 1.23% (bear 2: 3.73%), for the period from September, 3rd until

September, 15th the median of her night activity was 35.64% (bear 2: 10.33%) and for the period from September, 16th until September, 28th the median for her night activity was 4.61% (bear 2: 3.06%). At the same time her day activity decreased. For the period from August, 29th until September, 3rd the median of her day activity was 39.83% (bear 2: 28.44%), for the period from September, 4th until September, 16th the median of her day activity was 13.18% (bear 2: 24.86%) and for the period from September, 17th until September, 29th the median for her day activity was 43.81% (bear 2: 26.45%).
Bear 2 did not shift to nocturnal behaviour but her nocturnal activity still increased during that period while her day activity slightly decreased.
Repeating the Spearman Rank Order Correlation omitting the data for the period from September, 3rd until September, 15th no significant correlation was found anymore for bear 2 but only for bear 1 (bear 1: correlation coefficient 0.423, P=0.0105, N=36, bear 2: correlation coefficient 0.211, P=0.215, N=36).

The results of this study suggest that the brown bear's night activity might be influenced by the minimum temperature and that it is possible that a bear shifts from a diurnal to a nocturnal behaviour due to a sudden increase in temperature following a period of cold weather.

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HABITAT USE BY ASIATIC BLACK BEAR (*URSUS THIBETANUS*) AT MAJATHAL-HARSANG WILDLIFE SANCTUARY, HIMACHAL PRADESH, INDIA

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Observations on the Habitat use by Asiatic black bear (*Ursus thibetanus*) at Majathal-Harsang Wildlife Sanctuary, Himachal Pradesh, India, were made from May 1999 to June 2001, based on their evidences (n=114) and sightings (n=4). Indirect evidences comprised of feeding signs (crown damage, n=111) and scats (n=3). Black bear and its evidences were mostly recorded between October and April in *Ban* Oak (*Quercus lecotrichophora*) forests (n=101, 86%), and at elevation ranging between 1,800-2,070m [Mean = 1,941 ± 44.6 (SD)], and mostly (85%) in north eastern aspect. Bear used areas that had moderate to high tree cover [57% ± 9.2 (SD)], low shrub cover [10% ± 8.3 (SD)], and low grass/herb cover [14% ± 11.6 (SD)]. Most of the feeding signs of black bear were encountered in the form of crown damage (87%) on *ban* Oaks (91%) and the mean canopy damage was 28% ± 18 (SD). The mean height (m) and mean girth of trees (cm) that were used by black bear were 13.32 ± 2.5 (SD), and 139 ± 30 (SD), respectively. As the study area was close to villages (< 3 km), there were several reports of black bear raiding crops in the villages and three incidences of bear attacking humans.

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THE BROWN BEAR *URSUS ARCTOS* IN BELARUS: THE FIRST RESULTS OF ECOLOGICAL STUDIES AND CONSERVATION PROBLEMS

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During the preliminary ecological studies on the brown bear in Belarus we did (1) track survey in July-September (plus talking with experienced local hunters and hunting wardens) to estimate the predator density in three model areas; (2) snowtracking by late winter; (3) collecting and analysis of scats, study on feeding remains; (4) collecting information about the brown bear hibernation: habitats, period, giving birth, winter activity etc.; (5) questionnaire to locals and local hunter organisations and committees for nature protection about presence of brown bears, their numbers, visits of large predators in human settlements, aggressive behaviour etc. According to the obtained preliminary data basically brown bears were found in northern and central-eastern parts of Belarus, and the total population number was approximately 210-230 individuals. Several trends in the brown bear distribution are seemingly present. The first one was some increase of the predator numbers in the northeastern and central-eastern districts. Another news was present of many migratory brown bears moved rather faraway from the current border of continues range of the species. The second trend was gradual decline in brown bears in northwestern districts. In the ecologically rich model woodland dwelling on clay soil in northeastern Belarus the brown bear density varied from 2 to 8, and on average it was 4.7 individuals per 100 km^2. In central-northern part of Belarus in the conditions of ecologically poor predominantly pine forest dwelling on sandy deposits the brown bear density was lower - 0.8-2 (mean 1.2) individuals per 100 km^2. Seasonal changes in the diets of brown bears in northern Belarus were investigated. Mostly brown bears ate invertebrates, fruits and other plant litters. Remains of wild ungulates (both preyed and their carcasses found) were occurred in from 4 to 63%, on average 24% of the scats analysed. This food item constituted from 3 to 52 (mean 19)% of food biomass consumed. The following factors negatively influenced the brown bear population in Belarus were revealed: (1) illegal shooting especially during legal hunting and poaching of wild boars at oat fields by late July-September; (2) scaring of a mother from hibernating den by hunters and their dogs mainly during hunting on wild ungulates. In effect, the cubs are killed by the dogs or died from frost; (3) too much felling activity; (4) too much recreation, i.e. camping of people in the wild, ecotourism, collecting of mushrooms and berries, fishing etc. Also, one of the cause exacerbated the decline in brown bears in Belarus was fairly frequent kills of cubs by big males, and there is some support to the idea that an altered population structure can lead to an increasing in such cub mortality.

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FINE VERSUS COARSE LANDSCAPE LEVEL COMPARISON OF PRINCIPAL ROADKILL AREAS FOR THE FLORIDA BLACK BEAR (*URSUS AMERICANUS FLORIDANUS*)

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The Florida Fish and Wildlife Conservation Commission (FWC) has documented an increasing statewide trend in the number of roadkill Florida black bears since 1976. Several studies have examined the relationship between black bear populations and roads in Florida. Gilbert and Wooding (1996) prioritized 12 ‘chronic’ bear roadkill areas along approximately 60 highway miles in Florida

(1976-1995) by defining chronic areas as areas which have 8 or more roadkill instances within a distance of 7 miles. In 2001, Gilbert *et al.* identified 15 "chronic" roadkill areas along 130 highway miles statewide using integrated habitat features (1976-1999). Most recently, FWC identified 16 sites of "principal roadkill areas" along 133 highway miles. In the recent study, areas with 3 or more roadkill instances within a distance of one mile were identified as "principal roadkill areas" (2001-2003). Although the results from the recent FWC analysis identified a number of principal roadkill/chronic areas documented by Gilbert and Wooding (1996) and Gilbert *et al.* (2001), several segments were no longer classified as principal roadkill areas and a few new areas were documented.

In an attempt to determine which criteria best illustrates the relationship between roads and bears, each level of criteria were analyzed using similar time frames. These results demonstrate the impact of scale on black bear management decisions. These comparisons will demonstrate to managers what temporal and spatial level of scale and detail are needed to determine if problem roadkill areas are emerging or are of concern. The results emphasize the importance of standardizing the criteria so that management efforts are meeting conservation needs timely and efficiently. Using this information in combination with trends in both human and bear population data will provide a more comprehensive understanding of the linkage between the species and the landscape. Based on varying management needs, a finer or coarser level of analysis may be needed; however, it is important to recognize that the level of scale can impact analysis results and consequently black bear management decisions.

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ISOLATED POPULATION OF BROWN BEAR (*URSUS ARCTOS* LINNAEUS, 1758) IN BRYANSK REGION OF RUSSIA AND NEIGHBORING AREAS

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The Bryansk region is situated in the central part of East-European plain (51º40′ - 54º05′ N. and 31º10′ - 35º20′ E.). The main part of the region belongs to a subzone of coniferous-leaf forests. Since 1950s, in the Bryansk region a small isolated population of brown bear had appeared. It was alienated from the main species range in European Russia. In the beginning this population consisted of four separated subpopulations existed in the largest forest tracts of the region. Now only two subpopulations have survived. It is the subpopulation in the Kletnya forest tract that is in NW corner of the region (total square of the tract is 2,600 sq. km) and subpopulation in the Desna forest tract along the left shore of Desna River (total square is about 5,000 sq. km). By 1930s, total numbers of brown bear in Bryansk region was estimated to 60 – 65 animals [Lavrov, 1975]. Since 1958, in the region hunting on bears was forbidden. Despite of that the total numbers of the species continued to decline. In 1970, in the region 42 bears lived, most of them (31 animals) in the Kletnya forest tract [Lavrov, 1975], in 1975 – 32 animals, from them 20 animals in the Kletnya tract [Polyakova, 1975; Vatolin, 1979]. In 1980s, only 10 bears survived in Bryansk region [Vaisfeld, 1991; Pazhetnov, 1993]. During the last ten years a growth of bear numbers was observed. To support the brown bear population in 1996 - 2002 14 brown bear cubs were released at the forest tract situated in SE corner of Bryansk region (52°18'-52°50' N., 33°28'-34°40' E.). In 2003, total numbers of bears in the region was estimated to 45 – 50 animals. From them 20-25 inhabited the Desna forest tract and 10-15 inhabited the Kletnya forest tract. Besides, 5 – 10 bears were roaming through small forest islets situated in SW and NE of the region [Sitnikova, 2002]. In the neighboring territory of Belarus the population of 100-120 brown bears exists. It is divided on five subpopulations. One of them, inhabiting Khotim district of Mogilev region (53°21' N., 32°40' E.) is probably a part of the Kletnya population of Bryansk region. The main population of Belarus (Berezina population) inhabits the Berezinsky Nature Reserve in Minsk region (54°20'-55°10' N., 27°50'-28°40' E.), Other subpopulations (Babinovichi, Surazh, and Rosson) are situated in Vitebsk region (54°30'-54°55' N., 30°10'-31°10' E.; 55°10'-55°40' N., 30°10'-

31°00' E.; 55°20'-56°10' N., 28°00'-30°00' E.). Migrated bears were remarked in Gomel region. It is probable that there is exchange by animals between the Berezina, Babinovichi, and Surazh subpopulations of Belarus and the Kletnya subpopulation in Bryansk region [Kozlo, 1993; Sitnikova, 2004]. In Smolensk region brown bear inhabit only northern districts neighboring with Tver region. At the last of 1980s, the total numbers of bears in Smolensk region was estimated to 150-200 animals [Lavrov, 1975; Vaisfeld, 1991; Pazhetnov, 1993]. Probably, there is exchange by bears between the population of Smolensk region and the Kletnya subpopulation of Bryansk region [Sitnikova, 2004]. In Kaluga region singles (3-8 animals) were registered in SW part near the border with Bryansk region. We consider they are a part of the Desna population. Brown bear of Bryansk region is included in the local Red book. Since 1996, a program of restoration of brown bear in the region has been conducted. It includes releases of bear cubs. To protect brown bear in Bryansl region it is necessary to develop a joint program of brown bear conservation as for Bryansk as well for neighboring regions.

169 – poster

PRIORITIZATION OF FIELD-COLLECTED BROWN BEAR (*URSUS ARCTOS*) FAECAL SAMPLES FOR GENETIC ANALYSES

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Use of molecular techniques and non-invasive sampling is increasingly becoming the method of choice for many population studies. However, low success rate of DNA amplification from non-invasive samples and costly re-runs require processing of large number of samples, often making such studies prohibitively expensive.

In this study, we hypothesize that not every scat sample has the same chance of successful amplification, and not every sample carries the same amount of information. Scats are exposed to various environmental conditions for different periods of time before they are found and collected. Many of these factors, which can have adverse effect on the quality of the DNA in a scat, can be estimated in the field (e.g. exposure to direct sunlight, age of the scat etc). Scats that are spatially and temporally close to each other could have been deposited by the same bear on the same occasion, thus lowering their information value.

The study is a part of a conservation genetic study of brown bears in Slovenia. Samples were collected over two study areas measuring 175 km^2 and 270 km^2. The first area was sampled with volunteers in two 7-week intervals of intense sampling (May – June 2004 and September – October 2004). The second area was sampled by professional hunters of the Slovenian Forest Service. Sampling there was less intense, between May and November 2004.

403 samples were collected in 95% ethanol. Estimated age of the scat, local weather conditions, date and time of collection were recorded. Exposure to the elements (e.g. under canopy, unprotected in the middle of a road or a forest meadow etc.) and map coordinates were recorded as well.

Information value of each scat was estimated with regard to its spatial and temporal location as a spatial/temporal vector dubbed “information distance”. Recorded environmental factors and estimated age of the scat were used to assess probability of successful DNA amplification, which was expressed numerically as a “success factor”. The samples were clustered according to pairwise information distance between them, and the sample with the highest success factor was selected from each cluster. A priority list was then made with regard to the success factor, which included only the selected samples from each cluster. Samples were analysed in batches of 37. After processing of each batch, a new priority list was created that included the next-in-a-row samples from the clusters from which

DNA amplification of the prioritised samples failed. Also, the results were checked after each batch to see if the population density estimate was within acceptable error margins, meaning that the analysis could be stopped.

In studies with intensive sampling, the method has potential to significantly reduce the number of samples that need to be processed to get acceptable results, thus lowering the costs and speeding up the analysis.

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DENSITY ESTIMATION: MODEL FOR COMBINING DNA SAMPLING, CAMERA TRAPS, AND TELEMETRY DATA WITH THE MIDDLE GEORGIA BLACK BEAR POPULATION

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The Ocmulgee River drainage system, with Oaky Woods and Ocmulgee Wildlife Management Areas (WMAs) likely at the core of suitable habitat, sustains a distinct population of American black bears (*Ursus americanus*) in central Georgia, although current population density and status are unknown. Estimating demographic parameters of cryptic species, like the black bear, is difficult because of their elusive nature. Non-invasive sampling methods, such as DNA from hair or camera traps, are valuable in these situations, although detection probabilities for individual animals are variable with these methods. We are estimating detection probabilities (e.g., probability of detection with DNA, camera, or at least one method) by combining marked individual camera resightings and DNA recaptures, which are conditional on the presence of marked individuals within the sample region. Non-invasive genetic sampling has added complexity due to small amounts of DNA in samples; thus misidentification error must be included in DNA detection probabilities. We use a series of trapping webs to place hair snares and digital cameras on the WMAs for collection of hair and photographs, respectively. Bears with telemetry collars also are monitored for presence in the webs. Trapping webs provide a link between capture data and distance sampling, in addition to estimating detectability. We propose that this is advantageous over trap grids because: 1) density can be estimated directly, leading to less variation, and, 2) problems associated with edges are decreased, since traps are at a gradient of density (with more traps at the center than the edges) and based on first captures only. To evaluate model performance, we present simulated data for multiple sample sessions based on 1 session of data (collected Summer- Fall 2004) in our combined model, designed to estimate bear density using several mark-recapture markers.

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PREVENTION OF DENTAL CALCULUS IN CAPTIVE MALAYAN SUN BEARS (*HELARCTOS MALAYANUS*) BY DIETARY MODIFICATION

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Taronga Zoo in Sydney, Australia exhibits two Malayan sun bears. These animals were rescued from the restaurant trade in Cambodia as young cubs in 1995. They were transported to Australia in February 1997. The sun bears underwent a full health examination under general anaesthesia during the first week of arrival, whilst in quarantine. At this time the male's teeth were noted to be in very

good condition with mild staining. The female's teeth had very mild dental calculus on the upper canines and mild dental calculus on the lower incisors.

Since 2003 the male has undergone three general anaesthetics for unrelated reasons, however, dental scaling was required to remove calculus on incisor and canine teeth on each occasion. The degree of the build up of calculus varied from very mild to severe and primarily affected the canines and incisors. The pre-molars and molars have only been mildly affected or not at all. The female has required three general anaesthetics over a four and a half year period, for unrelated reasons, although, during each anaesthetic this animal too has required dental scaling to remove calculus.

Sun bears are classified as omnivorous, and in the wild are reported to feed mainly on fruits, wood-boring invertebrates, small vertebrates, coconuts, honey and insect larvae. Sun bears in reputable zoos are generally given a varied diet, with a wide range of fruits, vegetables, nuts, honey, mealworms and crickets, and occasionally meat and fish. Since their arrival, Taronga Zoo's sun bears have received a diet that we considered balanced and variable and that also addressed the need for behavioral stimulation. We had also administered veterinary dental products that are recommended for calculus prevention. These were not effective.

As a result of our concerns regarding the dental health of our bears, we examined the current diet. Each dietary component was assessed and changes were made after considering if each food item met with our aims of providing a diet that addresses good physical, mental, and dental health. With respect to dental health, changes were aimed at preventing plaque formation and subsequent mineralization and calculus formation. Food items that increase saliva production, raise saliva pH, reduce sugars and increase abrasive action on teeth were included. A commercial dog kibble that contains sodium hexametaphosphate that removes calcium from saliva and minimises mineralisation of plaque on the teeth was added. Research has shown that sodium hexametaphosphate reduces calculus formation in domestic pets and other animals. Intervals between sugary fruit feeds were increased to allow acids in the saliva to neutralize before exposure again.

A trial period of 6 months on the revised diet has begun. Before starting the new diet both sun bear's were anaesthetised and their teeth cleaned and polished. A significant amount of calculus had to be removed in both animals. Another examination will be scheduled at the end of this period to determine if dietary modifications have been effective.

172 – poster

FREQUENCIES OF BEAR SIGNS IN MID-SWEDEN AND MID-NORWAY; RESULTS FROM 1987 AND 1988 COMPARED WITH 2003 – 2004 AND BEAR POPULATION ESTIMATES FROM THE REGION

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Approximately 400 km of transect lines were censused in 1987 and 1988 for bear signs in Lierne Municipality of North-Tröndelag County in Norway and neighboring Strömsund and Krokom Municipalities in Jämtlands County in Sweden. The same census was repeated in 2003. In 2004 the same method was used, but with another transect system along the main valley of Ströms-Vattudal in Sweden. This transect crossed the border to Norway and continued west to the other side of the Scandinavian continental divided.

The similarities in bear sign frequencies between the censuses conducted in the late 1980th census and 2003 and 2004 were remarkable. The bear signs frequency for all three sub-areas had increased, but proportionally more in Norway that in Sweden. However, there was a very sharp decline and lower frequency of bear signs along the border of Norway and Sweden, and bear signs was hardly found in Norway 20 km west of the Swedish border.

This poster presents the results in detail, and discusses different aspects of this kind of registration of bear activity from a management point of view.

173 – poster

GOLDEN EAGLE (*AQUILA CHRYSAETOS*) ATTACK ON A BROWN BEAR (*URSUS ARCTOS*) CUB IN NORWAY

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A female bear with three cubs of the year was the 18th of April 2004 observed active outside their den in a southern faced mountain slope in Mid-Norway. This is very early for den emergence and later investigation revealed that flooding had forced their evacuation.

The bear family stayed at the place for more than a week and was observed daily from distance by employees from the Norwegian Nature Inspectorate. At the 25th of April, as the bear family was moving along an edge of the slope, the smallest bear cub was attacked and grabbed by a Golden Eagle. The bear cub was trailing the mother and sibling cubs by 10 meters. It was at the moment of attack temporarily isolated from the other bears as they had already slid a few meters down a steep snowdrift. The bear cub screamed loudly as it was lifted up and flown away and vanished out of sight of the observers in the clouded part of the mountains. Then screaming was heard for about 4 minutes and there is little doubt that the eagle killed the cub, but any remains were never found.

The poster will discuss more details about the circumstances around this incident and relate it to other known observations on eagle's predation on bears.

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EFFECTS OF ENVIRONMENT, SAMPLE AGE, AND PRESERVATION METHOD ON FECAL HORMONES IN WILD GRIZZLY BEARS

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Grizzly bears (*Ursus arctos*) in the contiguous 48 United States are classified as a threatened species under the U.S. Endangered Species Act. Considerable interest in restoring and managing this top-level carnivore in North America has led to several long-term monitoring programs for this species. Fecal hormone analysis has become a widely used technique for measuring an animal's endocrine

status and can contribute greatly to long-term monitoring programs. Fecal samples can be readily collected in a non-invasive manner (Wasser et al 2004) and provide a variety of stress, reproductive, and metabolic status measures that can be correlated with environmental pressures over time (Wasser 1996; Wasser et al 1997; 2004; Foley et al 2000; Millspaugh et al 2001; Creel et al 2004). However, non-invasive sample collection often includes samples that have been exposed to their natural environment for varying and usually unknown time periods. Since the amount of time between defecation and collection of the sample could affect the final measurable hormone concentration, we examined the temporal impact of exposure to natural environmental conditions (e.g., sun, rain, and microbes) on variation in grizzly bear fecal hormone concentrations in Glacier National Park, MT. This study provides the first comprehensive study of environmental impacts on fecal steroid metabolism conducted under field conditions. The study focuses on the measure of glucocorticoids in grizzly bear feces because of the importance of glucocorticoids as a biological indicator of environmental stress and the ease with which this hormone can be metabolized *in vivo*. Preservation method was also examined because this too can influence measurable hormone concentrations through metabolic changes and associated changes in metabolite affinities to the antibody used for their measurement.

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ECONOMICS OF GRIZZLY BEAR VIEWING: A TOOL FOR PRESERVATION OF HIGH DIVERSITY LANDSCAPE IN BRITISH COLUMBIA?

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Recent legislative and policy changes to forestry and land-use decisions in British Columbia have resulted in considerable emphasis on economic values in decision making. Commercial grizzly bear viewing was examined to determine the potential for preserving high diversity old growth forest through the land-use planning process and to identify barriers to the success of these operations.

A baseline economic survey of grizzly bear viewing operators was undertaken to assess the present impact using an input/output model (or National Accounting Standards). The design allowed for cross-sectoral comparison and was compatible with land-use planning guidelines. A separate survey of participants was used to determine the importance of bear viewing to destination choice in order to apportion total vacation costs appropriately. Operators and industry experts were polled for factors affecting the success of bear viewing, and a follow-up survey ranked the compiled factors. Geographical attributes of existing bear viewing sites and the surrounding areas were compiled and compared with the BC government's GIS database to produce a map of potential viewing sites.

Results provided information on a wide scope of viewing conditions and allowed for benchmarking best and worst-case economic scenarios. The economic impacts of the present industry were found to be relatively small, but can add significant value to low-elevation old-growth forest in regional planning. Commercial potential was found to be significantly underestimated in current tourism opportunities studies. A discussion of the barriers to success and concessions in a multi-stakeholder scenario is included.

176 – poster

DEVELOPMENT OF AN ANDEAN BEAR POPULATION INDEX ON THE LA LIBERTAD WILDLIFE RESERVE, ECUADOR

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The Andean bear (*Tremarctos ornatus*) is listed on the CITES Red List as vulnerable to extinction, and in Ecuador, the bear's status is categorized as endangered. While populations are legally protected within a variety of Ecuadorian conservation areas (e.g., national parks, ecological reserves), the bear's future survival is in jeopardy. Ongoing conversion of suitable habitat, particularly montane cloud forest, occurs in both reserves and in areas surrounding reserves, which in turn, increases the degree of habitat fragmentation.

Because of continual land conversion pressure, non-governmental conservation areas are gaining importance in the protection of bear populations. Recently, Sanchez *et al*. (2003) identified six privately-held areas located on the southern periphery of Sangay National Park as "Special Conservation Zones". Recognition of a special conservation status was primarily due to the potential of these areas to provide additional habitat for bears and thereby, to help stem the fragmentation process.

One of these zones, La Libertad Wildlife Reserve (LLWR), is a privately-managed conservation area supporting montane cloud forest and paramo grassland, both of which are utilized by bears. The goal of this study was to determine bear presence/absence and to establish a long-term monitoring study in the reserve as a complement to ongoing studies in Sangay National Park and throughout Ecuador.

Establishment of 22 transects occurred between October and November 2004 and were monitored for bear activity sign between January and March 2005. Each transect was selected randomly within paramo grassland (n = 12) and montane cloud forest (n = 10). Transects ranged in length from 150 to 300 meters; length was determined by the extent of habitat at the randomly selected point and by logistic feasibility. Signs recorded were: claw marks, feeding sign and scat.

Bear activity was more prevalent on forest transects; 0.76 signs/km were observed in forest in contrast to 0.013 signs/km on paramo transects. Sign distribution across transects suggests that bears frequent or occupy both montane cloud forest and paramo habitats. The most frequently identified signs were eaten tree bromeliads in forest and eaten ground bromeliads (*Puya* sp.) in paramo. The differential rate of sign relative to habitat suggests that bears reside in and utilize montane cloud forest more frequently and use paramo food resources more opportunistically. Kattan *et al*. (2004) report that this pattern has been observed throughout the Andean bear range. These results suggest that small peripheral areas can contribute to the maintenance of a population vulnerable to fragmentation by providing supplemental areas with suitable habitat for Andean bears.

177 – poster

ANDEAN BEAR SIGN – PROTOCOL DEVELOPMENT FOR AGING EXPLOITED GROUND BROMELIADS (*PUYA* SP.) IN THE ECUADORIAN PARAMO

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Andean bear (*Tremarctos ornatus*) populations are challenging to monitor because of their shy, elusive behavior and their tendency to reside in remote areas with difficult accessibility. Therefore, a common monitoring option is to use bear sign (e.g. scat, claw marks and evidence of feeding bouts) to document presence/absence and create measures of relative abundance over time.

In addition to the aforementioned uses of bear sign, determination of sign age could act as another tool for population status assessment by providing measures of site visitation frequency and how recently an animal visited an area. Paisley (2001) reported aging data for scat; otherwise sign aging information for this species is not available in the published or academic literature. The goal of this study was to develop a protocol for aging exploited *Puya sp*., a large ground bromeliad typical of high altitude grasslands in South America. Bears remove the large, spiny leaves and consume the leaf base. In some cases, they will consume the inner basal material, frequently referred to as the "heart".

The study site is La Libertad Wildlife Reserve (LLWR), a small, privately-managed conservation area located in the southern Ecuadorian Andes. Montane cloud forest and paramo grassland habitats, both which are utilized by Andean bears, are present on this property. Between November 2004 and March 2005, exploited puyas were identified by daily visual searches. Each exploited plant received an identification number, was mapped, photographed, and data collected on physical appearance over time. The aging process was quantified descriptively and categorized for overall alteration in color, degree of oxidation and degree of desiccation over time.

Twenty-nine exploited plants were identified. For each plant, the remnant basal tissue was observed to progress through 5 color stages and 6 oxidation patterns; both of which were predictable and related to the number of days since consumption. Desiccation measures were found to assist in aging for short or longer time periods since consumption, but not for time periods in-between (1 day and 90 days). Using both desiccation measures and color/oxidation stages, it is possible to estimate time since consumption and, therefore, estimate how recently bears have visited the area under scrutiny. At this point, we are able to age puyas up to 3 months after exploitation. This time period will increase after our next field season (October 2005). The specific protocol to age this particular type of bear sign will be detailed.

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RELATIONSHIP BETWEEN TREE-BARK PEELING BY BEARS AND COMPOSITION OF WATER SOLUBLE SUGARS IN CONIFERS

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Water soluble sugars have been recognized as energy source in the nutrition and metabolism of animals, and have been suspected to be a factor relating to strip tree-bark by bear. This study involved a relationship between tree-bark peeling by Japanese black bear (*Ursus thibetanus japonicus*) and

composition of water soluble sugars in four Japanese coniferous tree species; Sugi (*Cryptomeria japonica*), Hinoki (*Chamaecyparis obtusa*), Karamtsu (*Larix kaempferi*) and Akamatsu (*Pinus densiflora*). In the experiment trees of the 30 to 35-year-old class and approximately 25cm in diameter were felled in early-July. A total of 23 sap samples were collected from the cambiums (vascular tissues) of each tree by artificial stripping method and analyzed by a high-pressure liquid chromatograph. Total amounts of the water soluble sugars of each sap, summarized in Table 1, are expressed on a fresh-liquid basis. As water soluble sugars, fructose, glucose and sucrose were detected in the sap of experimental trees except Akamatsu. In Akamatsu there was not detected sucrose peak on the chromatograms. Total sugar content was highest in Akamatsu and to a lesser extent in Karamatsu, and lower in Sugi and Hinoki. The constitution of sugars as expressed percentage varied among tree species. Percentage of fructose to the total sugar content was highest in Akamatsu, medium in Sugi and lower in Hinoki and Karamatsu. Percentage of glucose was higher in Karamatsu and Akamatsu, and lower in Sugi and Hinoki. Percentage of sucrose was rich in Hinoki, medium in Sugi and lower in Karamatsu. These values showed that the Japanese coniferous trees had three kinds of sugar at different levels.

Table 1. Total amounts (mg/ml) of water soluble sugars in sap of Japanese coniferous tree species and their distribution (%).

Tree species	Total, mg/ml	Fructose, %	Glucose, %	Sucrose, %	n
Cryptomeria japonica	37.3	43.7	16.2	40.2	4
Chamaecyparis obtusa	39.0	27.6	13.0	59.5	6
Larix kaempferi	53.7	34.8	37.7	27.5	8
Pinus densiflora	63.4	62.7	37.3	0.0	5

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HELMINTHOFAUNA OF BROWN BEARS IN EUROPEAN RUSSIA

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The helminthismes play the important role among other diseases of large carnivores. Some of the parasitic disease, as trichinosis, may be fatal to man. The more abundant parasitic worms for the brown bear of Northwestern Russia are *Trichinella spiralis*. The bears strongly infected by *Trichinella* were often hunted in the some districts of Karelia during 1960-70. The larvae of these parasitic worms were found in the brown bears hunted in the forest and tundra zones of European part of Northeastern Russia. The brown bears inhabiting the taiga zone of Komi Republic also have the nematodes *Dirofilaria ursi*, except the *Trichinella*. In the southern part of distribution area the helminthofauna of brown bear is essentially richer. The analysis of 63 faeces of brown bear from the Bashkyria Nature Reserve found the eggs of Ascaridae (25%), *Strongyloides* (24%), *Trichospongilata* (5%), *Dicrocoelim* (6%), and larvae of *Strongilata* (15%). The analysis of bear tissues did not revealed the Trichinella in this region (Loskutov *et al*., 1993).

Food supply and its composition are the main ecological factors forming helminthofauna and the level of invasibility of brown bears. It was supposed that in natural biocenoses the climatic factors have an essential influence on the processes of circulation of parasitic worms, therefore, their species composition and degree of infection of carnivores are decreasing as the species advances the north and north-eastern boundaries of the range.

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BROWN BEAR OF THE NORTH CAUCASUS MOUNTAIN ECOSYSTEM WITH REGARDS TO CURRENT SOCIAL-ECONOMIC SITUATION

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The Caucasian population of a brown bear is isolated from all other bear populations of the country and occupies almost completely mountain ecosystems. Well-being of bears in the region depends on the status of the environment and anthropogenic factors. Specificity of the latter results from multinational character of the local communities, variety of life stiles and mentality and, in connection, various attitudes to use of natural resources.

Social and economic shocks happened in the last two decades in the post Soviet Russia have also influenced Caucasus. Impact on the bear of interethnic conflicts and military actions in the region is of special interest.

The general collapse of agriculture in the region has a positive effect on the bear. Collapse decrease in grazing cattle-breading (by 80%) has sharply reduced the impact level of the factor of disturbance on the bear. Abandoning of large agricultural areas (up to 40%) has led to formation of new protection and feeding areas.

At the same time, decrease in employment level of the impoverished population has resulted, similar to other regions of Russia, in growth of pressure on natural resources. However in the Caucasus it has mainly affected ungulate animals, not the bear. The Muslim part of the local population doesn't eat bear at all; and the fact that many of the bears in the region are infected by *Trichinella spiralis* makes their meat not eatable.

The total number of bears in the region (8 administrative units) in 1991 - 2000 was within 1,870 – 2,100. Minimum (1,830) was registered in 1995, maximum (2,280) - in 2003. The biggest number of animals currently is in Krasnodar region (about 630) and Karachaevo - Cherkessia (450 - 500). The lowest number of bears (60-70 animals) is in Ingushetia. The situation in Chechnya is not clear. Most likely, there are now about 200 bears.

Up to the end of the XX century number of bears in the Caucasus was insignificantly reducing, but during the last 5 years it is growing.

In the recent years the legal extraction of bears in the region was about twenty to thirty animals per one year. Mainly they are extracted in Krasnodar region (averagely about 20 heads) and in Karachaevo - Cherkessia (from 8 to 14 heads). In 2004 in Kabardino-Balkariya the bear has been removed from the Red Book of the Republic and now the licensed extraction there is about 1 to 3 bears per year.

In Northern Ossetia annual extraction does not exceed 3-4 heads, the same about Dagestan. The number of legally extracted bears in Ingushetia and Adygea is not known. In the Chechen Republic until 2001 hunting was completely closed. After a 9-year break hunting there is allowed on feathery game, fox, wolf, jackal and wild boar. Bear is not included into the list of game animals.

Bear poaching which was especially active in 1990s is still widespread all over the region. Main stimulus for this is high price for the skin. Scale of bear poaching is not known.

The effect of factors connected with military conflicts in region on the bear is local, but diverse. Bears leave the areas of military operations, in particular, in mountain areas of the Chechen Republic and adjacent territories, and move to more quiet areas, which are abundant in the mountains.

In most cases presence of bears directly in the areas of military conflicts is useful for the conflicting parties. In Chechnya the conflicting parties willingly use old well trampled tracks of animals, which are well known to the local people.

Besides, participants of the conflicts are not interested in hunting and have quite the opposite priorities. They are afraid of decamouflage and therefore they try not to shoot animals.

During the den period bears and people are practically separated. With the beginning of vegetation the conflicting parties move closer to foothills and plain areas whereas bears mainly remain in mountain forests and sub-alpine belts.

Short-term military actions generally cause no serious consequences for the bear. Thus, clashes in the beginning of 1990s in Abkhazia, on the border with Karachaevo-Cherkessia Republic along the Main Caucasian ridge, did not affected the number and distribution of bears in this part of the region and did not changed ways of their seasonal migrations.

At the same time the problem of relationship within bear - man system during military conflicts, and not only in the Caucasus, certainly requires the intent attention of researchers.

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GENETIC STUDY OF THE GREEK BROWN BEAR POPULATION IN THE AREA OF GREVENA

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INTRODUCTION - The brown bear (*Ursus arctos*) is considered to be critically endangered in Greece. The objectives of the present study are the investigation of genetic polymorphism and the genetic identification of the brown bear subpopulation in the northern Pindus mountain range. This is the first attempt to evaluate the genetic status of the species in the country and is expected to support the planning and implementation of effective management and conservation measures for the species in the future.

MATERIALS AND METHODS - The study area is located in the prefecture of Grevena in northern Greece. The samples used were mainly hair and faeces, as well as blood samples from individuals captured in the field. DNA isolations were performed using the QIAamp Blood, Stool and Micro DNA Mini Kits (Qiagen), following the suggested protocols.
A 176 bp fragment of the mitochondrial DNA (mtDNA) control region and microsatellite loci were used as molecular markers. The above loci were PCR amplified using the primers and protocols described by Taberlet *et al*. 1995; 1997. The mtDNA locus was analyzed by restriction digestions with *Alu*I and *Bcl*I and gel electrophoresis. The microsatellite loci were analyzed either by denaturing polyacrylamide gel electrophoresis and autoradiography or by Licor semi-automatic analyzer. Statistical analysis was performed using programs Genetix 4.0 and Genepop 3.3.

RESULTS AND CONCLUSIONS - DNA isolation was performed in a total of 162 samples. The mtDNA locus studied was successfully amplified only in 77 of these samples, due to the low quality of the genetic material isolated. The polymorphism of the above locus in the population, as revealed after digestion with the endonucleases *Alu*I and *Bcl*I, seems to be extremely low; 1 out of 52 samples analysed so far presented a different haplotype.
Eleven microsatellite loci were initially selected for the study. Five of them, namely UarMU09, UarMU59, UarMU64, G1D and G10L, were chosen for further analysis based on the quality and

quantity of the PCR product. In total, 53 samples have been analyzed so far; 39 of them in all five microsatellite loci. Statistical analysis reveals the presence of several alleles (10-5) for each microsatellite locus in the brown bear subpopulation studied. It appears, however, that the population deviates from the Hardy-Weinberg equilibrium.

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DIET, HIBERNATION AND WEIGHT LOSS IN A CAPTIVE GROUP OF BROWN BEAR (*URSUS ARCTOS*)

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The bear forest in Rhenen, the Netherlands is a rescue centre for mistreated bears from Eastern Europe. The bears are housed in a semi-natural enclosure (2ha) and provide an excellent opportunity to study a captive group of Brown bears. To stimulate their natural behaviour a so called natural feeding programme has been introduced 4 years ago. The main characteristic of this diet is a seasonal variation in calories (low in winter time, high in the autumn) and a large variety of food items which are similar to the food a bear can find in nature. As a result of this food programme the bears show a seasonal variation in body weight, more bears hibernate and less stereotypic behaviour is shown.

In this research the relation between the diet, variation in body weight and solidness hibernation was studied. The 9 bears which are momentarily housed in the bear forest were weighted monthly in 2004 and 2005. During wintertime it was regularly checked which bears were awake and which ones were sleeping. Preliminary analyses indicate that the bears loose 25-45 % of their body-weight during the winter. The bears which loose most body weight were the ones which were most frequently seen.

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ANTS FEEDING ACTIVITY OF JAPANESE BLACK BEARS AT GRASSLAND IN ASHIO MTS., CENTRAL PART OF JAPAN

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Ashio Mts. where had once heavily destroyed its vegetation due to pollutants produced in a copper mining process from 1890s to 1950s and a forest fire is located in the Nikko National Park, central part of Honshu Island in Japan. Although the landscape is still open and most of the mountains is consists of grassland, tree planting has been carrying out by the government.

During May – June, Japanese black bears *Ursus thibetanus japonicus* is being appeared at the grassland of the Ashio Mts. from surrounding forest areas where mizunara oak *Quercus crispula* is predominant. The bears have been using the grassland as ants feeding site, and therefore they spent most of their time over there.

We fitted GPS collar for three bears, one solitary female, one female with two cubs, and a male, during May – June in 2003 and in 2004. We also measured their activity pattern using an activity sensor which built in the GPS collar.

We could not have chance for direct observation of the male, but had chance to observe both females and could record some of their feeding behavior using a digital video camera. We set quadrats in the Ashio area and in a control area, a forest area of the Katashina area, for evaluating ants' species composition and the standing stock that can be used by bears.

In the results, both the ant species number and standing stock were higher in the Ashio area than the Katashina area. 7 species (0.01160g(dw)/m^2) and 3 species (0.00170g(dw)/m^2) were recorded in the Ashio and the Katashina, respectively. Most dominant species in the Ashio area was *Lasius flavus* (0.00249g(dw)/m^2) and then *Lasius japonicus* (0.00133g(dw)/m^2) and *Myrmica kotokui* (0.00099g(dw)/m^2) were following. The pupa was occupied 80.5% of the total ants standing stock.

The bears were definitely diurnal, and both females mostly have been feeding ants at grassland area. Using the activity sensor value, estimated active time for the female with cubs (FB70) at daytime during 10-24 June 2004 was 587.3min. / day (SD=128.8, n=15). FB70 has turn over 5.6 stones/ 5min. (SD=2.10, n=24), and average existed weight of ants for a stone was 0.0899g(dw) (SD=0.1613, n=121). Assuming FB70 has spent most of her active time for ants feeding, her maximum feeding weight of ants was calculated as 59.14g(dw)/day. This could be equivalent to 118,280 *Lasius flavus* (pupa) /day.

Nutritional analysis of the ants is our future subject.