



Factors affecting depredation levels caused by wolves in livestock farms in Mt. Oiti National Park - Central Greece.

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We studied wolf-livestock conflicts in Oiti National park (250 km², altitudinal range: 600-2200m) during summer of 2012. Livestock farming is consisted by transhumance free-raising flocks grazing from May to late October. Wolf (92/43 habitats directive- annexes II, IV) has shown a remarkable recovery during the last 15 years. 6733 sheep, 2068 goat, 472 cattle and 165 calves graze inside the park.

We interviewed 36 out of 39 livestock units grazing inside the park, using a detailed standardized questionnaire to collect information considering: type of farming, livestock number per species/unit, number and origin of livestock guarding dogs, number of workers involved in livestock guarding, use of predator-proof fences, number of depredation events per year (2010-2012), animal losses/event, and levels of compensation paid per farmer/year. We checked validity of information considering depredation levels, when possible, by comparing field data with that from archives provided by the national agricultural insurance authorities. All interviews were contacted in livestock husbandry areas, as to directly evaluate morphology and behavior of livestock guarding dogs. We compared depredation levels/farmer using non-parametric univariate tests and multivariate analysis (GLM models). Wolf current presence and distribution was evaluated with a network of camera traps been active for 40 days.

Livestock units experienced 2.62 attacks (range 0-20) and 5.4 animal losses (range 0-40) in average per year. Animal losses/attack averaged 2.93 (range 1-18). 12% of units experienced losses >5% of the flock/year. Cattle farms that enforced separation of nurturing calves inside carnivore-proof fences showed a remarkable decrease of depredation events on calves. Goats were selected more by wolves compared to their availability. Levels of losses per livestock unit/per year were negatively related to the number of good quality guarding dogs, number of workers involved in attending the flock, while it was positively related to forest cover of each unit grazing area. Average compensation coverage/year was very low compared to actual losses claimed but it was higher for units enforcing more intensively preventive methods.

Livestock farmers responded rapidly to wolf recovery establishing preventive methods to reduce losses, but with a great expense on labor and maintenance costs resulting in increased social tension.



Understanding factor affecting wolf occurrence in the Western Carpathians

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The conservation and management of wolves in the periphery of their distribution is challenging. Edges of species distribution are characterized by very few occurrences of individuals, which makes difficult obtaining an understanding of population dynamic. The importance of this understanding becomes stronger when hunting takes place nearby the edge, which may preclude population expansion.

Our study focused on the Beskydy Mountains located at the Czech-Slovak border which is at the edge of the Grey wolf (*Canis lupus*) and Eurasian lynx (*Lynx lynx*) occurrences in the West Carpathians. Because wolves are legally hunted in Slovakia and lynx is instead strictly protected year-round in both countries, we were interested in differences of occurrence between these carnivores in the last 10 years.

During 2003-2012, we monitored large carnivore occurrence by snow-tracking surveys. Data analysis revealed a statistically significant difference between the observation of tracks and other signs of wolves and lynx. The wolf was a very rare species and was recorded almost six times less often than the lynx. We discuss whether this pattern may result from differences in life histories between species or differences in management.



Austria – meeting place of three wolf populations: melting pot or black hole?

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The autochthonous wolf population of Austria was extirpated in the 19th century. Today Austria is surrounded by three large (Slovakia) or increasing (Western Alps and Slovenia) wolf populations. During the last 20 years the number of single dispersing wolves showing up in Austria has increased. In the years 2009 – 2012 at least 11 individual wolves were detected by genetic monitoring. These wolves were found almost all over Austria independent of the population they were originating from. Wolves from the Western Alps were found from Tyrol to Lower Austria, wolves from the Carpathian and the Dinaric Mountains reached areas far north and west in Austria. As a meeting point Austria may develop into a cross-breeding area of wolves from three distinct populations.

According to the time single dispersing wolves did stay in Austria, there seems to be a high turnover. Most wolves were detected only once or a few times within one year before disappearing again. One wolf has settled for about two years in Lower Austria but may have disappeared recently, too. The fate of most of the wolves is not known. Illegal killing may be a relevant cause regarding the fact that even competent state ministers concluded publicly that wolves and bears should be better shot due to the many troubles they cause. In this paper we discuss the reasons for the observed high turnover of wolves in Austria as well as the obstacles to ensure law enforcement and achieve acceptance of wolves.



Ascertainment of the spontaneous return of the wolf in Lessinia (Venetian Alps, Italy) and of the formation of the first mixed couple Italic-Dinaric

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The wolf in the Italian Alps has disappeared at the beginning of the last century due to persecution by man. In Veneto the latest reports date back to 1931 (Belluno area), in Lessinia (Province of Verona, N45°41'00 "E11°02'00") the extinction of the population dates from the first half of the 19th century, with possible isolated attendance until 1880. In January, 2012, after more than 130 years by the latest reports, it has been for the first time ascertained the wolf in Lessinia, as a result of a spontaneous phenomenon of dispersion.

The non-invasive monitoring and radio-tracking, performed in 2012 by staff of the Regional Natural Park of Lessinia, the State Forestry Department and the Provincial Police of Verona, have allowed to ascertain the presence of three wolves and the constitution of a couple formed by a female of Italic origin and a Dinaric male. The third one, a female found dead in August 2012, she was also belonging to the Italian population.

The Dinaric male "Slavc", equipped with a GPS radio-collar within the Project Life+ "SloWolf", has undertaken the dispersion phase on December 2011 and took office in Lessinia in March 2012. The Italian female, "Juliet", whose membership of the Italic population of wolves was genetically determined, comes in with all probability from the Italian western Alps and she has been detected in Lessinia from the beginning of 2012.

Their meeting, photographically and genetically documented since April 2012, gave rise to a potentially reproductive couple, which is, at the actual state of knowledge, not only the unique one in the north-east Italian Alps but also the absolute first one consisting of two wolves coming from different population, the Italic and the Dinaric one, not in contact each other for many centuries, event of exceptional biological and conservation value.



Monitoring of wolves by volunteers in Slovenia

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Continuous monitoring of population size and distribution is crucial for conservation and effective management of any species, but is often difficult to maintain, especially for elusive species like the grey wolf. Large areas are difficult and expensive to monitor. Collaboration with interested and trained volunteers is sometimes used to improve coverage of study area. However, data collected should be interpreted with caution and regular training of volunteers is highly recommended. In Slovenia wolf population was monitored between 2010 and 2013 using a sign and vocal survey conducted by volunteers and professional biologists. Sampling approach was designed to collect data and 2429 volunteers were included in wolf surveillance activities. 732 volunteers attended educational seminars, 453 took part in winter snow tracking and 190 in summer wolf howling monitoring. With participation of large numbers of trained volunteers, it was possible to monitor an area up to 3384 km² in one day. In winter minimum of 171 km of wolf tracks were followed, 12 prey remains and 185 genetic samples were found, importantly contributing to results of genetic analyses. Together with data collected by researchers and Slovenian Forest Service, the estimation of wolf population size, number of packs, distribution, and effective population size was done.



Evaluation of different method for monitoring wolf pack in the Appennine environment

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The wolf is one of the most difficult terrestrial mammal species to survey. That is due both to biological and habitat aspects. Wolves live in low density and have a secretive and predominant nocturnal life style. Moreover in many European Counties wolf presence is concentrated in remote areas, mainly mountainous and forested areas, with low human presence and scarce practicability of road network.

The wolf's presence goes often in conflict with human activities, as livestock and hunting. So province administrations, and research institutes needs to obtain census data with high accuracy.

The study was carried out in the North Apennine of Tuscany Region, Italy from April 2012 to March 2013. The methods performed in this study were: snow-tracking, wolf-howling, and camera trapping. We evaluated the wolf pack size and specie detectability between different methods.

Our study showed that there wasn't a significant difference between methods to evaluate the wolf pack size. Snow-tracking was the best method to discovery quickly the wolf presence than others ones. Wolf-howling and camera trapping permitted to evaluate breeding success of wolf pack. Moreover, camera trapping permitted to collect the highest number of wolves in the pack.

We conclude that to evaluate pack size and breeding success it's fundamental to perform all methods overlapping the information deriving from different methods.



Anticipating future human-wolf conflicts: predicting wolf expansion areas in Portugal

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The original range of the Portuguese wolf population decreased drastically until the late 80's. The wolf is fully protected in Portugal since 1986 and at the end of the nineties the population stabilized until current years. With recent wolf recovery in south Douro River in Spain, we can predict an expansion toward Portuguese territories. Since 80% of wolf diet in Portugal is livestock, the conflict with humans is expected to be high in recolonized areas. The aim of our study was to investigate possible wolf expansion areas and identify conflict zones to develop prevention actions. We developed a Habitat Suitability Index using Maxent model and reliable wolf presence data, from camera trapping and scat surveys with genetic validation. Using Maxent regularization multiplier of 1 and 10% omission rate, the resulting model corresponded to 9.5% of Portuguese territory mostly in the known wolf range. Since wolf is a generalist species we then changed threshold values for Maxent regularization parameter and threshold values for model training omission rate to highlight other possible expansion areas, under current conditions. New areas were mostly constituted by border zones with Spain, from Douro river to south of Tagus river, never reaching coastal areas, adding up around 5% more national territory than initial model. Besides wolf monitoring, prevention actions in these areas should include aid to livestock owners to implement livestock protection methods (e.g. guardian dogs or fences) and general public awareness.



Documented long-distance dispersal of wolf (*Canis lupus*) from Dinaric population with successful pack formation

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Dispersal is natural process in a wolf lifetime, when natal pack is left in search of mate, new territory, and food resource. Dispersal has major influence on distribution and genetic structure of animal populations, but is often difficult to detect. In winter 2011/2012 we documented a long dispersal of 2-year old male grey wolf (*Canis lupus*) "Slavc" from Dinaric population to the Venetian Alps. Wolf was equipped with GPS-GSM-VHF collar on 17th July 2011 in Slovenia. He left his transboundary Slovene-Croatian natal pack on 19th December 2011 and after 100 days of dispersal and crossing of three countries became stationary in the Lessinia Regional Park in Italy. He formed a new pack with female wolf that dispersed from the Italian peninsula population and the pair successfully mated in 2013. His new home range (100% MCP) size was estimated to 150 km² in comparison with 442 km² home range size (100% MCP) of his natal pack in Slovenia and Croatia. 2445 successful GPS locations were obtained from his collar and the total consecutive straight line distance between locations that male travelled during his dispersal was 1176km, overcoming anthropogenic and natural barriers such as highways, railways, urbanized and cultivated areas, river dams, large rivers and mountain ridges in Slovenia, Austria and Italy. From the present distribution in Dinaric wolf population, this is the first documented case of long dispersal with successful pack formation from two distinct wolf populations, showing a potential for future joining of these populations.



Shortcomings in assessing the status and planning the management of wolf population in Romania

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Wolf population dynamics is extremely different across Europe. Due to negative attitudes toward the species, intense harvesting, poaching, and economical and political aspects, wolves range from extinct in the North-Western and Central parts of the continent to large populations in the Eastern countries. In the last fifty years, wolf population dynamics in Romania was unstable. Between 1960 and 1970 the wolf numbers dropped from more than 3000 to about 1500. After 1970, laws for preserving large wild ungulate species led to a continuous ascending trend in wolf population. Field forms and the summarized data provided by the Hunting Funds managers in Romania, from 2005 to 2012, were analyzed and compared to the final official estimates of wolf population data, modeled by The Forest Research and Management Planning Institute (ICAS). During this period, the official estimates show an effective of 2300 up to 2700 wolves. The largest number of wolves is reported in the Carpathian Mountains, covered mostly with dense forests and many remote areas, difficult to survey during winter. Due to some methodological inconsistencies, census actions are not sensitive to the probabilities of double counts – as wolf packs home ranges are larger than Hunting Funds surfaces – and the data shows a high degree of uncertainty. Moreover, nationwide, snow tracking is the only method used to estimate and monitor wolf population, and these data supplies the final official estimates and the hunting regulations. Based on the official estimates, the Romanian Carpathians are still home range of a healthy, viable wolf population, and this offers a great opportunity for wolf conservation in a natural environment. Nevertheless, the limited reliability of the data, together with continuous habitat loss, makes it difficult to reach the conservation objectives. A successful implementation of management and conservation programs requires integrated monitoring and assessment of the ecological status, and trends in the dynamics and distribution of wolf populations. Further research is necessary to improve the data quality, among which testing of the applicability of other survey methods for effective monitoring of wolf population is crucial for scientific substantiation of management measures.



Attitudes toward, conflicts with, and management of wolves in rural villages in Armenia

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As is the case in other regions of the world where wolves and humans interact, human-wolf interactions in Armenia often result in feelings of animosity and helplessness, dead livestock and dead wolves. The Armenian government annually endorses a wolf cull however the size of wolf populations in Armenia has never been quantified nor has the actual extent of human-wolf conflicts in Armenia been studied, until recently.

During the summer of July 2012, I surveyed 23 communities in 4 regions of Armenia about their experiences with human-carnivore conflict. Using a combination of open-ended interviews, focus groups, community mapping and risk-ranking, I created a baseline for human-carnivore conflicts in the country. Among the topics explored were overall attitudes towards wolves and current strategies for dealing with human-wolf conflicts.

Although the government has promised to compensate individuals who kill a wolf, they rarely follow through with this promise and many villagers do not have guns, which has led to increasing frustrations, more livestock losses and unreported wolf kills. Although villagers throughout Armenia use a variety of strategies to avoid conflicts with wolves, including lethal removal, lights, noise, fencing, traps, and poisons, many of the surveyed villages reported increased conflicts with wolves in recent years and many also expressed a need for support. Current wildlife management policies in Armenia are not effective in helping communities deal with human-wildlife conflicts, and conflicts with wolves seem to be further exacerbated by conflicts with management policies. This begs the question, what is the best strategy for poor villagers in rural mountainous Armenia to avoid conflicts? How can we transform the current situation from constant conflict to peaceful coexistence and stewardship?



Zoo visitors attitudes toward large carnivores in Slovenia

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ZOos play an important role in promoting conservation through providing learning opportunities through personal experience with wildlife and awareness raising educational activities. Both, personal experience and knowledge are factors that can influence attitudes toward large carnivores and thus improve their coexistence with humans in human-dominated landscapes.

In 2009, researchers from the Biotechnical faculty, University of Ljubljana have organized workshops about Slovenian large carnivore species at the Ljubljana ZOO. This was done as a part of the EAZA European Carnivore Campaign, which aimed to raise awareness of carnivore conservation within Europe. We assessed ZOO visitors attitudes toward large carnivores found in Slovenia at the time when activities took place. 640 visitors were asked to rate the statements for supporting (factor 1) or opposing (factor 2) conservation for all three large carnivore species found in Slovenia; Eurasian lynx (*Lynx lynx*), Gray wolf (*Canis lupus*) and Brown bear (*Ursus arctos*).

The results show that ZOO visitors generally support conservation of large carnivores in Slovenia (Factor 1: M_{bear}=4,42; SD_{bear}=0,61; M_{wolf}=4,41; SD_{wolf}=0,62; M_{lynx}=4,42; SD_{lynx}=0,60). Opposing conservation statements were on average rated much lower (Factor 2: M_{bear}=2,57; SD_{bear}=0,75; M_{wolf}=2,55; SD_{wolf}=0,77; M_{lynx}=2,42; SD_{lynx}=0,77). There were no statistically significant differences in ratings on supporting conservation factor between females and males. On the other hand, there were statistically significant differences found in ratings on opposing conservation factor, where females were more opposed to conservation of large carnivores than males (all $p \leq 0,001$). There were no significant differences in visitors' ratings according to their age on supporting conservation factor, but there were small but significant differences in their ratings on opposing factor for lynx and wolf.



A way of public relations: The "Kontaktbüro Wolfsregion Lausitz" (contact office "Wolves in Lusatia") in Saxony, Germany

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After 150 years of absence in Germany the first free living wolf pack was re-established in the year 2000 in Saxony. Since then wolves have been dispersing in Saxony and into other parts of Germany. With the recovery of wolves in a man used landscape the challenge is to deal with prejudices, changes in herding methods and human fears. To fight a lot of false information and questions about wolves by the public, the "Kontaktbüro Wolfsregion Lausitz" (contact office "Wolves in Lusatia") was established by the Saxony State Ministry of Environment and Agriculture in 2004 as the main information center about wolves for public, media and authorities. As part of the wolf action plan for Saxony in 2009 the public relations have been carried out by the contact office "Wolves in Lusatia" since then. Its goal is to inform the public about biology and behaviour of wolves, their distribution and methods to protect the livestock. The contact office informs on an unbiased level and bundles information based on facts obtained by the monitoring and livestock protection. More than 200 lectures per year are mainly given as environmental education workshops to students (59%) and speeches to mixed audiences (30%). The others are held in front of special interest groups like hunters, farmers and environmentalists. Since 2010 more than 500 pieces of evidence of wolves e.g. sightings, tracks have been reported to the office. The office also produces press releases and regularly written newsletters, it maintains the website www.wolfsregion-lausitz.de, which is always updated with current information about the distribution, scientific projects, livestock depredations or proved reproductions in packs. A wolf museum, which offers people the possibility to inform themselves on wolves through the exhibition and different movies on wolves and their recovery in a man used landscape, is also maintained by the contact office. Another responsibility is to supply the trained staff of each Saxon county with information and to help them with the public relations in their respective county.

The contact office "Wolves in Lusatia" is a unique facility unprecedented in Germany and Europe solely run by the state.



Genetic characterization of eastern coyotes in Atlantic Canada

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We will present a preliminary genetic characterization of eastern coyotes from the Atlantic Provinces, Canada. This analysis was prompted as a result of uncharacteristically aggressive behaviours noted among coyotes on Cape Breton Island, Nova Scotia, Canada, which included a fatal attack on a human in 2009. The taxonomy and population genetic structure of wild *Canis* spp. in Northeastern North America is complex and controversial. The three putative wild Canid taxa present in Eastern North America include gray wolves (*Canis lupus*), eastern wolves (*Canis lycaon*), and eastern coyotes (*Canis latrans*). Some have argued that while *C. lupus*, *C. lycaon*, and *C. latrans* are each derived from distinct phylogenetic lineages, there has been extensive current and/or historical hybridization among these taxa. Eastern coyotes have only recently dispersed into northeastern North America during the last century. Furthermore, they have only been documented in Nova Scotia, which is part of Atlantic Canada, in the past two decades. Eastern coyotes in particular have hybridized extensively with eastern wolves and several populations in Ontario, Canada, and the northeastern United States have been found to contain both mitochondrial haplotypes and microsatellite alleles that are characteristic of eastern wolves and “typical” western coyotes. We present a phylogenetic analysis of mitochondrial DNA haplotypes from eastern coyotes from Cape Breton Island and mainland Nova Scotia that demonstrates the presence of both *C. lycaon* and *C. latrans* mitotypes. Quantitative analysis of eight nuclear-encoded microsatellite loci is currently underway. In addition to our genetic analyses, we have collected data on body size variables (e.g., weight, girth, body length, tail length) and skull dimensions (e.g., width and length) as well as calculating an “aggression index” for trapped coyotes. These morphological and behavioural variables will be compared with the genetic data to test whether there is an association between eastern wolf (*C. lycaon*) genetic characteristics and larger body size and/or higher aggression index.



Wolves & the MHC: variability, hybridization and mate choice in the Italian wolf population

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Isolated small populations may experience low adaptability and increased extinction risks due to reduced genetic variability, especially if at important functional genes such as the Major Histocompatibility Complex (MHC). We investigated the variability of three class-II genes (DRB1, DQA1, DQB1) in the Italian wolf population, which was long isolated and is now expanding after a recent bottleneck. Compared to other populations, we still found a remarkable MHC variability, showing signatures of historical selection (high dN/dS ratio). The Italian wolves are known to hybridize with domestic dogs, and dog-derived MHC alleles were detected in some genetically-admixed individuals. Background microsatellite and MHC loci did not show reduced variability due to the recent bottleneck. Thus, the population recovery seems not to be threatened by reduced MHC variation nor by deep introgression of domestic dog alleles.

The observed variability could be also influenced by reproductive patterns, which can rely upon MHC similarity between mates. Based on pedigree data of wild-living packs, as reconstructed from extensive non-invasive genetic sampling, we tested the hypothesis of non-random mate choice in 26 breeding pairs. Results showed an unexpected prevalence of MHC-based assortative mating, with excess of peptide similarity between breeding pair members as compared to random expectations. Moreover, variation in both relatedness and heterozygosity showed significant positive correlations with fitness traits (total offspring, years as reproducers, mean offspring per year) deduced from pedigrees. These findings suggest possible advantages for breeders that are more related at the MHC, but not at the genetic background. This balance of general inbreeding avoidance, MHC-assortative mating and heterozygote advantage can reflect the social structure of the species, potentially maximizing the adaptation to the environmental pressures.



The wolf: killer or victim? Forensic DNA analysis or wildlife conservation

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The recent expansion of the Italian wolf population through the Apennine and western Alps, after centuries of contraction, is causing conflicts with human activities, in particular with hunters and livestock breeders, leading to a rise in poaching or illegal killings. Here we present some applications of forensic genetics, showing how molecular tools can be used to solve ambiguous cases regarding the wolf (*Canis lupus*).

Using 12 unlinked autosomal microsatellites, mtDNA control-region sequences, a male-specific ZFX/ZFY restriction-site and four Y-linked microsatellites, we reconstructed individual genetic profiles to establish the species and origin population of several forensic samples:

1) through the analysis of DNA extracted from a confiscated necklace made of ten presumed wolf canine teeth, we confirmed a case of suspect serial wolf killing. The individual genotypes obtained from the teeth belonged to six different individuals, which were unambiguously assigned to the Italian wolf population by Bayesian procedures;

2) in Europe, most of livestock predations are attributed to wolves, though free-ranging dogs are sometimes responsible for them, and false attacks are declared by breeders to obtain compensations. We analyzed 33 salivary DNA samples collected from the bitten skins of the carcasses of 13 sheep and a horse presumably predated by wolves in seven farms in Italy. We obtained reliable genetic profiles from ten of them, finding that eight sheep were killed by wolves, the ninth one by a female dog, while the horse was post-mortem consumed by a male dog;

3) finally, handcraft items sold in markets can illegally contain parts of protected animal species and are sometimes confiscated by the Italian forest police. We analyzed a suspect wolf fur coat sold as a souvenir, which turned out to belong to a North American wolf subspecies (*Canis lupus lycaon*).

These examples demonstrate that, when reference populations are genetically typed, forensic techniques can produce reliable information, contributing to the conservation of endangered carnivores such as the wolf and to better understand their real impact on husbandry.



Determination of livestock predators from salivary DNA

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The last two decades saw a sharp increase in small livestock breeding (especially sheep) in the Slovenian wolf presence area. The numbers of stray dogs is also on the rise since 1998 when a change in The Slovenian Hunter's Ethics code banned their culling. At the same time, the wolf population is making a recovery. This is increasing the possibility for livestock depredation events caused either by wolves or dogs. Livestock attacks that are attributed to wolves typically have a very detrimental effect on the tolerance of this species by the local communities. In the field or at a post-mortem, it is frequently difficult to recognize with any degree of certainty if the damage was done by a dog or a wolf, with wolves usually getting the blame. The answers in such cases can be provided by noninvasive genetics.

We collected saliva samples from around the wounds on livestock carcasses in predator attacks on livestock for three consecutive years, and analyzed ~500 samples collected at more than 300 damage cases. We analyzed 11 microsatellite loci for individual ID and SRY locus for sex determination. To distinguish between different canids living in the area we also analyzed a batch of tissue/saliva/hair samples for each of the species (wolves – 71; dogs – 47; foxes – 11; jackals – 27). A simple protocol for determination of the species was devised, and the assignments to wolf or dog reference group were additionally tested using genetic clustering software for a set of reference samples. Genotyping success was ~65%. We found a correlation between amplification success rate and three variables (weather, time between the kill and the sample collection, and sampling site). Predictions using the binomial distribution suggested that the species ID success depends mainly on the number of collected samples at the damage case, and the time passed between the depredation event and the collection of the samples. Based on our study the damage inspectors of Slovenia Forest Service are now routinely collecting saliva samples in situations where the perpetrator species is uncertain.



Social behaviour of Iberian wolf packs: a preliminary study based on footage obtained in the wild

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Most knowledge on social interactions among pack members is based on captive wolves, mainly due to the elusiveness of this species in the wild. However, behavioural traits recorded from captive wolves may differ from the ones living in the wild, raising the need for field studies on social behaviour of wild packs. This study aims to assess social behaviour in two breeding packs of Iberian wolves (Vez and Soajo packs) in Northwestern Portugal. Field data were obtained from footage recorded in rendezvous sites during three breeding seasons (July-September of 2008, 2010 and 2011) to obtain: i) pack size (min. number of adults and pups per pack); ii) individual identification of adult wolves based on morphological features; and iii) social interactions of pups and identified adult wolves.

Wolf individual identification was based on specific characteristics of each adult wolf related to coat patterns and other distinctive features (e.g. GPS collared; enlarged nipples). Behavioural types recorded for each identified individual were divided into three main classes: individual behaviours (self-grooming, resting, moving, other), interactions with adults (neutral, dominant, submissive) and interactions with pups (feeding, solicitation, socializing).

We were able to identify three adults from the Soajo pack (pack size of min. 5 adults and 5 pups), and six adults from the Vez pack (pack size of min. 8 adults and 8 pups). Due to limited sample size from Soajo pack, social interactions were quantified only in the Vez pack.

Individual behaviour prevailed in both pups and all identified adult individuals. Pups socialized with other pups more frequently (recorded in 49% of footage) than with adults (29%). Social interactions among adult pack members were not dominated by obvious agonistic interactions among them (e.g. dominance-submissive behaviours), in contrast to what is frequently described in captive wolves. Three adults, including the breeding female engaged more frequently in social interactions with the pups as compared to other adults. Although rarely addressed in available literature, our study demonstrates that individual identification of wild wolves based on coat patterns can be achieved and be a source of insightful information for social behavioural studies.



The wolf-prey-human system in Scandinavia—do we really need more wolf research *in situ*?

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Recolonizing carnivores can have a large impact on the status of other species in the ecosystem. These effects may include both direct lethal effects of predation and indirect effects on the behavioral ecology of prey and on other species including humans. Wolves (*Canis lupus*) have re-colonized the central parts of Scandinavia during the last 30 years and have been shown to primarily rely both on large ungulates, such as moose (*Alces alces*), and on the smaller-sized ungulate, roe deer (*Capreolus capreolus*). The preference for the two species is largely governed by their population density, which in turn affects territory size and ultimately the local density of wolves. Age structure of the moose population has implications for several components of wolf predation in Scandinavia, and kill rates are among the highest in the world. New establishments of wolf territories have important consequences for the local management of the moose population. Moose hunters in Sweden seem to respond functionally to a new wolf establishment by an instant reduction in moose harvest, especially on adult females. This may be considered as an adaptive management behavior in order to compensate for the increased mortality rate in the moose population imposed by wolves. At the wolf territory level, landscape structure is an important factor for the risk of predation as this may vary by several orders of magnitude within the same territory. This landscape effect is different for the two main prey species. Although moose are the primary wolf prey and landscape structure affects risk of predation, GPS-collared moose seem not to respond to local wolf establishment by altering their pattern of habitat selection as has been suggested elsewhere for prey meeting re-colonizing wolf populations. We conclude that few of our findings on wolf predator-prey ecology in Scandinavia could have been predicted from the scientific literature produced from other wolf-ungulate systems in the world.



Regarding the wolf's feeding behavior during wintertime in the Eastern Carpathians

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The wolf (*Canis lupus*) is an indigenous species of the fauna in the Eastern Carpathians (Ukraine). In the period 1969 – 2012, the annual average number of the predator here amounted to over 350 individuals, while the density was 0.1 to 0.15 individuals over the area of 1000 ha the lands suitable for being their habitat.

The wolf is a predator that preys on various kinds of animal. Its feeding behavior is determined by availability and accessibility of food. In places where there is enough natural food (wildlife), the wolf will not hunt domestic animals, it lives on the wildlife. The wolf's main food, under conditions of the Eastern Carpathians, is hoofed animals (*Cervus elaphus*, *Capreolus capreolus*, *Sus scrofa*). In the early 21-st century, among all the recorded wolf-induced death cases of hoofed animals, 70% of prey was deer, 22% - roe deer, and the rest was wild boar. However, the ungulate numbers in the Eastern Carpathians are insignificant making somewhat about 30 thousand of individuals. In wintertime, the region is not able to provide the wolf with sufficient amount of its natural food for various reasons. The most accessible food to the wolf in this period of time is domestic animals among them dogs in the first place.

We have analyzed wolf's feeding on dogs in the Skole Beskids (northeastern part of the Eastern Carpathians). It was found that of 22 villages situated in the Skole Beskids area, wolves' attacks on dogs were recorded for 18 settlements. It should be noted that no attacks on dogs (or death cases of dogs were minimal) in those villages through which run public roads of international significance, that is, roads with a heavy 24-hour traffic. In the village of Zavadka, a maximum number of wolves' prey – 22% of the total number of dogs – was recorded.

The first attacks on dogs are commonly observed late in September, the last ones in March. The dogs that became a prey to wolves were of various size, weight and age, some of them were featured by rather essential sizes. The dogs were attacked both by lone wolves and packs of 2 to 3 predators at different times of the day.

Thus, insufficient natural food (that is ungulates numbers) for wolves in the Eastern Carpathians during wintertime results in wolves' preying on dogs. 80% of settlements in the Skole Beskids (the Eastern Carpathians) have their dogs attacked by wolves. In order to reduce wolves' feeding on domestic animals, it is necessary to raise the numbers of ungulates in this region, to control the numbers of wolves by hunting, first of all, lone individuals, not territorial ones.



Persistence in time of wolf pack in Scandinavia

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The basic social unit of a wolf population is the pack. It usually includes a pair of two reproducing individuals located within a specific territory. Despite its fundamental role in the dynamic of wolf population, persistence and structure of wolf packs are overlooked. The use of presence-absence field data of packs have been used to create habitat occupancy models, to estimate population size and predict future trends in distribution range and numeric estimation of wolf population. But longitudinal studies based on the dynamic of recognizable wolf packs have been little studied, especially because of the lack of complete and long-term data. Here we used intensive and ongoing long-term field data collected by the Scandinavian wolf project to highlight the factors affecting the structure and persistence in time of more than 130 different wolf pairs and packs in Scandinavia. The Scandinavian wolf population is a well suited model because it is an isolated population, and its colonization and expansion of population range are well known. Our results investigate whether the intra-packs characteristics (i.e. inbreeding coefficient, pack size, reproductive success, turn-over of reproducing individuals) or spatial characteristics (i.e. prey density, human activities, and vegetation characteristics) influence the persistence in time of wolf packs in a human-modified landscape. Furthermore because of high additive mortality rate caused by poaching in Scandinavia, we expect a high turn-over of reproducing individuals and a low persistence in time of packs. Our results will help conservation policies, and look beyond numbers to include impacts and importance of the social dynamics of wolf packs.



Conflict management in free-ranging wolves (*Canis lupus*)

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Wolf sociality is characterized by benefits from group living due to cooperative breeding, hunting and territory defence, and costs due to competition for resources such as mates, food and space. Our study aims at understanding conflict management in free-ranging wolves (*Canis lupus*). As wolves live in stable social units, defend a territory, share long lasting individualized relationships, and experience within-group aggression, we expected conflict management strategies. By analysing 106 hours of video recordings, we collected detailed behavioural data about two packs in the Yellowstone National Park. Affiliative behaviours occurred earlier and more often after a conflict as compared to controls periods. Post-conflict affiliative interactions were primarily initiated by victims and were mostly directed towards the former opponent. Solicited and unsolicited consolation occurred, possibly highlighting benefits of conflict resolution for group members other than those directly involved in a conflict. The number of post-conflict affiliative behaviours was positively correlated with the number of aggressive behaviours, indicating that escalation of a conflict requires increased investment in conflict mitigation. The conciliatory tendency was relatively high (44.1 %) and comparable to the values reported in primate species with a relaxed dominance style. One specific affiliative behaviour was most often used for conflict management, but never observed in control periods. Our results suggest that conflict resolution mechanisms are a key component of the social life of wolves facilitated by clear but relaxed dominance relationships and promoted by the significance of group membership and cooperation in this highly social species.

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