

# **10<sup>th</sup> European Roe Deer Meeting**

## **BOOK OF ABSTRACTS**



**Srní, Šumava National Park, Czech Republic, 7<sup>th</sup> to 10<sup>th</sup> June 2011**



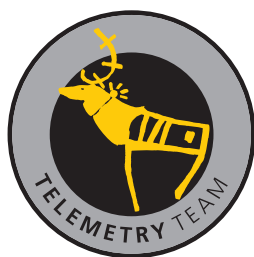
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**editors**

**Pavel Šustr and Marco Heurich**

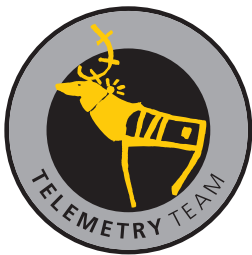


**organized by**

**Šumava National Park and Protected Landscape Area Administration**

**with help of**

**Bavarian Forest National Park Administration**



**Book of Abstracts of 10th European Roe Deer Meeting,  
Srní, Šumava National Park, Czech Republic, 7<sup>th</sup> to 10<sup>th</sup> June 2011  
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Design and programming: Pavel Šustr**

**Organizing committee:  
Pavel Šustr  
Marco Heurich  
Markéta Kašparová  
Kirsten Weingarth**

## **Program of the meeting**

### **Monday, 6th June 2011**

Hotel Šumava, Srní village

14:00 - 18:00 arrival and registration

### **Tuesday, 7th June 2011**

Hotel Šumava, Srní village

08:00 - 18:00 arrival and registration

08:00 - 10:00 meeting of EURODEER working group

10:00 - 10:30 coffee break

10:30 - 12:30 meeting of EURODEER working group

12:30 - 13:30 lunch

13:30 - 15:00 meeting of EURODEER working group

15:00 - 15:30 coffee break

15:30 - 17:30 meeting of EURODEER working group

18:00 dinner + welcome drink for all participants

### **Wednesday, 8th June 2011**

Hotel Šumava, Srní village

08:30 - 09:00 introduction

09:00 - 10:20 Session 1 Morphometry / Diet

10:20 - 11:00 coffee break

11:00 - 12:20 Session 2 Behaviour

12:20 - 14:00 lunch

14:00 - 15:20 Session 3 Habitat

15:20 - 16:00 coffee break

16:00 - 17:00 poster session

17:30 - 22:30 medieval dinner in Rabí - largest castle ruin in the Czech Republic

### **Thursday, 9th June 2011**

Hotel Šumava, Srní village

09:00 - 10:20 Session 4 Space Use

10:20 - 11:00 coffee break

11:00 - 12:40 Session 5 Management and Monitoring

12:40 - 14:20 lunch

14:20 - 15:40 Session 6 Other

15:40 - 16:20 coffee break

16:20 - 17:30 small field trip

18:00 - ??? dinner

### **Friday, 10th June 2011**

7:00 - 19:00 excursion to western part of NP Šumava and NP Bavarian Forest

(NPBW Visitor centre Hans-Eisenmann-Haus in Neuschönau, Guided tour at the Tree top walk, Lunch, Hiking through the forest wilderness of Bavarian Forest and Šumava National Parks)



## Program of sessions

### Wednesday

#### Session 1

##### Morphometry / Diet

**Wed 9:00 - 10:20**

- Giulia Age and sex morphometric variation in a central Appennine roe deer population (Tuscany, Italy)
- Jelenko Roe deer (*Capreolus capreolus* L.) mandible size as an indicator of environmental conditions and habitat quality
- Verheyden Do roe deer gain nutritional benefit from feeding in open landscape?
- Barančková Roe deer diet composition based on microhistological analyses of faeces

#### Session 2

##### Behaviour

**Wed 11:00 - 12:20**

- Ortmann Sex allocation and costs of reproduction in European roe deer (*Capreolus capreolus*)
- Becker Suckling behaviour and individual milk uptake in European roe deer fawns (*Capreolus capreolus*) - evidence for intraspecific conflicts?
- Krop-Benesch Activity patterns of an Eurasian lynx (*Lynx lynx*) and its relation to its prey species, the European roe deer (*Capreolus capreolus*)
- Heckmann Seasonal variability in daily activity pattern of European roe deer (*Capreolus capreolus*)

#### Session 3

##### Habitat

**Wed 14:00 - 15:20**

- Torres Roe deer habitat use at the southern edge of their range
- Dupke Temporal habitat preferences in roe deer at different scales
- Stergar Culling data represent a useful basis for research and management of free-ranging ungulates: example of roe deer habitat modelling in Slovenia

## Thursday

### Session 4

#### Space use

Thu 9:00 - 10:20

- Sönnichsen Space use of roe deer in the surroundings of the Bialowieza Primeval Forest – preliminary results
- Morellet Seasonal patterns of home range size variation in European roe deer along a latitudinal gradient
- Debeffe Do female roe deer undergo breeding dispersal? The excursion behaviour of females during rut
- Cagnacci Partial migration in roe deer

### Session 5

#### Management and Monitoring

Thu 11:00 - 12:40

- Pokorny How useful are adapting crossing structures for roe deer movements over fenced motorways: a Slovene experiences
- Wiesner Product presentation zoosleep 16/5
- Dachs Deer as molecules – REM as a new method in estimating roe deer densities?
- Brand Determining the spatial distribution of the Lynx' prey species by a pellet group count in the Šumava (Czech Republic) and Bavarian Forest (Germany) National Park
- Franke Monitoring red deer and roe deer with a combination of aerial infrared and high resolution RGB images in forested areas

### Session 6

#### Other

Thu 14:20 - 15:40

- Pellerin The role of forest-dwelling deer in long distance seed dispersal
- Hagen Assessing mortality factors acting on different time-scales on the population dynamics of roe deer: the interplay of road mortality, lynx predation and hunting
- Linnell The status of roe deer science and roe deer scientists: reflections on the past, present and future on the occasion of our 10th meeting
- Kjellander Roaming tight when outnumbered: the roe deer – fallow deer case



# ORAL PRESENTATIONS

(in alphabetic order of first authors)

## ROE DEER DIET COMPOSITION BASED ON MICRO-HISTOLOGICAL ANALYSES OF FAECES

Miroslava Barančková<sup>1</sup>, Jarmila Krojerová-Prokešová<sup>1</sup>, Pavel Šustr<sup>2</sup> & Marco Heurich<sup>3</sup>

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The roe deer is an important factor affecting forest regeneration, especially by browsing. It is known for the preference of hardwood browse, but its diet depends highly on the composition of and changes to local vegetation and can contain substantially larger amounts of other food components, e.g., forbs, which can surpass the volume of woody plants. Thus, to evaluate the level of roe deer influence, it is important to know the composition of its diet in the studied habitat.

In the Bohemian Forest, the diet composition of roe deer was analysed as part of a large project studying major changes in forest habitats caused by bark beetle outbreaks and wind calamities. It was studied at eight sites, situated in both the Czech and the German part of the Bohemian Forest, using microscopic analyses of faeces. Faeces were collected on the studied sites within a two month period (February/March, April/May, June/July, August/September, October/November, and December/January) to evaluate the changes in roe deer diet throughout the year. For each collecting period, we attempted to collect and analyse 5 faecal samples from each site. Together, 176 faecal samples were collected and processed.

Analyses of food fragments preserved in the faeces revealed the presence of forbs (e.g. Asteraceae, Fabaceae, Lamiaceae, Ranunculaceae), shrubs (e.g. *Rubus fruticosus*, *Rubus idaeus*, *Vaccinium* spp.), tree species (e.g. *Abies* sp., *Betula* sp., *Fagus* sp., *Picea* sp., *Swida sanguinea*), as well as the presence of ferns and mosses. On average, the largest part of the roe deer diet consisted of forbs, which have been identified as an important part of the diet on all sites regardless of altitude. Their average volume did not fall below 20% and reached a maximum of 40% in summer. The other three components grasses, broadleaved and coniferous trees, reached an average volume of over 10%. *Vaccinium* spp. and *Rubus* spp. were important diet components especially in autumn, with the average volume of the first not exceeding 10%, and the second reaching 23%. Three other diet components – ferns, mosses, and fruits – stayed below an average volume of 5%. The diet composition on studied sites largely reflected the present food resources and observed annual changes generally followed patterns known from previous studies.

Oral

SUCKLING BEHAVIOUR AND INDIVIDUAL MILK UPTAKE IN EUROPEAN ROE DEER FAWNS (*CAPREOLUS CAPREOLUS*) - EVIDENCE FOR INTRASPECIFIC CONFLICTS?

MIRJAM BECKER<sup>1</sup>, CLAUDIA SOBE<sup>2</sup>, PAUL BERTHEAU<sup>3</sup>, ANNE SELTMANN<sup>4</sup>, FRANK GOERITZ<sup>1</sup>, HERIBERT HOFER<sup>1</sup>, SYLVIA ORTMANN<sup>1</sup>

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Roe deer (*Capreolus capreolus*) show a high level of maternal input compared to other ungulates (Linell et al. 1998), but contradictory results about sex specific investment have been published as too many aspects seem to be unclear (Vreugdenhil et al. 2007). The latest study of Macdonald and Johnson (2008) suggests a condition-dependent allocation of sex in roe deer and a mixed pair of offspring seems to optimize maternal investment during lactation. Since postnatal maternal investment and lactation effort is hard to quantify and studies of mother's and offspring's suckling behavior are rare, our study will help to answer the question about sex specific maternal input and potential conflicts in roe deer at lactation period.

Roe deer are kept at the IZW's field station in semi-natural enclosures. The groups consist of one buck, up to three does and their annual fawns. Suckling behaviour of fawns was weekly recorded by behavioural monitoring during the lactating periods 2009 and 2010. To quantify individual milk uptake as well as overall energy expenditure of the fawns, stable isotopes were used (doubly labelled water method). The fat, protein and lactose content of almost 100 roe deer milk samples were analyzed through near-infrared absorption.

Suckling frequency of fawns was highest at an age of two weeks with more than 25 events during the day and then constantly decreased with increasing age. When fawns got older the percentage of suckling events terminated by the mother increased, which possibly indicates a mother-offspring conflict. Comparing the mean suckling duration of both, sexes and siblings, our results have shown that there were no differences in both cases. This suggests that suckling behaviour as an indicator of maternal input was neither sexually nor individually affected. The use of stable isotopes will allow quantifying the milk transfer to individual fawns and by this sex specific maternal input.

Oral

## VARIATION OF STRESS LEVELS IN ROE DEER ACCORDING TO LANDSCAPE STRUCTURE

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Wildlife populations are subjected to an increasing pressure linked to human activities. These human activities introduce multiple risks and stressors by modifying the quality and the quantity of habitat available to wildlife populations. In human-dominated landscapes, population dynamics may be more dependent on the response to human stressors than natural regulation (resources, predation, competition).

Because of the documented roe deer population growth and geographical expansion over the past few decades, this species is increasingly exposed to human activities over much of its range. However, there are very few studies focusing on the roe deer's responses to human disturbance and their consequences in terms of individual life history traits. For ungulates, resource quality seems to be positively correlated with human-related sources of risk. Thus, there is a trade-off between access to resources of high quality and risk-taking. This balance should be optimal to maximize fitness and should result in a compromise in landscape use.

Our main hypothesis is that stressors and risks linked to human activities will modify individual behavior because individuals will optimize access to resources and minimize risks (trade-off). To verify this hypothesis, data were collected on a roe deer population monitored over the long-term. GPS data enabled us to study accurately the spatial behavior of roe deer. Different analyses, such as K-select analyses, enable us to observe how roe deer adapt and modify their space use in relation to the above trade-off. Physiological data were also collected during capture sessions, such as levels of cortisol hormones or parasite loads. These measures provide indicators of stress and allow us to determine the landscape of fear for roe deer in an agricultural-based ecosystem.

A link between the level of cortisol and landscape structure which differed between periods with and without hunting illustrates how hunting modifies stress levels and hence the landscape of fear. More precisely, the cortisol level decreased significantly with the proportion of forest in the landscape during the hunting period, but this relation was not significant outside of the hunting period.

This result highlights the importance of considering anthropogenic influences on spatial behavior and stress responses of wildlife populations.

## MANAGEMENT IS MORE IMPORTANT THAN ECOLOGY. WHAT SHAPES THE DISTRIBUTION OF ROE DEER AND RED DEER IN THE GREATER BOHEMIAN FOREST ECOSYSTEM?

Tom Brand<sup>1</sup>, Manon Kaandorp<sup>1</sup>, Sabine Müller<sup>1</sup>, Björn Reineking<sup>2</sup>, Pavel Šustr<sup>3</sup>, Marco Heurich<sup>4</sup>

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Conservation and sustainable harvesting of red deer *Cervus elaphus* and roe deer *Capreolus capreolus* relies on proper management which in turn relies on population parameters such as distribution preferences. Therefore a study about the distribution of those two species in the Greater Bohemian Forest Ecosystem (GBFE) was conducted.

The GBFE lies on the border of the Czech Republic and Germany. The GBFE includes two different national parks (Šumava and Bavarian Forest), which follow different management approaches. To compare the distribution preferences the two national parks formed the centre of the study area. Around the national parks a 15 km wide area was included to study the effects of the surrounding area, including areas with human settlements. The study area has a diverse vegetation cover and large height differences (over 1,000 meter); the total study area size was 3,354 km<sup>2</sup>.

A standing crop pellet-group count was used to determine the distribution of the study species. To sample the study area a transect method using circular plots was chosen. At the coordinates equilateral triangular transects of 1500m were walked. Every 100m a plot with a radius of 1,8 meter (10m<sup>2</sup>) was sampled.

Both natural and anthropogenic effects were studied to allow for a broad view of the possible causes of different spatial preferences, such as elevation, forest, presence of national parks and country differences. Pellet counts were analysed with generalized additive mixed models, accounting for overdispersion and spatial autocorrelation.

Roe deer distribution was most strongly influenced by elevation and country. National park and forest had less influence. The highest density of roe deer was found at 700 m above sea level and decreases continually as elevation increases. In the Czech Republic more roe deer were found than in Germany; in both countries densities were higher outside the national parks. Additionally, forest had a slight positive influence on roe deer.

The significant difference between the countries shows that not only natural effects, but also human management regimes, have an influence on roe deer distribution. The way human beings hunt, till the land and live their lives has the same influence, than natural causes.

## PARTIAL MIGRATION IN ROE DEER

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We studied partial migrations in the European roe deer (*Capreolus capreolus*), a species particularly suited for such a study, due to a wide distribution range and a high level of ecological plasticity and adaptation to human-induced environmental changes. We undertook a comparative analysis of a set of representative and contrasting European ecosystems (boreal, boreo-nemoral, alpine, central European and sub-Mediterranean), using a data-set of about 100 individuals tracked for at least 1 year, using GPS collars. One of the main findings was the relevance of intermediate migratory behaviour, i.e. many animals performed numerous trips back and forth between winter and summer areas before taking a final decision and stabilize their range. The migration process resulted highly inter- and intra-individually variable, where the "classic" partial migration alternatives (residents and sharp migrants) were only the extremes of a highly complex behavioural gradient. The probability of adopting a migratory strategy, and sharp migrations in particular, depended on modulation by external factors, and in particular by the presence of snow, and on costs of displacement. The behavioural migratory gradient seemed therefore an expression of ecological plasticity and quick adaptation to climatic variation. However, migration patterns differed a lot between males and females, providing evidence that sex-specific adaptations also play a role in shaping the movement tactics of roe deer.

Oral

## DEER AS MOLECULES – REM AS A NEW METHOD IN ESTIMATING ROE DEER DENSITIES?

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Camera traps become increasingly popular in wildlife biology and offer new methods in population estimation. The Random Encounter Method (REM) is based on a two dimensional gas model and uses trapping rates combined with animal and camera specific parameters to estimate population densities. No individual recognition is needed for this method and monitoring costs could be reduced. The roe deer is an ideal candidate to evaluate the capabilities of this method in the field, because of their body size and distribution. Further research concerning the method should concentrate on two factors: an animal's individual velocity and camera specific parameters, e.g. the reliability of triggering.

This study was funded by the Austrian Research Promotion Agency (FFG) Project No. 814274 We thank Georg Mattersberger and Erich Temmel (Leobener Realgemeinschaft) as well as Bertram Blin and Alexander Waldmüller (Forstbetrieb Kletschach) for logistic and financial support.

## DO FEMALE ROE DEER UNDERGO BREEDING DISPERSAL? THE EXCURSION BEHAVIOUR OF FEMALES DURING RUT

Lucie Debeffe<sup>1</sup>, Francesca Cagnacci<sup>2</sup>, Christophe Bonenfant<sup>3</sup>

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Breeding dispersal is defined as the net movement between two successive breeding sites and is one of the most important processes in population dynamics. Breeding dispersal is a poorly understood and seldom reported phenomenon in mammals, despite its potential importance for population dynamics and genetics. Female roe deer reportedly make short excursions during the rutting period (July-August). These excursions may be considered as a kind of breeding dispersal (in a genetic point of view), since the breeding site of an individual female which undergoes these excursions may change between two successive breeding seasons, although the home range of the female does not change, as is expected under the strict definition of breeding dispersal.

We investigated the ranging behaviour of adult roe deer females monitored with GPS collars in 12 populations across Europe using the EURODEER database. This database includes GPS locations from six countries for a total of 197 adult females referenced until now (France N=114, two study sites; Italy N=65, five study sites; Germany N=10, two study sites; Norway N=6; Sweden N=7; Belgium N=5). The EURODEER database provides a unique opportunity to test the generality of female excursion behaviour in roe deer, but also to obtain a better understanding of their proximate and ultimate causes.

On the study site of Aurignac in South-West France, 87 females have been monitored for a duration of one year each, from 2003 to 2010. 22.6% of yearling females (2 years old) and 38.3% of adult females (>2 years old) made excursions during the rutting period. Analyses of others study sites have not been performed yet. However another study in Italy also demonstrates the existence of these excursions during rut, indicating that female excursions appear to be a common pattern throughout Europe. Because roe deer natal dispersal occurs before the age of two, and because both sedentary animals and dispersers remain faithful to their adult home range, the potential for mating with relatives may be substantial in a population with a low natal dispersal rate. These excursions may be motivated by an active mate choice behaviour by females and may be a behavioural process promoting inbreeding avoidance.



Oral

## TEMPORAL HABITAT PREFERENCES IN ROE DEER AT DIFFERENT SCALES

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Patterns of an individual's space use reflect the complex, often competing demands that influence movement behaviour.

Numerous studies on habitat preference exist but only few consider temporal variations, even though it is well known that resource requirements of roe deer as well as resource availability in landscape vary over time.

In our study, GPS telemetry data of 42 roe deer (26 male, 16 female) were analysed with regard to seasonal and circadian variations of the usage of 25 different vegetation types. We followed two approaches. (1) Preferences, defined as the disproportionality between usage and availability, were quantified for each individual separately under use-availability design at fine temporal scales (hourly, monthly). (2) Data of all animals were combined and fitted via a generalized additive model (GAM) to describe preference with respect to time (daytime and month) for all recorded animals.

Apparent temporal patterns of resource preference were detected with both, usage/availability design and GAM. Significant variations of preference over time indicate changes in resource requirements. Based on expert knowledge, preference for food during night and preference for cover during day could be inferred. Furthermore a sex specificity in site selection was detected, in particular during the course of the year. Does showed a higher preference to sites granting a high energetic gain during pre- and postnatal care. In addition, they appeared to put less emphasis on cover during fawning season.

Our analysis exemplifies the need for incorporating temporal dynamics in resource selection.

Habitat preference analysed with respect to temporal varying covariates may facilitate a deeper understanding of movement behaviour of roe deer.

Oral

## MONITORING RED DEER AND ROE DEER WITH A COMBINATION OF AERIAL INFRA-RED AND HIGH RESOLUTION RGB IMAGES IN FORESTED AREAS

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The use of cost effective and silent light aircrafts and the increased availability of infrared cameras on the civil market made the aerial surveys with IR cameras an interesting option. We want to present our results of aerial counts of larger mammals in forested areas using a combination of IR and RGB true colour images. The IR images are being used for detection whereas the high resolution RGB images are being used for species-specific identification. The aircraft was equipped with a computer linked camera system consisting of a JENOPTIC® infrared camera (640\*480 Pixel) and a Canon 5D Mark 2® high resolution RGB camera. The aim of the 3 year project (Oct. 2008 – Sept. 2011) which is sponsored by the Deutsche Bundesstiftung Umwelt (DBU) is to establish a new monitoring method for larger mammals (especially ungulates) in forested areas. Until April 2010 we flew 21 missions over the national parks Bayerischer Wald, Hainich, Kellerwald-Edersee and the biosphere reserve Pfälzer Wald-Vosges du Nord. We overflew each investigation area of about 6000 ha in linear transects. Flying in altitudes of approximately 450 m above ground level the cameras scanned an area of 1.200-2.000 ha per flight, thus covering 20-30% of the investigation area. Depending on the area up to 19 larger mammals per 100 ha were detected. Furthermore we accomplished a study to test the detection rate in relation to the coverage (different type and density of the vegetation). Further flights are being planned for 2010/2011.

Oral

## ASSESSING MORTALITY FACTORS ACTING ON DIFFERENT TIME-SCALES ON THE POPULATION DYNAMICS OF ROE DEER: THE INTERPLAY OF ROAD MORTALITY, LYNX PREDATION AND HUNTING

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Population dynamics of wildlife species are influenced by several impact factors acting on different time scales like year by year variations in mortality caused by hunting pressure or long term variations caused by climatic fluctuations.

Roe deer is one of the most common deer species of central Europe successfully adapted to variable mortality factors, namely selective hunting, predation, traffic and weather conditions. However, it is not known which of these factors are impacting roe deer populations to which amount when all factors are applied simultaneously. Another well known challenge for researchers and hunters is the estimation of the roe deer density and the degree of uncertainty for planning hunting-bags.

An age structured population model containing the classes fawns, barren does, yearlings, bucks and does was constructed to investigate these relationships in detail. To parameterise the model, we used hunting data of Baden-Wuerttemberg (BW) and the Bavarian National Park (BNP), data on predation by *Lynx lynx* included as a Holling Type II functional response, density-dependent base-line mortality and data on traffic mortality.

The model output was analysed by sensitivity analysis for several scenarios with a temporal extent of 20 years. It was used to investigate different hunting strategies and measures and their efficiency contributing to an adaptive roe deer management. The model results contribute to a better understanding of the interactions between human hunting, its uncertainty, natural impact factors for roe deer populations and population dynamics of roe deer itself.

## ROE DEER (*CAPREOLUS CAPREOLUS* L.) MANDIBLE SIZE AS AN INDICATOR OF ENVIRONMENTAL CONDITIONS AND HABITAT QUALITY

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For recording of annual hunting bag and for categorization of eliminated animals in Slovenia, roe deer (*Capreolus capreolus* L.) mandibles are collected annually by game managers; these mandibles have a huge potential for scientists, ecologists or wildlife managers. Indeed, they provide basic information on animal size, which reflects the influence of different environmental factors (mainly the quality of the habitat).

Differences in the size of roe deer, culled in the entire Slovenia in 2007, was assessed by measurements of mandible lengths ( $n = 11.152$ ). The longest mandibles and therefore the largest body have roe deer from eastern Slovenia (roe deer bucks: Pannonian Slovenia:  $\bar{a} = 158.6 \pm 0.2$  mm; Subpannonian Slovenia:  $\bar{a} = 159.3 \pm 0.2$  mm). The shortest mandibles (the smallest body) were found in the population of the southwestern Slovenia (Submediterranean region:  $\bar{a} = 156.1 \pm 0.3$  mm).

The multivariate analyses confirmed that the main influence on the mandible lengths of roe deer yearlings has the age of an animal. This factor represents 76 % of the total explained variance. Environmental factors together explain 23% of the total explained variance; the highest variance is explained by factors that represent the quality and abundance of food resources. Particularly the share of cultivated land, the share of grassland or the share of coniferous trees, respectively, positively influence the mandible size, while the length of the forest edge has a negative influence. Other factors that exert negative influence on the mandible size of roe deer are also: (i) precipitation, which means energy loss due to needed thermoregulation (4.5% explained variance); (ii) density of red deer (*Cervus elaphus* L.), i. e. inter-specific competition.

Roe deer fawns have the fastest growth (no differences between genders) in first six months of their life, i. e. until December, when the growth slows-down; however, the animal still grows until its second year. After the animal is fully grown, environmental factors can't influence its body size. Therefore, mandibles may be appropriate and well-standardized samples, which show the differences in environmental conditions of roe deer habitat.

## ACTIVITY PATTERNS OF AN EURASIAN LYNX (*LYNX LYNX*) AND ITS RELATION TO ITS PREY SPECIES, THE EUROPEAN ROE DEER (*CAPREOLUS CAPREOLUS*)

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Activity patterns of animals are influenced by several factors. One of these in predators is prey availability. At the National Park Bavarian Forest, the main prey species of lynx is roe deer. Roe deer activity in this area has been shown to be an alternation of resting and activity bouts during the entire day with activity peaks at dusk and dawn. Lynx has been reported in studies from other areas as mainly, but not exclusively nocturnal.

We have equipped six male and five female roe deer with GPS collars from VECTRONIC Aerospace between March 2005 and December 2007, and one male lynx from March 2005 to July 2005 and from November 2005 to February 2006 with the same sensors. The time of death in 23 collared roe deer killed by lynx in this territory has been recorded between May 2004 and March 2010 (total of 230 days). Activity of collared animals was measured 4-8 times per second with an acceleration sensor, and the average acceleration was stored over five minute intervals. Activity was analysed with the PC program Activity Pattern (VECTRONIC Aerospace): values were plotted as actogram, and mean activity levels during the day were compared to find activity peaks and resting periods.

Analysis of activity patterns showed that the lynx had a clear day-night discrimination with activity mostly from the afternoon to the next morning. Activity in roe deer was organised as alternating bouts of resting and activity. Both species had overlapping activity peaks at dusk, while the dawn peaks of roe deer overlapped with those of lynx only from May to June. The 18 roe deer kills mostly happened during the first half of the night, which included the roe deer's dusk peak, but also the resting time which followed the dusk peak. These results suggest that the activity peaks of the observed lynx were synchronised with the activity peaks of its prey, but also includes their resting times. However, it is not clear yet whether the killed roe deer was active or resting at the time of the ambush. This needs to be investigated in further studies.

Oral

THE STATUS OF ROE DEER SCIENCE AND ROE DEER SCIENTISTS: REFLECTIONS ON THE PAST, PRESENT AND FUTURE ON THE OCCASION OF OUR 10TH MEETING

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It is now 20 years since the idea of the European Roe Deer Group was conceived at a side event during the IUGB meeting in Godollo, Hungary in 1991. The first meeting was held in Sweden in 1992, and since then the meetings have been held in Italy (twice), Norway, Portugal, Spain, Scotland, Slovenia, France and now the Czech Republic. During this 20 years of cooperation there has been a tremendous development in the level of roe deer research, facilitated at least in part by the increase in cooperation between individuals and institutions across international borders. Researchers have investigated just about all possible aspects of this species; studying it from the perspectives of behavior, ecology, demography, life-history, physiology, management, health, disease and genetics. It is now fair to say that roe deer are among the best studied of all large mammals. However, on the occasion of our 10th meeting it seems appropriate to reflect on where we have come from, where we are, and where we are going. An analysis of bibliographic databases provides interesting insights into publication trends and the impacts of various papers. Based on this analysis of literature and a poll of published roe deer researchers we will discuss the main trends and identify key avenues for future research topics and collaborations. Although it may seem premature to reveal the conclusions, we feel safe in saying that we believe that the impetus seems set to continue, as initiatives like Eurodeer open the way to break new ground. I'm also sure that the our favorite species will continue to offer us many more surprises in the years to come

Oral

SEX ALLOCATION AND COSTS OF REPRODUCTION IN EUROPEAN ROE DEER  
(*CAPREOLUS CAPREOLUS*)

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European roe deer show a high level of maternal investment and mothers in above average condition deliver bigger and heavier litter and wean heavier juveniles. Average birth mass of fawns is not affected by maternal body mass indicating that roe deer invest in quantity rather than in quality of their offspring. Although birth mass is equal among the sexes, male juveniles are heavier than female juveniles at the end of direct maternal care (October).

To determine costs of reproduction we assessed both in captive roe deer, future reproduction output i.e. the effect of preceding litter size at birth on current litter size, and body mass change between consecutive years as a function of litter size and litter composition during lactation.

High investment into current reproduction seemed to decrease future litter size, whereas litter size increased after a reproduction pause. Non pregnant and non nursing females gained mass between years, and mothers nursing big litters lost more weight than those nursing small litters. However, fawns sex seemed to have no effect on body mass change of the doe, and mothers weaning sons did not lose more mass than mothers weaning daughters.

High quality roe deer mothers invest in litter size, but pay a cost with respect to future reproduction and body condition. However, a reproduction pause might enable them to replenish body reserves and allow successful weaning of big litters in the following year. In contrast to hypotheses on sex allocation in ungulates, production of sons seemed not to be more expensive than production of daughters. The increased weaning mass of sons compared to daughters might be caused by differences in food consumption after the period of exclusive maternal care (lactation) or mothers of sons are able to compensate an extra investment into their son by the time of weaning in October.

Oral

## THE ROLE OF FOREST-DWELLING DEER IN LONG-DISTANCE SEED DISPERSAL

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Herbivore ungulates are key-species in ecosystems, and their recent demographic and geographic expansion will influence global dynamics of plant species. Our objective is to identify positive effects of forest-dwelling deer on plant dispersal processes. Contrary to open habitats where most seeds are dispersed by the wind, long-distance seed dispersal essentially relies on animal movements in forest habitats. Due to their ability to cover long distances, large herbivores are supposed to be important vectors in long distance (> 100 m) seed dispersal. To quantify this, we analyzed daily paths of 16 roe deer females equipped with GPS collars in the Chizé forest (n = 185 daily paths from 2003 to 2008). To estimate seed retention time, we monitored the fate of seeds from the moment they have been eaten or picked up by the animals to their release on the ground. Fur and hooves of hunted roe deer have been brushed and faeces collected to identify seeds carried by epi- and endozoochory respectively. Our results revealed that forest roe deer might disperse seeds at distances longer than 1000 metres during a daily path in forest. Identification of seeds collected on fur, hooves or in faeces is in progress and will allow us, combined with animal movement and time retention of seeds, to estimate seed dispersal curves produced by roe deer. These additional results will be presented during the meeting.



Oral

## HOW USEFUL ARE ADAPTING CROSSING STRUCTURES FOR ROE DEER MOVEMENTS OVER FENCED MOTORWAYS: A SLOVENE EXPERIENCES

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Road infrastructure has been intensively built in Slovenia in the last two decades. Like in many European countries, all motorways are fenced with the aim to increase road safety; however, this provokes fragmentation of habitats, hinders animal movements and results in isolation of wildlife populations. Therefore, different types of underpasses and overpasses are of a particular importance for enabling migrations of individuals and genetic flow within species. Apart from specifically constructed (dedicated but costly) ecoducts, several other crossing structures (e.g. bridges, water passages, roads) are often slightly adapted to act as a wildlife passages. However, due to small, inappropriate gauges and many anthropogenic disturbances their effectiveness is rather questionable.

Since 2007, usage of 33 adapting crossing structures (16 bridges, 9 water passages, 6 small underpasses for agricultural access, and 2 narrow road overpasses, respectively) by wildlife has been intensively monitored on six sections of three new motorways in Slovenia (Ljubljana-Zagreb, Ljubljana-Jesenice, Maribor-Budapest). Crossings of middle- to large-sized mammals (ungulates and carnivores) were determined permanently over the year by surveying and counting animals' footprints/tracks in sand pads on the bimonthly basis. Moreover, infrared photo-traps were occasionally used at the selected structures to confirm both species determination and their usage of adapted passages.

Although monitored crossing structures are of rather small dimensions (width <20 m), they were all at least occasionally used by wildlife, and >4,000 mammalian tracks were recorded in total. Red fox was the most frequent species using these structures (35.0% of all tracks recorded), followed by roe deer (23.8% or 977 tracks), and martens (14.6%). Roe deer at least sporadically used 27 structures (82%), and it avoided only majority of very small (2 m wide) water passages. On the contrary, this species relatively often used all other types of structures, particularly in the case that their width exceeds 10 m. Although their effectiveness depends also on characteristics of adjacent habitats as well as on roe deer density, an intensive usage of the most favourable passages (a regular crossings were recorded on several structures) indicates that adapting crossing structures enable connectivity of roe deer subpopulations from both sides of motorways.

Oral

## SPACE USE OF ROE DEER IN THE SURROUNDINGS OF THE BIALOWIEZA PRIMEVAL FOREST – PRELIMINARY RESULTS

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Differences in home range size have been a subject of many ecological studies. Variation in age, offspring and in the productivity of the environment is known to influence home range sizes. Additionally, a higher proportion of cover is decreasing the risk of predation. Thus, variation in heterogeneity of the habitat and visibility are believed to affect space use patterns. So far, several studies on space use of roe deer have been conducted in Western Europe, but data on spacing behavior of roe deer in Eastern Europe is still limited. Our study aims to investigate the influence of different factors such as sex, age, type of habitat and availability of cover on home range sizes of European roe deer throughout the year in contrasting habitats in Eastern Poland.

The study area was located in the outskirts of the Białowieża Primeval Forest ranging from contiguous woodland to a mosaic of coniferous and mixed forest with fields and further to open, mainly agricultural fields. Roe deer were live-trapped in winter and fitted with VHF or GPS/GSM collars.

In total we analyzed locations of 27 roe deer (14 females and 13 males) throughout the year from March 2007 until March 2011. Home range sizes ranged from 0.5 km<sup>2</sup> (females during summer) to 2.4 km<sup>2</sup> (males during spring). Out of 27 captured roe deer, five (three subadult females, one subadult male, one adult male) have dispersed from 7 to 22 km. Main influencing factors of home range sizes were sex and the heterogeneity of the habitat.

## CULLING DATA REPRESENT A USEFUL BASIS FOR RESEARCH AND MANAGEMENT OF FREE-RANGING UNGULATES: EXAMPLE OF ROE DEER HABITAT MODELLING IN SLOVENIA

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In most European countries free-ranging ungulates mortality is well documented due to intensive and well-controlled management of these species. Therefore, culling data (i.e. several systematically collected data on culled animals) have great research potential, for example for population demography studies, spatial trend analyses, habitat modelling etc. Furthermore, these data are very important for the population management, including planning of culling quotas. However, accuracy of data gathering (e.g. verification, spatial resolution) is fundamental for their applicability. In Slovenia, unified and standardised system for collecting free-ranging ungulates and large carnivores mortality data was developed. For every removed (culled, road-killed, ruined etc.) individual, the following data must be recorded: sex, age estimation, body mass, cause of mortality, date and location of mortality, antler mass, and trophy value, respectively. Since 2004, all mortality data have been georeferenced with a 1 km<sup>2</sup> accuracy. This spatial resolution is similar to telemetry data resolution, but sample sizes are much larger and spread throughout the whole country. Data are collected at the country level in a united digital database, which includes logical filters that control data correctness. Some of the data (e.g. sex, age) are also verified by expert commissions every year. Apart from a mandatory duty also an internet application, which enables real-time graphics (e.g. culling data for individual hunting ground) and other applicative outcomes, was developed to keep the motivation of hunters to enter data. Exceptional research potential of gathered data was confirmed in many previous studies, such as study of the effects of environmental factors on red deer and wild boar body mass, and reconstruction of the present and potential distribution for all ungulate species. Data were also used for roe deer studies, including habitat selection study. Large number of removed roe deer (approximately 45.000 yearly) and its home range size, which coincides with spatial resolution of the data, makes roe deer culling data particularly useful. In this contribution we present habitat model for roe deer in Slovenia, produced by linking roe deer removal data (data over several years representing good population density index) and data on environmental factors in the same resolution.

## ROE DEER HABITAT USE AT THE SOUTHERN EDGE OF THEIR RANGE

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Understanding the spatial distribution of organisms is a central topic in ecology. The European roe deer (*Capreolus capreolus*) population is in Portugal at the southwestern edge of its distribution. This wild ungulate is a native species in Portugal, where populations have always persisted in a few patches in the north of the Douro River. Although declines have occurred in the 1980's, they are now in expansion in northern Portugal. Roe deer population numbers have remained stable at generally low densities, despite the lack of a legal harvest. This differs from the rest of Europe, where roe deer populations have expanded dramatically in recent decades. In Portugal, there is an enormous paucity of information regarding roe deer population distribution and the factors affecting its distribution. Such information is essential for the correct planning of conservation and management plans in both a local and national context. By using pellet group counts, we looked at the importance of habitat structure and composition, landscape structure, and human disturbance (e.g., distance to the nearest house and to the nearest paved road) in shaping the distribution of roe deer at a habitat patch scale and a wider landscape scale. At the patch scale, roe deer distribution was positively associated with high density of shrubs and with increasing distance from roads. At the landscape scale, roe deer distribution was negatively associated with spatial heterogeneity, namely mean shape index. Our findings suggest that landscape structure, vegetation composition and distance to roads are all important factors influencing roe deer distribution, highlighting the importance of multi-scale approaches. However, these results must be interpreted as providing a first preliminary assessment of roe deer habitat / landscape relationships, and there is a need to a follow-up with studies that allow for finer scale analyses, and that allow an exploration of the mechanisms behind the observed patterns.

Oral

## DO ROE DEER GAIN NUTRITIONAL BENEFIT FROM FEEDING IN OPEN LANDSCAPE?

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In Europe, roe deer are currently established in virtually all types of rural agro-systems. Depending on local landscape structure, roe deer may have access to different habitats (forest, wood, hedge, meadow and crop) that provide different food resources. We expect that within a given population, the diet of individuals should be related to landscape structure, both in term of composition and nutritional quality. We analyzed 142 rumen samples and 238 faecal pellet groups collected in a 80 km<sup>2</sup>; rural area in South West France. In summer and non-mast winters, roe deer ate more cultivated seeds and less browse, and obtained higher diet nutritive quality with increasing availability of crops and meadows in the local landscape. The pattern was less marked in other seasons. Notably, in mast autumns and winters, the consumption of acorns across the entire landscape resulted in a low level of differentiation among individuals in diet composition and quality. In addition, roe deer consumed more grasses in the open sector than in the forest, with particularly high consumption in winter, likely in relation to the shortage of browse and the relatively high quality and availability of grass leaves in this season. The pronounced flexibility of roe deer feeding behavior enables them to use the nutritious plants of cultivated fields and meadows when available and may explain local heterogeneities in individual phenotypic quality.

## AGE AND SEX MORPHOMETRIC VARIATION IN A CENTRAL APPENNINE ROE DEER POPULATION (TUSCANY, ITALY)

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This study aims, through osteometric analysis of the mandible, to obtain information on the biometric characteristics, on development and intraspecific variability of the population of roe deer in the province of Pistoia (Tuscany, Italy), and morphometric characters to compare with those collected from other Italian and European populations.

The sample includes 385 roe deers hunted in the programs for wildlife-hunting management of the species, during the hunting seasons from 1999-2000 to 2002-2003, within local hunting unit ATC Pistoia 16.

For each mandible were collected 16 morphometric characters different, recognized with a special digital calliper (accuracy of 0.01 mm). The analysis was conducted among age classes (fawns: age < 1 year; yearling: 1 < age < 2 year, adults: > 2 year) and between sexes. The age determination was carried out by analyzing the state of eruption and/or replacement and the degree of wear of teeth of the jaws of roe deer.

The analysis of variance (ANOVA) allowed indication which morphometric characters vary considerably between classes of sex and age. The discriminant analysis (Stepwise Discriminant Analysis) allowed to determine which characters are able to discriminate by age and sex of roe deer.

In this work, except for the length of the molars row, there was a significant difference between the morphometric variation of each character class of yearling and adult. The most important characters are able to differentiate adults than yearlings were: 1) distance between the posterior margin of the angular process and the back edge of the 3rd molar; 2) length of premolars row; 3) height vertical branch.

Analysis of morphometric characters variation between sexes showed no significant differences for fawns nor for yearling. In contrast, for adults, 7 morphometric characters differ significantly between the sexes. The most important characters to be able to differentiate sex of the adults were: 1) maximum length of mandible; 2) height of jaw to the front edge of the first molar; 3) total length of mandible.

The values determined in this study for the main measures of the mandible are placed in the range of variation known for the species in Europe.

Oral

## PRODUCT PRESENTATION ZOOSLEEP 16/5

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The ballistic problem for a safe distance immobilization is the exact fine tuning of precision and impact force.

It is a very big problem that animals get hit by a projectile with too much impact force. With 40 years of experience in immobilization from zoo and wildlife did Prof. Dr Henning Wiesner in a close partnership with Horst Blaser and Clemens Kimmig develop a complete new concept for narcotic guns with a special projectile. The new concept is based on a good ballistic and wildlife protection measure.

### Design

In the process developing Zoosleep 16/5 we took a high measure in rugged and technical perfect design so that the narcotic gun is good under difficult field situation.

Zoosleep 16/5 is a very easy to use pulpup version with a total length from 94cm and a barrel length of 85cm. The gun weight is 3,2kg.

The gun doesn't need a CO2 capsule and got its own pump pressure system with two pressure tanks. The Pump can be used with a very low hand force. With one pressure filling we can take 2-3 quick shots.

The loading process is easy to do through the back end of the gunstock. The safety is in the trigger guard.

With Zoosleep 16/5 and the special projectile we can reach a distance of 80m. The use of a range finder is necessary.

The pressure regulation is based on an electronic measure system with a sensor showed on a digital display by 5m steps.

With two valves mounted in the side of the frame we adjust the pressure to the shooting distance.

All spare parts like ( O-rings, valves, batteries 9Vblock) are international available and easy to change.





# POSTERS

(in alphabetic order of first authors)

Poster

## ROE DEER MANAGEMENT AND REINTRODUCTION PLAN IN ANDALUSIA (SPAIN)

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While roe deer distribution is continuous and expanding in the north half of Spain, towards the south, roe deer are present in isolated populations, with the south-western limit of the species' worldwide distribution extending into the provinces of Cadiz and Malaga. The low density of roe deer populations in Andalusia, in contrast to Northern Spain and Central Europe may be explained by the peculiar productive conditions of the habitat in the Mediterranean region. But also habitat transformations and the high numbers of wild and domestic ungulates influenced the extinction of roe deer in some Andalusian areas.

With the aim of increasing the roe deer distribution in Andalusia, the Regional Government started in 2009 the "Roe Deer Conservation and Management Plan", which includes the reinforcement of the Andalusian roe deer populations that present low density levels, and the reintroduction of the species in suitable areas where it disappeared in recent time. In the case of reintroductions, roe deer are being released in enclosures (8-15Ha) until they are acclimated, then restricted doors will be open in the enclosure to allow their free movements; before this moment, some individuals will be marked by radio-collars to follow their dispersion.

The Plan will also promote corridors for natural dispersion of roe deer populations and actions to improve the habitat quality for the species, such as conditioning natural sources and creating artificial water points (very important for roe deer during summer), to create small open sunny areas (0,25Ha) in the forest by clearing the vegetation (which produce good feeding areas for roe deer), to create small planting areas (0,25Ha) with botanically suitable species for roe deer, and to create some artificial feeding points when necessary (mainly for recapturing individuals).

## ROE DEER (*CAPREOLUS CAPREOLUS* L.) AND ENVIRONMENTAL POLLUTION: DENTAL FLUOROSIS OF ROE DEER AS THE CONSEQUENCE OF FLUORIDE POLLUTION, SLOVENIA

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Roe deer (*Capreolus capreolus* L.) is one of the most important game species in the majority of European countries; moreover, it is also one of the most suitable species for bioindication of environmental pollution in terrestrial ecosystems, such as heavy metals or fluorides.

Fluorides (fluorine compounds) are natural compounds of the geosphere – fluorine is the 13th most abundant element in the earth crust. Nevertheless, anthropogenic activity can significantly contribute to increased fluoride concentrations in the environment. Due to a high affinity of fluoride ions to calcium, the chronic toxic impact of fluorides on mammals reflects mostly on skeleton and/or teeth. In the latter, the mineralization process of enamel and dentin is disturbed, which reflects in dental fluorosis. Assessment of dental fluorosis is one of the reactive bioindication methods, based upon the ocular examination of all six check teeth in one hemi-mandible of the animal. The sum of all six scores represents the dental lesion index (DLI, range: 0 - 30).

For reactive bioindication of fluoride pollution in Slovenia, assessment of dental fluorosis (DLI) has been done on a huge sample set, representing the total annual (year 2007) cull of all adult roe deer ( $n = 14,672$ ) in the county. The presence of dental fluorosis (incidence: 14.9%; average DLI =  $0.6 \pm 0.0$ ; Max DLI = 25) exhibited that dental fluorosis of roe deer in Slovenia (appearance and severity) is significantly lower in comparison with some other areas in Europe. Only one region, where the major pollution source of fluorides (aluminum plant) is located, showed higher average DLI (HG Boris Kidrič: average DLI =  $7.8 \pm 1.3$ ; Max DLI = 20). In this region, roe deer (sub)population might be negatively influenced by these pollutants, due to the decrease in average life expectancy as a result of the high dental fluorosis (faster teeth attrition).

Among different factors that influence the appearance of dental fluorosis, the main negative influence exhibit: (i) anthropogenic fluoride point sources; (ii) the age of the animal – dental fluorosis increases with age; (iii) the forest share – trees intercept some of the fluorides from the atmosphere.

With the increase of human influence on the environment different methods of bioindication are being developed or used to determine the exposure of living organism to different types of environmental stress, especially pollution. Therefore, in Slovenia a totally new and cheap method for reactive bioindication (assessment of dental fluorosis) represent a suitable and very detailed tool for the assessment of fluoride pollution of the environment. Indeed, detailed studies on mandibles have an enormous potential in environmental bio-monitoring programs and should be performed also in the future.

SPATIAL BEHAVIOUR AND HABITAT REQUIREMENTS OF MALE ROE DEER (*CAPREOLUS CAPREOLUS*) IN ŠUMAVA AND BAVARIAN FOREST NATIONAL PARKS

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Analysis of male roe deer spatial behaviour was one of the basic studies in Czech-German project concerning the lynx and roe deer ecology in Šumava mountains. Particular aim of the study was to compare the spatial behaviour and habitat requirements of roe deer in NP Šumava and NP Bavarian Forest. GPS positions of 19 males were used in the analysis. The data were acquired through the use of GPS plus collars (Vectronic Aerospace). Dynamics of spatial behaviour was analysed by changes of seasonal home ranges expressed by MCP and Kernel HR calculated with the help of Hawth's Tools extension for ArcGIS. Analysis of habitat requirements was carried out by precise land cover classification based on aerial orthophotomaps in original scale 1:3000. We focused mainly on the home range size and habitat selection during different seasons (including the rut) and age. Landscape structure, habitat composition, anthropogenic impact differ in both study sites, therefore the comparison of roe deer spatial behaviour and habitat preferences revealed evident variation. This individual differences in habitat selection indicate the high roe deer ability to survive in many types of habitat. Acquired knowledge could be helpful for both local and European level of management practices of roe deer population.

## INFLUENCE OF LYNX PRESENCE, ODOUR AND HUMAN HUNTING ON THE VIGILANCE BEHAVIOUR OF ROE DEER (*CAPREOLUS CAPREOLUS*)

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We compared the influence of human hunting and the presence of lynx on the behaviour of roe deer. Therefore, two observation studies were carried out within two study sites; one within the Rachel-Lusen-Area of the Bavarian Forest National Park, where roe deer is the lynx' main prey and no hunting on roe deer takes place, and one outside the National Park within a private hunting ground.

First, vigilance was compared between the two areas, between daytimes – evening and night – and in respect of the hunting intensity (August and September). Second, the roe deer's reaction on lynx urine was tested in an experimental approach.

The individual behaviours of 259 animals were recorded from hunting stands with binoculars and spotting scope during 40 evenings, and by car during 30 nights with the help of an infrared camera and night-vision glasses. Each roe deer was observed from 1 to 20 min per animal. Time and length of behaviours were analysed using a mixed model (GLM). In both areas, preliminary results show significantly longer and more often vigilance in the evening than at night ( $p < 0,001$ ). Additional analysis is still in progress.

The behavioural reaction of roe deer to lynx odour (urine spread over the meadows) was tested observing 40 animals on 6 meadows, including 7 identified leading does. Time and length of behaviours were analysed with a mixed and a replicated model (GLM rep). With the presence of lynx urine roe deer show significantly longer ( $p < 0,001$ ) and more frequent ( $p = 0,025$ ) vigilance. They change their behaviour more often as well.

In conclusion, roe deer recognize their predator's scent and react excited and more vigilant. In both study sites it was found out that roe deer shows an increased vigilance during dusk (evening) compared to the night.

Poster

## REINTRODUCTION OF ROE DEER AT LONG RANGE: HANDLING AND TRANSPORTATION PROTOCOL WITH EQUIPPED VAN

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The first containment and transportation of roe deer has been traditionally carried out with boxes with measures commensurate to the size of the animals in order to limit movements. The containment of animals for several hours in boxes has been particularly stressful for the animals, with an incidence of high mortality especially in males if the capture period coincides with hierarchical or territorial stage.

As part of a reintroduction project with the containment and transport times in the order of 18-24 hours from the time of capture, the transport was tested by a specifically equipped van. The van is fitted with wood panels and stringers of adequate height to reduce the risk of severe impact, in case of abrupt movements of the vehicle. The animals are placed free in the equipped van with mask. The animals are monitored from the truck's cab using wireless cameras equipped with infrared lights to act promptly in case of problems, as well as to record the behavior during transport. The long-distance transportation of more than 50 animals has allowed us to verify that no animal has suffered traumas due to causes related to transport.

This paper describes the technical features of the structure used for the transport and handling protocol of animals.

## INCIDENCE OF ENAMEL HYPOPLASIA IN ROE DEER POPULATION IN SLOVENIA

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Enamel hypoplasia is the term used for conditions where the formation of enamel is defective, usually in quantity, although there is a condition, usually called enamel hypocalcification, in which the enamel is of normal thickness but is not fully mineralized; therefore it does not have the characteristic translucency of enamel but is white and opaque and may be grossly softer than normal.

In the year 2007 the left hemi-mandibles of the total annual cull of roe deer from Slovenia, namely 41,895 mandibles of roe deer in total (14,679 fawns, 11,869 yearlings, and 15,347 adults) were inspected for the presence of enamel hypoplasia. The preliminary results show that hypoplasia occurred in 216 cases of roe deer adults (excluding the dental fluorosis), representing 1.4% of all examined mandibles (permanent teeth), while on the other hand only one example of hypoplasia in deciduous teeth was detected. The hypoplasia was most frequent at all three premolars (P1 – P3) and third molar (M3); since the dentition of all three permanent premolars occurs in the same period as the dentition of the third permanent molar (i.e. in the second half of the first year of the life of an animal), the uniformity of the presence of the hypoplasia on those teeth was expected. The results show that the exposure to stress (the cause for the hypoplasia) was present in the late spring and early summer when enough food is available and thus the malnutrition can not be the cause for the hypoplasia. Therefore, the causes should be searched elsewhere, and the parasitism is the most likely one. Indeed, the spatial distribution of the incidence of hypoplasia is in favor of such a theory. Namely, the hypoplasia was not observed in mountain regions, while it was very high in lowland hunting grounds, especially in those with higher portion of moist meadows, or those in the lower streams of rivers Sava and Mura. Indeed, the fluke parasitism can most likely be the most important influential stressor for the teeth formation, and consequently affects the population vitality.

## CAMERA TRAPPING – HOW TO ESTIMATE ROE DEER DENSITY USING PHOTOGRAPHIC CAPTURES

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Reliable estimates of abundance are essential for both science and management of European roe deer (*Capreolus capreolus*) but traditional survey methods are often cost and time intensive. The rapid advance of camera trapping technologies and new analytical approaches like REM (Random Encounter Method) might potentially lead to more precise estimates at lower costs.

We tested the applicability of REM in a free ranging roe deer population in Styria, Austria. Camera trapping included traditional Capture-Mark-Resight (CMR) and the new REM. At the same time two well established pellet count methods (Faecal Accumulation Rate and Faecal Standing Crop) were used as a density baseline. First results indicate strong differences between the estimates of the various approaches.

In a follow-up study we will test the results using an experimental setting. The trial will take place at a forested 60ha enclosure with a comparable roe deer density. Six roe deer are equipped with GPS collars and additionally animals are marked using ear tags. We deploy a dense camera trap array that will allow a stepwise comparison between different levels of capturing effort. With the help of a new analytical approach photographic captures will be summarised as Spatially Explicit Capture-Recapture (SECR) histories. The aim of this study is to evaluate the reliability and accuracy of different camera trapping methods and sampling designs in order to improve density estimates of roe deer populations in the wild.

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Poster

## ESTIMATING ROE DEER DENSITY USING DNA FROM FAECAL PELLETS, AND MARK-RECAPTURE-ANALYSIS

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Our objective was to develop a mark-recapture approach based on DNA analysis from faecal pellets to estimate abundance and density of a free ranging roe deer (*Capreolus capreolus*) population in a forest dominated landscape in central Palatinate Forest, South West Germany. In Winter (March) 2011 we collected roe deer pellets on 20 line transects, each with ca.5,5 km length, over a 5 day period daily. Size of study area was approx. 36 km<sup>2</sup>. We extracted DNA from the surface of faecal pellets, and used a set of 8 microsatellite markers to identify individual roe deer. We collected 2.011 faecal samples. Do reduce laboratory costs we took a subsample of 400 samples in a first step for genotyping. Results of population estimate will be presented.

In a next step we will verify our estimation result by collecting tissue sample and DNA analyses of harvested roe deer in the study area. Finally we compare the resulting population densities to the roe deer harvest in the study area helping to evaluate the effectively/efficiency of the roe deer management.

## INFLUENCE OF HUNTING ON THE VIGILANCE BEHAVIOUR OF ROE DEER IN THE SURROUNDINGS OF THE BIALOWIEZA PRIMEVAL FOREST

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Prey species are exposed to mortality risks, which vary in space and time. In natural environments predation risk, either high or low, is hardly temporally uniform, and therefore prey should exhibit variation in anti-predator response according to the temporal variation in risk. Beside many others, vigilance is an important anti-predator behaviour and widely practiced among prey. As a common game species roe deer experience seasonally varying risk of hunting by humans. In order to minimize hunting and predation risk roe deer show a high level of vigilance. Our study aims to investigate the impact of hunting and time of day on vigilance behaviour of free ranging roe deer and we predict that vigilance increases within the hunting season and during the day compared to the close season and night-time. We tested whether the anti-predator responses of roe deer at two scales of temporal variation in risk follow the predictions of the “risk allocation hypothesis”. Additionally we evaluated the effect of group size on the individual vigilance rate of roe deer, regardless of time of the day and season.

The study area is located in the edges of the Bialowieza Primeval Forest (Eastern Poland) and is characterized by a mosaic of coniferous and mixed forest, pastures, meadows and open, mainly agricultural embossed fields. Vigilance behaviour of groups or single animals was assessed based on visual observations by describing every kind of roe deer behaviour. For locating roe deer during the night and behavioural observations a thermo-vision camera was used.

In total we performed and analyzed 90 day time observations and 40 night time observations during and outside the hunting season from December 2008 till March 2009. As predicted roe spent more time vigilant during the hunting season and during daylight than during the non-hunting season and night. The “risk allocation hypothesis” was only partly supported by our results.

## OCCURRENCE OF SHIGA TOXIN-PRODUCING *ESCHERICHIA COLI* (STEC) IN BAVARIAN ROE DEER

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STEC are an important food-borne pathogen, which can cause severe illness in humans such as bloody diarrhea, hemorrhagic colitis or hemolytic uremic syndrome. Human infection can be caused by ingestion of raw or insufficiently cooked meat, but also via direct contact with animals carrying STEC. Especially ruminants pose a risk since they are regarded as the main reservoir. In this work, the occurrence of STEC in roe deer (*Capreolus capreolus*) was studied using feces samples and rectal swabs. Additionally, information on the duration of STEC excretion in roe deer should be obtained.

In February and March 2010, 24 feces samples from 20 roe deer and during winter 2010/2011 46 rectal swabs from 35 roe deer were collected in the Bavarian Forest National Park. In total, 70 samples of 51 roe deer were taken. The samples were analysed for the occurrence of the shigatoxin genes 1 and 2 using real-time PCR.

STEC was detected in 83% of the feces samples and in 76% of the rectal swabs. In total, 84% of all animals shed STEC in their feces. From 15 animals, 2 to 3 samples each were obtained in different time intervals (from 1 day up to 10 month). Nine of these animals were shedding STEC at intervals of about two months, 2 animals remained STEC negative for about 1.5 months and 4 animals tested positive in the second sample after periods of in average 4 month. The study also showed that taking rectal swabs was not only a more convenient method, but also resulted in a higher number of STEC isolates, in comparison to using frozen feces samples.

This study demonstrates a high occurrence of STEC in roe deer feces. However, not every STEC strain is regarded as human pathogenic, further sero- and genotyping of the isolated strains is necessary to assess the risk for public health. It is impossible to determine the duration of STEC excretion in roe deer due to the low number of animals sampled repeatedly so far. Hence, the study needs to be continued with repeated sampling of further animals and over longer time.

## STRESS EXPOSURE OF ROE DEER DURING CAPTURE IN A BOX TRAP

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Wildlife studies using wireless tracking devices require trapping of animals, but the animal welfare during this procedure is poorly understood.

It is the intention of the study to obtain objective results on stress exposure of roe deer during their capture in box traps. For this purpose some traps are equipped with infrared-cameras.

The camera continuously videotapes the trap from the moment of capture until the release of the roe deer. To date, seven animals have been captured and a total of 56 hours of video footage have been recorded. The video material is analyzed in detail in order to obtain statistics on the temporal behavioral stages. The behavior in the trap is divided into 4 categories: lying, eating, standing calm, and moving disquietingly. We found that there is a high individual range in the behavior of roe deer. Most of the animals start eating immediately after the trap-door shuts. After this period some deer start moving disquietingly, stepping backwards and turning around for several hours. These periods of movement are always interrupted by periods of the deer standing calm. However, duration and frequency of calm periods vary significantly among the individual deer. In contrast to this behavior, other captured roe deer lie down and doze almost the entire night. Video monitoring of roe deer in traps seems to be at this point the only technique for non-invasive measurements of the stress level during capture. Other methods providing specific information on stress require either direct human contact with the roe, leading to a drastic increase of the stress level, or extended times of captivity. In the future, stress measurements of game will depend on the technical development of other non-invasive methods.



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Remarks