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IX Congresso Italiano di Teriologia

Civitella Alfedena (AQ), 7-10 Maggio 2014

edited by

S. Imperio, S. Mazzaracca, D.G. Preatoni

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Civitella Alfedena (AQ), 7-10 Maggio 2014

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edited by
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An online repository for mammals in Italy: **therio.it**

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The increased need for data on distribution of species used for monitoring obligations and species conservation and control planning have recently promoted the development of many initiatives devoted to collect digital georeferenced data stored in online repositories. Among these Global Biodiversity Inventory Facilities (<http://www.gbif.org/>) represents the largest effort to share data on species stored in museums and institutions over the world, providing free access (through this portal and its web services) to more than 400 million records. These initiatives also promoted the growing of field of citizen science, where both specialists and non specialized people are directly involved in collecting data on species and natural habitats. One of the successful initiative is the online repository on birds in Italy ornitho.it, promoted and funded by the LIPU.

Considering the central role of scientific institutions and associations to guarantee the accuracy and a correct use of data property, the University of Molise and the Italian Mammal Association implemented **therio.it**, a new online repository on mammals in Italy, <http://www.distat.unimol.it/therio/>. To allow future sharing of data among public institutions, the data-

base of **therio.it** includes 74 fields from the Darwin Core structure used by GBIF.

Despite this complex structure, the interface with the users is friendly, including only few obligatory fields (date, observer, location, species, kind of datum) relative to species occurrences. Of these, the species field contains a predefined list of current recognised scientific names of mammals occurring in Italy, defined by a panel of the Italian Mammal Association experts. All data sent by observers are filtered by experts of each taxon, validated and then uploaded in the repository. All data can be freely accessed by users and are downloadable as well. Only registered users can send a record, and only administrators can modify, add information, and finally upload it into the repository. A regulation of data property and use has to be signed by registered users and administrators. Future development of the web repository are image, sound, and video uploading by registered users, application for smart phone and tablets for automatic recording of data in the field, data recording from published material and collections, and links to data stored in public and private institutions.

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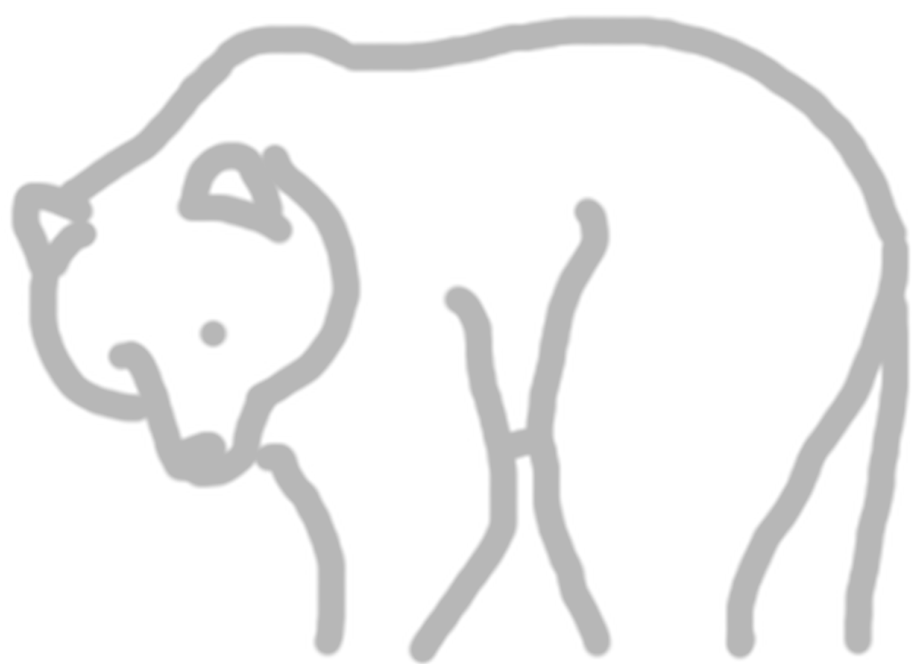
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La gestione venatoria e le strategie delle aree protette nella conservazione dei Mammiferi: punti di forza e criticità

La gestione faunistico-venatoria e le strategie di conservazione messe in atto nelle aree protette sono spesso concepite come attività indipendenti se non addirittura, quanto meno dall'opinione pubblica, in antitesi. Tali interventi dovrebbero, in realtà, avere obiettivi convergenti, dato che in entrambi i casi la finalità è condivisa, ossia la gestione sostenibile della fauna e la sua valorizzazione. Negli ultimi anni in entrambi i contesti si è assistito a una massiccia produzione di informazioni e ad un generale aumento delle conoscenze relative sia al numero ed alle caratteristiche degli animali gestiti (censimenti, prelievi, danni ecc.), sia alla loro caratterizzazione geografica e territoriale rispetto agli istituti faunistici o alla vocazionalità ambientale (con l'impiego routinario di Sistemi Informativi Territoriali). L'adeguata valorizzazione di queste informazioni, ai fini della conservazione dei Mammiferi, è stata spesso limitata dalla mancanza dei necessari collegamenti e sinergie tra le attività svolte nei territori a gestione programmata della caccia e quelli destinati alla protezione della fauna.

L'obiettivo della sessione è quello di raccogliere contributi da studi che hanno acquisito ed integrato le conoscenze su popolazioni di Mammiferi che insistono in differenti istituti faunistici (aree cacciabili ed aree protette) mettendo in luce le opportunità o le criticità, consentendo di effettuare una valutazione di nuove strategie di gestione integrata della fauna selvatica per la conservazione dei mammiferi all'interno e all'esterno delle aree protette, coniugando la conservazione della biodiversità e la tutela degli habitat, con l'uso sostenibile delle risorse faunistiche e con la convivenza tra fauna e attività agricole e pastorali.

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IX Congresso Italiano di Teriologia

Opening Lecture: Managing wildlife in a human dominated world or managing man into the wild? Experiences from the last remaining populations of wild mountain reindeer

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Opening Lecture

Norway is home to the last remaining population of wild mountain reindeer, *Rangifer t. tarandus*. The overall population is not threatened, as it counts ca. 40000 individuals and it is largely regulated through harvest. However, the development of infrastructures has been rapidly fragmenting the population, which is now divided into more than 20 isolated and largely no-longer migratory sub-populations confined within areas that do not necessarily provide optimal amounts of both summer and winter pastures. The consequences of the ongoing fragmentation process in terms of fitness and long-term viability are largely unpredictable, especially in view of further anthropogenic encroachment and climatic changes. Hence, a long-term management strategy for the species requires first understanding its requirements in terms of space use (i.e. habitat choices and movement patterns and before population fragmentation), their consequences in terms of fitness, and the development of mitigation measures and sustainable land management plans.

First, we used GPS locations of ca. 200 reindeer monitored for ca. 10 years to estimate the seasonal habitat preferences reindeer would exhibit if there were no barriers to movements, with the ultimate aim of assessing and comparing habitat quality among existing sub-ranges. Classical habitat suitability models built within each population would not allow such comparison, as they would only estimate populations' realized niches, i.e. their habitat use given availability within the area they are presently confined to. Hence, we developed a framework for modelling information from each population's realized niche to infer the species' environmental preferences unconstrained by accessibility. The estimates allowed comparing habitat quality among sub-areas, and understanding where would reindeer migrate should barriers to movements be removed. The estimated differences in habitat quality among sub-areas matched differences in population performance, as indicated by results of population models. Second, we aimed at estimating reindeer movements uncon-

strained by infrastructures and human disturbance. We focused on the locations of ca. 8000 remains of pitfall traps built up to 2000 years ago and used up to ca. 350 years ago, which testify the locations of areas where large amount of reindeer were channelled during migratory movements. The data suggest that the species was grouped in a couple of large, interconnected population units performing massive migrations between adjacent mountain systems from coastal to inland areas, largely corresponding to the areas identified by the models described above. The joint analysis of archaeological data together with present-day GPS locations of ca. 200 reindeer monitored for ca. 10 years showed that most ancient migration routes have now been abandoned, largely due to the development of roads, railways, recreational cabins and dams. The analyses estimated direct and indirect contributions of different types of infrastructures to blocking ancient migration routes, thus providing tools to be used to aid sustainable land management. These nation-wide analyses were supplemented with detailed analyses in focal areas using spatially-explicit hourly data on the amount of visitors using hiking trails to identify reindeer thresholds of tolerance to disturbance.

Finally, we used Step Selection Functions to create friction maps characterizing habitat traversability from a reindeer perspective. Randomized Shortest Path algorithms were applied to these cost-maps to identify present movement corridors between optimal seasonal habitats, and barriers hampering or impeding such movements.

The combination of habitat, space use and population analyses are bringing us a step closer to understand why, how and where to suggest mitigation measures to re-establish landscape connectivity. The challenge is now to develop (active) adaptive management strategies, together with stakeholders, to grant viable populations in the long term.

IX Congresso Italiano di Teriologia

Conservazione della lepre italiana: è possibile una sintesi tra gestione venatoria e protezione?

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G219

La conservazione della Lepre italiana costituisce un chiaro esempio di come la pianificazione di misure efficienti per garantire la sopravvivenza di specie a rischio possa essere il frutto di una mediazione tra l'attività venatoria e la protezione integrale delle popolazioni. Le difficoltà nella distinzione sul campo tra *L. corsicanus* e *L. europaeus*, infatti, rende necessario, nell'Italia centro-meridionale, un approccio focalizzato sul genere *Lepus* e la definizione di misure destinate tanto al territorio cacciabile (Ambiti territoriali di caccia, Aziende faunistico-venatorie, ecc.) quanto alle aree protette o comunque di divieto di caccia. Le ricerche effettuate sulla Lepre italiana da quando è stata riconosciuta come specie hanno confermato uno stato di conservazione differenziato a livello geografico, con popolazioni più vitali in Sicilia ed una situazione più a rischio e popolazioni frammentate nel resto dell'areale della specie. Uno dei principali fattori di minaccia è costituito dalla gestione venatoria della Lepre europea sia a causa dell'abbattimento volontario-involontario di esemplari di Lepre italiana, sia per l'impatto causato dai ripopolamenti con Lepre europea nell'areale di distribuzione della specie endemica. A parte la Sicilia, infatti, soltanto in poche aree isolate fisicamente (Tenuta Presidenziale di Castelporziano) o geograficamente (PN Gargano, PN Circeo) è possibile ritrovare solo *L. corsicanus*, nella maggioranza dei casi la specie vive in simpatria con *L. europaeus*. Inoltre, benché le principali popolazioni di Lepre italiana siano presenti nelle aree protette delle regioni centro meridionali, esistono nuclei per lo più isolati della specie anche in territori di caccia (ad esempio in provincia di Grosseto e nel Lazio settentrionale, in provincia dell'Aquila e in Molise); tali nuclei sono particolarmente importanti in quanto rappresentano possibili centri di collegamento ed espansione di una ideale rete ecologica della specie. La loro conservazione risulta quindi prioritaria per una sopravvivenza a lungo termine della specie. Tuttavia, la rigorosa protezione di queste popolazioni potrebbe non essere sufficiente, in quanto potrebbe essere osteggiata dal mondo venatorio e soprattutto provocare effetti controproducenti quali casi di bracconaggio di protesta e diminuzione di nuove segnalazioni di presenza. Di conseguenza, strategia ottimale

dovrebbe prevedere un coinvolgimento diretto di tutti i portatori d'interesse coinvolti direttamente o indirettamente nella gestione della specie e di prevedere una gestione venatoria differenziata a livello geografico locale. Un simile approccio è stato utilizzato dall'ISPRA in collaborazione della Regione Abruzzo, la Provincia de l'Aquila ed i Parchi Nazionali e Regionali dell'Abruzzo, per avviare un programma di gestione della Lepre europea finalizzato alla conservazione delle Lepre italiane. La prima fase del programma è stata dedicata ad incrementare le conoscenze sulla distribuzione della Lepre italiana, prendendo in considerazione le informazioni pregresse e raccogliendo direttamente dati sul campo utilizzando tecniche diverse (*spotlight census*, fototrappole, ecc.) nelle Aree protette e nel territorio cacciabile. Questa indagine preliminare ha permesso di incrementare la conoscenza sulla distribuzione della Lepre italiana e della Lepre europea, sulla base della quale sono state identificate aree di divieto di caccia alla lepre (coincidenti con le aree di presenza accertata di *L. corsicanus*), e aree di probabile presenza della specie, nelle quali non è permesso effettuare ripopolamenti con *L. europaeus* e nei quali è previsto l'esame di un campione di lepri abbattute per accertarne la specie. Inoltre, sono stati effettuati specifici corsi per il riconoscimento e la gestione della Lepre italiana indirizzati ai cacciatori. Queste attività hanno permesso di avviare una gestione sperimentale, nella quale i cacciatori sono stati direttamente coinvolti ed il cui passo successivo è costituito dalla creazione di distretti specifici, con cacciatori abilitati sulla base di corsi specifici. La ricerca nelle aree protette ha consentito di identificare le aree importanti per la Lepre italiana ed ha conseguentemente permesso di prevedere misure specifiche per la sua conservazione utilizzando i piani di gestione delle singole aree (SIC, ZPS, Aree protette, ecc.); l'obiettivo finale del progetto è quindi quello di identificare misure specifiche, anche temporanee, in grado di assicurare la sopravvivenza della Lepre italiana e di permettere un sostenibile prelievo della Lepre europea. Un simile modello potrà poi essere adottato in altre aree critiche presenti ad esempio in Molise, Lazio e Campania.

Does the insurance system enhance mitigation of predator-livestock conflicts? Experiences from the Province of Grosseto

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GI19

Within the LIFE MEDWOLF project (LIFE11/NAT/IT/069; 2012-2017) we analysed the functionality of the regional legislation (Law 26/2005) which introduced an insurance policy in order to obtain compensation for damage caused by predators. Based on the insurance registry, and limited to the Province of Grosseto, every year (2007-2012) an average (\pm SD) of 18.2 (\pm 4.4) holdings declared damages, 56.3 (\pm 27.5) depredation events were reported, and €28.395 (\pm 11.359) were paid in compensation. A mean of 60.3 (\pm 7.8) holdings were insured on a yearly basis, representing 5.51% of all sheep holdings in the Province of Grosseto in 2012 (n=1095). To assess extent and direction of predator-livestock conflict, and the effectiveness of management interventions, we analysed temporal trends in: depredation events, the number of insured holdings, and costs for compensation and damage prevention. These figures were contrasted to those relative to the 2000-2005 period, before

changes in the current regional legislation took place. Finally, to investigate whether official damage records are representative of the actual damages incurred, we compared depredations declared in 2012 to the insurance to those declared to the National Health System (ASL), the latter required by all livestock holders regardless of whether they were insured or not. Results suggest that functionality of the insurance policy is questionable: (a) very few holdings are insured; (b) despite the fact that depredations are annually increasing ($R^2=0.85$, $F=22.78$, $p=0.009$), the number of insured holdings has remained constant ($R^2=0.13$, $F=0.58$, $p=0.491$); (c) in 2012, the number of holdings that declared damages to the ASL were 177% higher than those that declared damages to the insurance (n=61 vs. n=22, respectively). The management implications of our study extend beyond the Province of Grosseto, and it allows a quantitative evaluation of current-conflict resolution management strategies.

Resource selection and connectivity of recovering brown bears in the Brenta Dolomites

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GI18

Reintroductions are often difficult and can result in increased dispersal and mortality of released animals, especially in fragmented landscapes. Connecting habitat patches that support occupancy is key to ensuring long-term population recovery for umbrella species such as brown bears (*Ursus arctos*). In 1999 the reintroduction project "Life Ursus" was initiated and 10 brown bears were translocated from Slovenia to the Eastern Italian Alps (Adamello-Brenta) where the bear population was considered extirpated by the end of the 20th century. Here, we describe the habitat selection and space use patterns of reintroduced brown bears in Trentino, Italy, with the ultimate goal of identifying corridors between preferred habitat patches. We built annual resource selection functions (RSF) using generalized linear mixed-effects models with data from 6 bears fitted with GPS collars between 2006 and 2012 at the landscape and home-range scales. Then, integrating habitat selection, movement and landscape features we employed least cost path (LCP) analyses to empirically define regional movement corridors. Finally, we used Kappa-statistics to compare the realized habitat selection at the landscape scale with a habitat suitability model (HSM) developed to predict potential habitat prior to reintroduction.

At the landscape scale bears selected home-ranges at intermediate elevations in steep terrain. Habitat selection inversely correlated with road occurrence and human use landcover types, i.e. settlements, pastures and agricultural lands. Bears selected landcover types that provide forage, such as shrublands, deciduous forests, but also orchards. Within their home-ranges bears

also avoided landcover types related to human use (especially bike trails, settlements and pastures). K-fold cross-validation indicated a high predictive capacity of our RSFs. We identified road crossings of movement corridors between preferred habitat patches throughout the study area; with higher densities in the south. The comparison between the predictive pre-reintroduction HSM and the realized habitat selection showed fair agreement with highest agreement in rocks/ice, agricultural lands and water. Spatial discrepancies resulted from the HSM predicting lower suitability in orchards, deciduous forest and wetlands and higher suitability in conifer and mixed forests than the RSF.

The combined process-based approach of the RSF and LCP analyses aids to identify both potential habitat for brown bear settlement and corridors that will allow for settlement in the future. This approach also provides information on the biggest constraints to bear movements, such as the barrier created by the Adige valley. But, we suggest verifying and monitoring the use of movement corridors with e.g. camera traps or DNA monitoring. Our RSF allows identifying areas where current and future brown bear habitat selection may occur and thus, can aid to reveal potential conflict areas. Increasing awareness for key brown bear habitats and corridors and raising local acceptance of this species, especially in the interface between human dominated landscapes and wilderness areas, is necessary for brown bear conservation.

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Long-distance, long-term movements of Apennine brown bear outside its core area

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G179

The Apennine brown bear (*Ursus arctos marsicanus*) is an endemic subspecies of brown bear living in a small area of central Apennines, Italy. It is threatened by human-induced mortality, small population size, small geographic range and low genetic diversity. One key point for its survival is its geographic and demographic expansion. The goal of our work was to shed light on the presence of Apennine brown bear outside its core area. We surveyed the western sector of the peripheral range (Lazio region) from 2005 to 2013 using occasional sample collections in the first three years, and a large-scale opportunistic sampling design in the following years. We also collected non-invasive genetic samples for individual genotyping (11 STR and 1 sex-specific marker). Overall we collected 322 bear signs; 115 samples were used for genetic analysis. We identified six male genotypes; four of them (65M, 76M, 86M, 89M) were never found elsewhere neither before nor after our sampling; 65M was sampled in four different years roaming always in the same zone of the study area, 86M in two years in two zones, 76M in two years in a single zone, while 89M was sampled in only one year; genotype 70M, sampled in 2010, was repeatedly found from 2006 to 2010 in the northernmost sector of the peripheral range and in 2012 in the eastern sector; genotype 72M was found in our

area in 2006, then it was repeatedly found in the core area from 2008 to 2013. 65M and 70M died in 2008 and 2012 respectively from natural causes, 86M died in 2013 because of a car accident. Up to now, reproductive events have never been reliably ascertained outside the core area, so we can argue that all the sampled individuals, at a given moment of their life, moved away from the core area towards north-west over long distances (from at least 40 up to 130 km), and roamed in the peripheral range; two individuals also moved back southwards. Such long-distance, long-term movements have never been reported before for Apennine brown bear. Even if the sampled individuals were only six, their presence demonstrates a high connectivity between the core area and some hotspots of the peripheral range, and a high suitability of such hotspots; however, deaths indicate that mortality sinks can exist, for instance related to uncontrolled cattle diseases or to road kills. In addition, our results demonstrate that dispersal is strongly male-biased. Mortality sinks and male-biased dispersal, together with other large-scale threats (wild boar hunting, uncontrolled cattle diseases and others), should be taken into account in management policies to create optimal conditions for bear range expansion.

Verso una strategia di gestione integrata delle popolazioni di cervo tra aree protette e aree cacciabili: le criticità superano i punti di forza?

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GI188

Il cervo (*Cervus elaphus*) del Parco Nazionale dello Stelvio ha mostrato negli ultimi decenni un notevole incremento distributivo e di abbondanza, che ha portato le popolazioni a raggiungere valori di densità tra i più alti per l'arco alpino e ad esercitare impatti significativi sulle attività umane e sugli ecosistemi. Nell'area protetta e nelle zone limitrofe sono attualmente presenti oltre 10000 cervi che, nelle zone di massima concentrazione invernale raggiungono valori di densità superiori ai 30 capi per km². Soprattutto in tali aree l'impatto sulla rinnovazione forestale e sulle componenti arbustive del sottobosco è significativo ed ha effetti sulla conservazione degli habitat e, a cascata, sulla biodiversità (ad esempio, i galliformi). Inoltre, si innescano interazioni competitive con altre specie di ungulati quali il capriolo e il camoscio. Le popolazioni di cervo del Parco fluttuano attorno ad elevati valori di consistenza, con oscillazioni più o meno ampie a seconda degli andamenti invernali. Gli effetti sono evidenti, oltre che sulle altre componenti degli ecosistemi, sulla condizione delle popolazioni e sull'andamento dei parametri demografici. Per questo sono stati attivati all'interno dell'area protetta piani di controllo numerico con l'obiettivo di ridurre gli impatti verificati, anche attraverso la riduzione della densità delle popolazioni. Nel caso del cervo, in relazione alle sue esigenze spaziali ed al suo comportamento opportunistico e caratterizzato da migrazioni stagionali, spesso non è opportuno mettere in atto strategie di conservazione e gestione nelle aree protette, concepite come attività indipendenti rispetto alle aree esterne in cui, di norma, è ammessa l'attività venatoria.

Tali azioni gestionali sono state effettuate nell'ambito di specifici Piani di gestione e conservazione, in cui sono stati raccolti ed analizzati i dati relativi allo status delle popolazioni di cervo e agli impatti arrecati agli ecosistemi. Attraverso una valutazione della distribuzione stagionale delle popolazioni e la cattura e marcatura di oltre 200 soggetti, è stato possibile verificare la totale continuità dei territori interni ed esterni all'area protetta per le esigenze ecologiche del cervo. La situazione non è omogenea in tutto il vasto territorio, né è semplicemente possibile considerare i cervi dello Stelvio come un'unica popolazione, infatti il Parco si estende su 1341 km², comprende aree diverse dal punto di vista amministrativo ed è attraversato da creste montuose che di fatto tendono a separare nuclei demograficamente unitari (unità di popolazione). Il territorio dell'area protetta, con le corrispondenti aree limitrofe, è stato perciò suddiviso in sette Unità di gestione (UG; estensione media: 45500 ha, deviazione

standard: 23070 ha). Per quattro di tali UG sono stati predisposti specifici piani di controllo numerico con finalità riduttive.

La necessità di definizione di un'unica strategia integrata che preveda lo stretto coordinamento tra quanto realizzato all'interno e all'esterno del Parco non è motivata solo dall'individuazione di popolazioni che si muovono a cavallo di differenti istituti faunistici, ma anche dal fatto che le modalità di gestione adottate all'esterno spesso influenzano in modo significativo il comportamento spaziale del cervo che si concentra all'interno del Parco, dove gode di maggior tranquillità. La strategia di gestione integrata, applicata in tre delle sette UG, ha previsto, attraverso la condivisione di protocolli di intesa tra Enti, il totale coordinamento delle azioni di prelievo da realizzarsi all'interno e all'esterno dell'area protetta per il raggiungimento dei seguenti obiettivi: 1) riduzione degli impatti sugli ecosistemi all'interno del Parco, attraverso una riduzione della densità delle popolazioni di cervo; 2) aumento delle densità di popolazione all'esterno, attraverso una riduzione dei piani di abbattimento; 3) distribuzione delle popolazioni tra area protetta ed area cacciabile più omogenea, attraverso l'istituzione in quest'ultima di varie aree di rispetto di estensione limitata entro cui sospendere l'attività venatoria. L'esperienza tuttora in corso nell'UG lombarda dell'alta Valtellina (SO), in cui nel 2011 e 2012 sono stati avviati i prelievi di controllo, sta mettendo in luce numerosi punti di criticità legati alla definizione dei ruoli degli Enti coinvolti ed al processo decisionale partecipato intrapreso. In una delle UG del settore sudtirolese (Martello - Media Val Venosta), in cui sussiste il maggiore impatto alla rinnovazione forestale, è stato effettuato un prelievo medio annuo di 305 cervi (min 255, max 380), tra il 2000 e il 2012, che ha portato ad una riduzione del 37% delle densità, a fronte di un obiettivo del 50%. Alla progressiva riduzione della popolazione di cervo non è corrisposta una parallela diminuzione dell'entità della brucatura della rinnovazione forestale, rendendo pertanto necessaria una revisione critica degli obiettivi e delle modalità di raggiungimento degli stessi.

Saranno infine discussi i punti critici emersi dall'attuazione delle azioni gestionali descritte, le nuove proposte per raggiungere una efficace strategia integrata tra aree protette e cacciabili (e.g., attuazione della cosiddetta "hunting for fear") e le prospettive future legate ai cambiamenti che stanno avvenendo nella composizione delle biocenosi delle Alpi centrali (e.g., arrivo dei grandi predatori).

Echo-pathological aspects of coypu *Myocastor coypus* and possibility also in Italy of allocating its meat for human consumption

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GI13

In our country in general the health aspects of coypu *Myocastor coypus* are evoked as threats for public interests and suggest disturbing scenarios negatively affecting also the management approach of this alloctonous species; but the reality could be different.

About the echo-pathological aspects the state of published knowledge is mostly based on a broad survey on causes of death carried out in Argentina, where the species is native and common, integrated with results of a health monitoring plan carried out on animals caught in Modena and comparing the outcomes with those of similar surveys carried out in Louisiana, France and furthermore in other Italian areas. This overview, for convenience, is taking into account endo- and ecto-parasites, bacteria and viruses, focusing on major aspects of the various investigations carried out on coypu freely living in wild, and integrating them with those of experimental researches carried out by authors from different countries, both in the areas of origin and those of naturalization and farming. The species is receptive to certain infections transmissible to humans and/or cattle, but this needs to verify the practical importance of diagnostic and epidemiological results, in general situations outside of south America and in particular in the Italian situation. The condition of the reservoir was in fact perfectly demonstrated for communicable diseases such as fascioliasis (France) while in other cases (leptospirosis) such status has been recently proposed (France); of course in Italy these aspects are to prove or considered of minor importance or however, not easily assessable and this leads the attention for this species to a situation of normality, as for any other wildlife. However, this invasive species is relatively recent in our country and this suggests keeping monitored the adaptation process from echo-pathological point of view, as populations may develop more interaction with the local fauna and ecosystems.

Control plans in Italy produce large amounts of carcasses often disposed of with significant costs; regrettably it is generally

overlooked that the depletion of coypu populations in not few areas of the subcontinent of origin and the initial success of its breeding in Europe was initially due not only to the production of fur, but also to the intense use of its meats. Actually, in recent decades, the duplicity of interest has been greatly diminished, not everywhere, almost to cease altogether to be limited to only fur; moreover, due to the sharp depreciation of skins, the interest for breeding vanished and caused the abandonment in the wild of the rodents in many countries, Italy including, where in last decades the species is spread in many regions. In some countries the interest in the use of the meat remains commonly high (Argentina) or is recently promoted (Louisiana), while in others this rodent is used in rural area as both fresh meat and preserves (Germany, France). After World War II, even in Italy, the species has been locally the subject of rural micro-projects based on meat and fur but quickly the production resulted limited to fur. This has left few traces in the requirements for inspections on slaughter activities and meat processing which anyway since 2004 have been replaced by more robust European Regulations. Actually Reg. 853/2004/CE treats rodents freely living in the wild susceptible to be considered <small wild game> hunted for human consumption. From this approach also in Italy the coypu harvested as part of culling plans would be destined for human consumption through an approved game-handling establishment. This possibility to consider coypu also as a resource should not be ignored, avoiding to maintain prospects *a priori* limited to production of large amount of carcasses to be disposed of with high costs. On the other hand reduction plans producing coypu for meat would require only modest measures in order to rationalize the collection of the carcasses according to the criteria applied to small wild game whose costs would be covered by revenues. These measures may qualify control plans and their operators, would drive game meat of excellent features to the market of ethnic food and culinary curiosity and ultimately may help to consider the coypu in a more technical way.

Workshop - Adattamenti, evoluzione e dispersione nell'Italia dell'era glaciale

Le oscillazioni climatiche che hanno caratterizzato il Pleistocene e, in particolare, gli ultimi 500000 anni, hanno avuto notevoli ripercussioni sulle dinamiche e sull'evoluzione delle faune nel contesto degli ecosistemi terrestri della penisola italiana. Inoltre, la particolare fisiografia del territorio che oggi chiamiamo Italia, ha accentuato fenomeni di endemizzazione e isolamento, contribuendo a costituire l'attuale assetto faunistico con peculiari specificità, anche nel contesto teriologico. Ad esempio i fossili più antichi ritrovati in territorio italiano rivestono una importanza cruciale per comprendere gli eventi di dispersione e i fenomeni che hanno portato all'attuale distribuzione delle specie e alla composizione stessa delle associazioni. Obiettivo del *workshop* è quello di presentare lavori teriologici che propongano analisi di dati faunistici e paleoambientali, con la finalità di mettere in luce le possibili sinergie delle ricerche in ambito teriologico svolte nel periodo pleistocenico, in particolare su specie ancora esistenti per le quali sia quindi possibile effettuare analisi comparate.

Coordinatori

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IX Congresso Italiano di Teriologia

The Late Pleistocene occurrence of the Alpine ibex in Italian peninsula

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W002

This work focuses on the Alpine ibex (*Capra ibex*) occurrence in Italian peninsula during the Late Pleistocene. Nowadays this species inhabits open, rocky habitats at high altitude, above the tree line. In the Late Pleistocene some colder and drier periods and the diffusion of steppes and grassland habitats is indicated by the presence of this ungulate, as well as the chamois and marmot, at low altitude (e.g. Grotta Polesini 40 m a.s.l.). Its occurrence is documented in Italian peninsula in several sites, also in central and southern Italy. The diffusion of mammals with "cold" affinities (e.g. the occurrence of the modern wolf, the lynx and the ibex) indicates the beginning of the Aurelian Mammal Age in the Italian biochronological framework. The

ibex is known in Italy since MIS 6 (around 140 ky BP) as recorded at Poggio cave and Grotta Grande - Sector C of Scario (Salerno), the outer levels of Paglicci cave (Foggia) and San Bernardino cave (Vicenza) and the R and S layers of Broion cave (Vicenza). The Alpine ibex, together with red deer, was a dominant species in the large mammal assemblages. Here we present a review of the Italian Late Pleistocene sites where ibex remains have been found. Palaeoecological reconstructions are presented and discussed with a particular attention of the role of the human activity as hunting and butchering strategies, carcass transport and site function.

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The wolf in Italy: a palaeontological perspective

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W004

Palaeontology can provide an important contribution to our knowledge of the species that still live in Italy from the Pleistocene on, providing a historical perspective. The natural history of a species allows us to understand the differences between the living ones. The wolf *Canis lupus* is still living in our territory from a long time.

The modern wolf has originated from the small Middle Pleistocene canid *Canis mosbachensis*. The most ancient remains of wolves are from Beringia and the first findings in Europe are from the Lunel-Viel Cave in France (400-350 ky). The first occurrence in Italy is from Polledrara di Cecanibbio, near Rome, (340-320 ky) and, from the biochronological point of view, it is very important because it marks the beginning of the Aurelian Mammal Age.

The climatic fluctuations have influenced the geographical distribution pattern of numerous taxa as well as the alternation of different morphotypes of wolves. The wolves that lived in glacial periods have significantly bigger body size and are more massive than the ones from interglacials. A dimensional cline

due to latitude, according to Bergman's rule, is also observed. Despite their importance the Italian Pleistocene wolves have never been studied before in their whole. The aim of this work is to show the variability of Italian wolves during Pleistocene in comparison with variability of the modern relatives. The morphological features are due to multiple dispersal events and local adaptations. In particular the case of the wolf from Romanelli Cave (Lecce) are reported here. The remains of *Canis* come from the level G of "terre rosse". The underlying stalagmite H was dated by $^{230}\text{Th}/^{238}\text{U}$ to < 69000 years, and the overlying stalagmite F to 40000 ± 3250 years by the same method. The wolf from Grotta Romanelli presents some anatomical characters like the reduction of tympanic bulla or the protrusion of the roots of the last upper molar from the maxillary bone. This features are considered as a probe of a body size reduction in a fast time. The compared study of morphological variation allow us to understand which characters are due to allometric variation during ontogenetic development.

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The Eurasian canid *Cuon alpinus* from the Late Pleistocene of Italy

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W003

Since the late Middle Pleistocene many large mammals spread into Western Europe from Asia. Among them carnivores as lynx and grey wolf became quite common in the Late Pleistocene faunal assemblages and are still part of the European faunas. Other species, such as *Cuon alpinus*, became extinct at the beginning of Holocene, when most of the Megafauna disappeared. The dhole *Cuon alpinus* (Pallas, 1811) is a medium-size social canid (body weight 15-17 kg for males, 10-13 kg in females), with teeth features typical of hypercarnivorous canids, such as the African wild dog *Lycaon pictus*. Dholes are hunters, socially organized in packs of five-ten individuals, pursuing the preys also for long distances. Prey target is represented by large and medium-large mammals like deer, wild pigs, mountain sheep, gaurs and antelopes. Nowadays the distribution of *Cuon* includes some areas of south-east Asia (India, Malaysia, Sumatra and Java), but the historical range included the whole China, Mon-

golia and part of Eastern Russia. During the Late Pleistocene the distribution reached the whole Eurasia and North America. From late Middle Pleistocene to earliest Holocene faunal assemblages of Italy *Cuon alpinus* has been recorded and it is documented by teeth, jaw portions and incomplete post-cranial remains; its fossil record is very restricted compared to other canids, such as the Mosbach wolf or the grey wolf. On the basis of the faunal assemblages studied, niche overlap for the dhole and other canids was apparently high, since they were competing for the same medium-size ungulate prey, such as cervids, wild boar, and wild goats and sheep.

The morphological and morphometrical analyses on the Pleistocene dholes from Italy highlight a certain degree of variability, although a number of diagnostic features have been identified, supporting an attribution for all the specimens studied to the species *Cuon alpinus*.

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Il felino di Ingarano (Pleistocene Superiore, Puglia) e l'origine del gatto selvatico (*Felis silvestris*) nella penisola italiana

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W001

Nella penisola italiana i resti fossili del gatto selvatico (*Felis silvestris*) risalenti al Pleistocene Superiore sono rari e per lo più rappresentati da denti e frammenti dello scheletro postcraniale. Tale condizione rende difficile ricostruire i tempi e i modi della comparsa e della diffusione di questo felino in Italia nel corso del Pleistocene Superiore e i rapporti filitici tra le forme attuali. I dati della biologia molecolare indicano che la specie attuale sia originata circa 50 mila anni fa (Yamaguchi et al., 2004). I resti fossili di un gatto selvatico provenienti dal sito del Pleistocene Superiore di Ingarano (Puglia), da depositi datati circa 40000 ± 2000 anni con il metodo $^{39}\text{TH}/^{234}\text{U}$ (Bedetti e Pavia, 2007), sono stati analizzati e studiati, oltre che con le consuete metodologie biometriche, mediante l'utilizzo di immagini tomografiche e ricostruzioni 3D. Il materiale fossile si presenta in ottime condizioni di conservazione ed è costituito da un cranio intero completo di mandibola (ING 2000/17), privo solo dell'arcata zigomatica sinistra e dei canini e degli

incisivi superiori. Al momento è il cranio fossile più completo e meglio conservato di gatto selvatico, per il Pleistocene Superiore dell'Italia. Il fossile è stato sottoposto a sezioni virtuali di immagini derivate da TAC ed elaborate con software dedicati che hanno permesso la realizzazione di *endocast* dell'encefalo e dei seni frontali che forniscono ulteriori elementi di analisi. Il confronto del felide fossile con specie attuali come *Felis chaus*, *Felis silvestris* e *Felis lybica* mette in evidenza un set di caratteri peculiari che contraddistinguono il felino di Ingarano che potrebbe rappresentare una forma ancestrale di gatto selvatico europeo.

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Nuove evidenze paleontologiche sulla storia evolutiva delle lontre nel bacino del Mediterraneo

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W005

La sottofamiglia Lutrinae (Carnivora, Mustelidae) è oggi rappresentata da sei generi e tredici/quattordici specie acquatiche o semiacquatiche. Le lontre sono però estremamente rare nel record fossile, soprattutto se paragonate ad altri gruppi di carnivori. Il più antico rappresentante della sottofamiglia noto a oggi è *Mionictis*, dal Miocene inferiore della Francia, mentre il genere *Lutra* sembra comparire nel Miocene terminale con la specie *Lutra affinis*.

Le lontre del Pleistocene Inferiore sono praticamente sconosciute in Europa. Gli unici due taxa riportati in letteratura sono *L. bravardi* dal sito francese di Étouaires (il cui olotipo è andato probabilmente perduto) e *L. sinerizi* da Villarroya, Spagna (rappresentato da un'unica mandibola incompleta). Dopo un lungo periodo di apparente "assenza" dalla documentazione paleontologica, le lontre "riappaiono" alla fine del Pleistocene Superiore e nel Pleistocene Medio con la specie *L. simplicidens*. Questo taxon si ritiene ancestrale a una lunga serie di specie insulari endemiche del Bacino del Mediterraneo. Al contrario, la lontra eurasiatica attuale, *L. lutra*, sembrerebbe di origine asiatica. La recente scoperta di un cranio completo dal sito di Pantalla

(Umbria) e la "riscoperta" di una mandibola proveniente dal Bacino del Valdarno Superiore (Toscana) permettono di colmare, almeno in parte, la lacuna di conoscenze sulle lontre pleistoceniche europee.

Il reperto toscano, riferito alle Unità Faunistiche Olivola-Tasso (circa 1.9-1.8 Ma), rappresenta la più antica testimonianza di *L. simplicidens* e rafforza l'ipotesi di un'origine africana del taxon, date le forti affinità con *L. fatimazohrae* dal Marocco, risalente al limite Plio-Pleistocene.

La lontra fossile di Pantalla è rappresentata dall'unico cranio completo di un Lutrinae del Pleistocene Inferiore in Europa. L'età è paragonabile al reperto del Valdarno. Benché l'anatomia craniale di *L. simplicidens* sia a tutt'oggi sconosciuta, possiamo escludere l'attribuzione del reperto umbro a questa specie, date le maggiori dimensioni e alcune caratteristiche della dentatura. Il complesso quadro della storia evolutiva delle lontre nel Bacino del Mediterraneo è arricchito da un terzo fossile italiano ancora inedito: una mandibola pressoché completa dal Pleistocene Medio di Calorie (Bacino del Mercure, Basilicata), riferita a una specie di grossa taglia ancora indeterminata.

Fossil records and species distribution models: providing more than a single snapshot in time

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W006

Species distribution models (SDMs) based on current species ranges often underestimate the potential distribution when projected in time and/or space. This can have important consequences in global change biology, and particularly for predicting the effects of future climate change on biodiversity. A multitemporal model calibration approach has been suggested as an alternative, but the applications based on this approach are limited to a handful. Using the alpine marmot (*Marmota marmota*) as an example, we explored the importance for SDMs to include fossil data as well as the current species distribution. We considered for our analyses the entire Italian peninsula, and we obtained data on the current presence of the species from the CK-Map database. Data from fossil records (location and date) were obtained through a literature review. We obtained current climate from the Worldclim database, while climate for the past (time frames corresponding to the dates in the fossil records) was obtained from published data. Using the algorithm in MaxEnt, we calibrated an SDM based on the current species presence (current-only SDM) that was then projected onto current and past climate. In this way we obtained a picture of the potential distribution of the alpine marmot in different time frames.

All SDMs were evaluated using a quasi-independent dataset (obtained through a split-plot approach repeated 100 times for each model), and the current-only SDM projected in the past was compared with fossil records. We also calibrated an SDM based on current data and fossil record (total SDM), which was evaluated using the same approach as the current-only SDM. The two modeling approaches provided strikingly different results, both in terms of predicted species distribution and in terms of evaluation statistics. In particular, the current-only SDM when projected in the past predicted an extremely limited presence of the species in the Italian peninsula, in complete contrast with the total SDM according to which the species was potentially present also in the lowlands (e.g. the Po plain) and basically in the entire Italian peninsula, especially considering the last glacial maximum. Our results can potentially have important implications for projecting the species distribution into future climate and for conservation planning. Calibrating SDMs as an ensemble through time represents clearly a way forward to a better understanding of a species' range and its ecology in a changing climate.

Dal locale al globale: fattori di cambiamento delle comunità di Mammiferi

Le comunità animali evolvono nel tempo per adattarsi ai cambiamenti ambientali, siano essi naturali (es. dinamiche di successione vegetazionali, cambiamenti climatici) oppure di origine antropica (es. riduzione ambienti naturali, introduzione di specie aliene). In questo contesto una maggiore conoscenza dei fenomeni di base che influenzano le biocenosi e la loro variabilità assume importanza nella gestione e conservazione delle specie autoctone. In particolare, recenti studi sulla biodiversità dei Mammiferi hanno messo in evidenza come la ricchezza della fauna italiana ed europea sia maggiore di quanto pensato finora, rendendo quindi necessario affrontare alcune criticità conservazionistiche, legate ad esempio alla rigidità della legislazione ed alla necessità di processi decisionali flessibili. La sessione quindi si propone di presentare lavori inerenti lo studio dei cambiamenti delle comunità teriologiche dovuti all'evoluzione naturale o all'influenza, diretta o indiretta, dell'uomo.

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Opening Lecture: Mammalian community dynamics in the anthropocene: the overriding dominance of humans across scales and the globe

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Opening Lecture

Humans now commandeer most of the global net primary productivity, and in the era of climate change, our impacts permeate all aspects of the natural world. Traditional conservation paradigms such as wilderness management, ecosystem management, restoration ecology and ecological integrity have been useful for applied conservation in the 20th century. But how useful will these equilibrium-based conservation paradigms be in the 21st century in the face of emerging no-analogue communities, continuing human-caused global change, and responses to climate change? Starting with the case study in Banff National Park, Canada, I illustrate the application of ecosystem management to mammalian community dynamics focusing. Following extirpation through poisoning programs in the 1950's, gray wolves recolonized in the 1980's, and their ecosystem impacts manifested through "classic" trophic cascades to elk, beavers, songbirds, aspen and willow. This seems like a "text-book" example of ecological restoration that has often become an international conservation objective. But closer examination reveals that human activity confounds the simple interpretation of wolf-caused trophic cascades. Human activity excluded wolves, disrupted predator-prey dynamics, provided supplemental food, excluded fire and human hunting, and was limited by the inadequate size of even the largest National parks. As a result, gray wolves even caused extirpation of native species. Thus the "wilderness model" of ecosystem management failed to capture the necessarily large and long-term scales of variation. Moreover, in

the era of climate change, new mammalian species are recolonizing Banff National Park, further altering mammalian community dynamics. Expanding beyond national parks across western North America, we see continued failure of the wilderness-based trophic cascade model to explain ecosystem function as 90% of landscapes are dominated by human agricultural activities. Nowhere are the long-term, and non-equilibrium, effects of humans on ecosystems more apparent than in Europe. With 5000 years of history of agrarian societies dominating mammalian communities, it is surprising to find the "wilderness" model for wildlife conservation so alive and well in Europe. Movement's like rewilding will surely flounder, for the same reasons as in North America, by failing to explicitly consider the effects of humans on ecosystems. With the ecological concepts of equilibrium upon which most conservation paradigms rested in the 20th century surely "dead", what then should be the goal of 21st century conservation of mammal communities? Reviewing the basic premises of the Neutral Theory of Biodiversity, mammalian ecologists must recognize non-analogue communities as the new "norm", and be wary of efforts to restore Eden. Instead, we must firmly understand the effects of human activities, past, present and future, on mammal communities, anticipate changing species distributions and biotic interactions, and use ecological theory including humans to develop a relevant conservation vision under global change in the 21st century.

Alpine landscape in the last 40 years: description of changes and influence on population dynamics of roe and red deer

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C088

Over the past few decades, the alpine landscape has undergone profound changes experiencing in many areas an increment of woods. These replaced open areas, decreasing their surface and reducing border areas (i.e., ecotones).

To better understand these dynamics and their influence on biological communities, we promoted a study in a 1309 km² area, including Adamello Brenta Nature Park and a surrounding area of 5 km radius (Trento Province, Central-Eastern Alps, Italy).

We collected data about land use in 7 sample sites (tot. 63 km²; i.e., 5% of the entire study area, representing different elevation ranges, aspects, and human presence) in order to i) quantify the environmental changes that occurred over the past 40 years through the use of GIS (photo-interpretation techniques – 1:2000 m digitalization scale); ii) correlate these data with the status, distribution and population dynamics of roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*); iii) provide indications of possible addresses to be adopted as part of improvements for wildlife.

Through the analysis of orthophotomaps of three different years (1973, 1994, and 2011; pixel = 1 m) we determined land use allocation of the sample area (7 land use class were used: urban area, agriculture zone, woodland, shrubland, open areas below the tree line, meadows, and scree slope).

Changes in percentages of different land use classes, spatial analysis of landscape patches and modelling of attributes associated with patches were made by means of Patch Analyst Tool for ArcGis 9.3.

Moreover, through the use of ImageJ software 1.6.0 we evaluated the tree density (i.e., the percentage of land occupied by the orthogonal projection of the tree crown) in 20 squares of 300 m randomly selected within woodland class. In this analysis, each

pixel was classified as “tree/no tree” both with Thresholding method and using the plugin Color Segmentation (Algorithm: Hidden Markov Model).

Revealed environmental changes were correlated to the status, distribution and population dynamics of roe and red deer.

We recorded an increase of 7.59% for woodland and of 2.41% for shrubland, while the 4.24% of open areas and meadows disappeared in the last 40 years. The percentage of tree cover area was 50.07% in 1973 and 57.83% in 2011 (i.e., a reduction of distance among tree crowns and/or an increase of trees density).

In general, at landscape level, over the past 40 years we recorded a decrease in Number of Patches (from 960 to 602), Total Edge (from 1027.883 to 703.000 m), Mean Shape Index (from 1.59 to 1.49), and Mean Patch Fractal Dimension (from 1.40 to 1.37). Moreover, Shannon’s Diversity Index (from 1.39 to 1.25) and Shannon’s Evenness Index (from 0.69 to 0.60) revealed a decrease in the level of landscape diversity and also a decrease in heterogeneity of habitat distribution.

The distributions and population dynamics (evaluated by means of hunting records and drive censuses over the 40 last years) of roe and red deer showed trends in correlations with revealed environmental changes, following the preferences reported in literature for the different species. In particular, the environmental changes seem to be in favour of species such as red deer, while they seem to restrict roe deer. Monitoring environmental changes should be considered a milestone in wildlife conservation. Understanding the processes at work and their consequences on the different species can allow to put into practice appropriate management and conservation strategies for species and habitats even through environmental improvements.

Alien mammals in Italy: pathways, impacts and general patterns

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C151

Non-native mammals cause major impacts on biodiversity as well as on the human livelihood, and in general the proportion of species that become invasive is much higher for mammals compared to other taxonomic groups. In order to provide an updated picture of mammal invasions in Italy we compiled information on species introductions to Italy or translocations from mainland to Sicily and Sardinia that have occurred from the Neolithic to recent times. We do not considered subspecies and feral species, except for *Mustela putorius* “furo”. It must be stressed that mammals are indeed a particularly good case study to reconstruct historic patterns of invasions, because they are more visible than most other animals, and give rise to fossils that enable us to understand the time of presence even for very far past. For all cases of mammals’ introductions, data on introductions, known extinctions, pathways of introduction and impacts have been collected. The dataset permitted to assess the trends of alien mammals’ establishment in the region.

We collected information on 40 species: 31 species are considered naturalized, 5 species are still present but are not naturalized yet, and 4 species went extinct. Considering the 36 species that are still present, 19 are introduced to Italy from other countries, 15 are autochthonous in mainland but were introduced

to Sicily or Sardinia and 2 are cryptogenic species. These 36 species are 12 Rodentia, 9 Carnivora, 8 Artiodactyla, 4 Lagomorpha, 2 Soricomopha and 1 Erinaceomorpha. Information on the date or period of introduction is available for 39 species: 14 were introduced from the Neolithic (6000 BC) to the year 0, 6 species from year 0 to 1500 AC, 2 in the XVI century, 13 in the last century and 4 in this first part of the 2000s. The rate of species introduction (number of species introduced in a period/number of years \times 100) increased from 0.1-0.7 in the Neolithic to 10-40 in the last six decades years (1950-2010), with an exponential growth ($R^2=0.88$, $F=140.1$, $P<0.001$).

Aim of the study is also to contribute to the implementation of a national database on alien species in Italy, that ISPRA is developing under a request from the Italian Ministry of Environment. This inventory will provide the basis to understand how species enter to Italy, assess the ecological and economic risks involved with these introductions and prepare a framework for early warning. The establishment of national inventories of alien species will also be required for the enforcement of the upcoming EU Regulation on invasive species, and allow a prioritization of action, as requested by the community and global policies on invasive species.

Removing alien species to preserve native communities: an evaluation of the EC-SQUARE LIFE project results on squirrel management

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In 2010, a EU-funded LIFE+ project (LIFE09 NAT/IT/095 EC-SQUARE), with the general objective to conserve native red squirrels and forestry ecosystem functionalities, started developing methods to remove grey squirrels (*Sciurus carolinensis*) and red bellied squirrels (*Callosciurus erythraeus*) in different socio-ecological contexts. This will be integrated with societal assessments to investigate and shape public perceptions of the general problem posed by alien species, and in particular in the case of charismatic species such as alien tree squirrels. Developing and carrying out specific control methods linked to local public perception of the alien species will allow us to test the efficacy of innovative methods under different local contexts and to introduce new strategies to manage alien species which will be made available to policy makers at different administrative levels.

With the first actions, we gathered detailed data on distribution range and population size of the two squirrel species in all known presence sites. This was achieved by hair-tube surveys, direct observations and trapping in sample areas.

The monitoring has led to the identification of a greater number of nuclei of grey squirrels in Lombardy and a larger area invaded by the species in Piedmont, whereas in Liguria most of the introduced grey squirrel population appears still confined in the Genoa Nervi urban park and in the adjacent private gardens, but with some presences in the countryside out of the built-up area at the risk of spreading in the Apennine woods. General Management Plans (GMPs) were developed at a Regional basis, which, as a first step, defined a series of indicators of both population status and socio-economical background, as well as different management practices, ranging from total eradication to control and/or containment. The GMPs allows us to evaluate, on a per-site basis, the actual population status, taking into account both grey squirrel population dynamics and site landscape characteristics, as well as a characterisation of social drivers and pressures. All GMPs foresee capturing squirrel with Tomahawk live-traps. In Lombardy and Piedmont squirrels are immediately euthanised by CO₂ inhalation, following AVMA guidelines and European Directives, with authorization of local authorities. In

Liguria, because of high public appeal of grey squirrel at Genoa Nervi Park and surroundings, the GMP supported eradication by live-trapping grey squirrels, with subsequent sterilization and release of the animals in other urban parks. Animals were also sampled for scientific research (studies of micro- and macro-parasites, fertility parameters, detailed age estimates, genetic studies). As a first result, the capture activity showed a re-colonization of different areas by the red squirrel as a result of the removal of grey squirrels.

The results of our trapping and information campaigns revealed several critical issues when a project aims to eradicate/control and invasive alien mammal species. First of all, an EU directive with the obligation for member states to control alien species is not yet available and a "Case-file" opened by the Standing Committee of the Bern Convention and/or their recommendations have no financial fine when the country does not take appropriate actions. Second, the national/regional legal framework in our country also needs to be revised since alien species are not recognised as such and as a threat to biodiversity in the L.N. 157/92 and as consequence they are protected by this law; the authorization process is complex and leaves room for possible appeals to the Administrative Court that may delay the project. Third, expertise in communication and in public relations is essential. The Project Task Force is trying to provide citizens with a better knowledge on the issues related to introduced species in general, and the competition between grey and red squirrels. Unfortunately this is not easy in Italy, because the media (televisions, newspapers, web sites) generally prefer to emphasize the emotional aspects (killing of such cute squirrels that "certainly do not create problems") rather than explain the ecological damage and the need to protect native species. One of the problem that we encountered in communicating the project was the "it is not true" syndrome. Scientific data supported by several lines of evidence, such as the replacement of the red squirrel by the grey squirrel, are denied in the newspapers simply saying "it is not true", without having to provide any evidence to support this statement.

Cover and vegetation phenology as drivers of fine-scale habitat selection by european roe deer (*Capreolus capreolus*) in the italian Alps

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C143

The European roe deer (*Capreolus capreolus*) occupies a wide range of habitats in Europe, from deciduous and coniferous continental forests, to Mediterranean shrubwoods, to agricultural plains. Thanks to its high ecological plasticity, this species ranges also in Northern and Alpine environments, where harsh winters and a short vegetation growing season are potential limiting factors to distribution and abundance. Habitat and resource selection at the fine-scale have been investigated in optimal habitats, or in controlled settings. To our knowledge, no specific study has assessed fine-scale habitat selection at the two extremes of the distribution range of this species, i.e. the northern latitudes and the alpine environment. On top of macro-habitat analysis, a fine-scale habitat selection allows to assess the relevance of food-related variables, such as group of plants, and their phenological states, and other specific components of the habitat, such as hiding cover.

In this study, we assessed fine-scale habitat selection by European roe deer (*Capreolus capreolus*) from the beginning of the spring green up (April) until the end of the breeding season and establishment of family groups (October) in a very diverse environment in the Italian Alps. We used conventional logistic regression to assess habitat selection throughout the study period, and conditional logistic regression to take into account the temporal aspect of habitat selection on a weekly basis. We sampled topographic covariates (elevation, aspect and slope), habitat-related covariates (such as vegetation communities and cover) and food-related components of habitat (vegetation composition and phenology) in used and available locations along the movement trajectories of 14 adult roe deer equipped with GPS telemetry collars.

Our results indicate that roe deer did not select any particular

altitudinal range or aspect class, whereas they selected mildly steep slopes and dense canopy cover, probably to avoid heat stress during warm summer days. In accordance with previous observations, roe deer preferred young forest stands to climax environments, in which the dominant overstory species were ash (*Fraxinus* spp.) and hazel (*Corylus avellana*). The selection of food-related components of habitat reflected the selection of macro-habitats, since roe deer positively selected shrubs (in particular, *Fraxinus* spp., *Erica herbacea*, *Rhododendron* spp. and *Vaccinium* spp.) throughout the study period, whereas selection for grasses and sedges emerged only at a weekly scale. Habitat selection was clearly related to vegetation phenology, since roe deer selected plants in the most nutritive phenological stages, i.e. shrubs with buds, new leaves and fruits, and newly emergent grasses and sedges. Finally, we found temporal variation in habitat selection patterns by roe deer for food-related habitat components, but not for topographic and macro-habitat covariates or cover. However, I found higher regression coefficients for all drivers of habitat selection at the weekly scale compared to the seasonal home range scale. Our findings confirm the dependence on specific plant typology and phenology stages of a species with high nutritional requirements, such as a selective browser with low fat accumulation. Despite its high ecological plasticity, roe deer distribution might therefore be directly affected by land use practices (esp. forestry management of mature forest) and variation of the vegetation growing season due to climate change. For example, a contraction could be expected at the southern end of the distribution, whereas an expansion might be foreseen at the northern altitudes, or at intermediate altitudes in the alpine range.

Walking on the snow, feeding at the box: drivers of winter habitat selection by roe deer (*Capreolus capreolus*): an empirical assessment in the Alps

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C148

In an alpine environment, accessibility to food during winter represents one of the most limiting factors for animals and can hamper individual survivorship. Typically, snow is the element that mostly affects food availability by covering food items. Moreover, snow also affects food accessibility by increasing the energetic costs of walking for those species that lack specific adaptation to locomotion in deep snow. To compensate for such food limitation and help ungulate population to survive over winter, supplemental feeding sites have been set up, with the consequences of strongly modifying resource distribution and thereby individual use of space.

We investigated the relative importance of snow cover, snow quality- i.e. snow sinking- and supplemental feeding in shaping winter habitat selection of the European roe deer (*Capreolus capreolus*), a small deer species, with a distribution range from Mediterranean to Scandinavia, across a variety of landscapes and climates. In alpine environments, winter represents the limiting season for this ungulate. In particular, roe deer morphological traits does not allow an efficient locomotion in deep snow and consequently resource accessibility and acquisition. Therefore roe deer adopt specific behavioural adaptations, e.g. migration or selection of overwinter areas, to escape unfavourable winter conditions.

However the importance of snow cover, and especially snow quality in terms of sinking on shaping roe deer winter habitat selection in the Alps, has never been evaluated. The context of our study offers a good case to evaluate locomotion vs acquisition of resources, given the presence of supplemental feeding sites, that favour resource acquisition and consequently contribute to determine roe deer movement tactics and use of space in winter time.

We performed a fine-scale empirical assessment of snow depth and hardness within a used - available design, and compared it with the information provided by remotely sensed Moderate Resolution Imaging Spectroradiometer data (Snow MODIS,

500 m resolution). We developed a resource selection function by means of multivariate logistic regression-mixed modelling framework (GLMM).

We found that within their winter range, roe deer strongly selected forest canopy and spots with harder snow (i.e. with less snow sinking), whereas only a weak positive effect of proximity to supplemental feeding sites was detected. Snow cover distribution from MODIS was not retained in the best model.

We conclude that roe deer in winter selected those habitats that provide a good thermal shelter and an efficient filter for snow-fall. The presence of forest canopy may provide both hiding and thermal protection, by reducing the amount of snow on the ground and limiting daily temperature variation. Moreover forest canopy reduces the depth of snow cover layer limiting the energetic costs associated with movement. These factors are likely to increase overwinter survival of roe deer. The adoption of a particular behavioural tactic, i.e. the usage of trails previously formed by other individuals to move from bedding sites to supplementary feeding sites, might explain the unexpectedly weak effect of closeness to supplemental feeding stations on roe deer winter habitat selection.

We suggest the importance of complementing large scale models of snow cover (MODIS data) with site-specific information on snow quality and distribution, especially in mountainous areas with high local heterogeneity.

Our results confirm the strong effect of snow cover and snow quality on roe deer winter habitat selection. We suggest that the modification of snow cover abundance and seasonal extent due to ongoing climatic changes affects roe deer population dynamics patterns because of the scarce adaptation of snow typical of this species. The investigation of trends between snow distribution and roe deer population performances might therefore provide important indications for the correct management of this ungulate in an alpine environment.

Climbing dam walls: new habits for the Alpine ibex?

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C039

Salt represents a very important component of any animal diet, but it is sometimes difficult to obtain. Natural or artificial salt licks are used by plant-eating species to integrate a low-sodium diet. Some particular salt licks are visible in external dam walls, where salty minerals regularly exude from the concrete bricks. Different mountain species, such as the Chamois, the Alpine ibex and even the Alpine marmot, can be observed climbing dam walls across the Alps. However, only ungulates can reach considerable heights and slopes. In this respect, dams represent true open laboratories to study the gradient limits of locomotion. Four dams are known to be used by ungulates in Italy, two in Piedmont and two in Lombardy (central-western Alps). The dam walls are made of brickwork with cement (3) or concrete blocks (1), are 24 to 64 m high, with slopes variable from 123% to almost vertical ($\infty\%$). The animals were filmed in two of those locations: i) Lago della Rossa (Valli di Lanzo, Turin, Piedmont, 2716 m a.s.l.), brickwork wall, 24 m high, straight slope of 161% from ground to 19 m, then almost vertical. Pictures taken at 15 s time interval (0.07 fps); ii) Piano Barbellino (Val Seriana, Bergamo, Lombardy, 1868 m a.s.l.), concrete wall, 64 m high, straight slope of 123% from ground to 31 m, then 157% for 22 m, and then almost vertical. Pictures taken at 5 s interval (0.2 fps). Film footage were taken between July and October during the years from 2010 to 2012.

In total 54 alpine ibex were filmed, 21 on the Lago della Rossa dam wall and 33 on the Piano Barbellino one. All the animals were either kids, young males or females, and their body masses were estimated and categorised as follow: medium size, small size and kids. No large males were observed climbing the dam walls.

The overall weighted average incline of their paths was 37% uphill and 46% downhill. Ibex used to climb on zigzag routes and run down on more linear tracks. The gaits employed by the animals were walk and gallop but, occasionally, they adopted an intermittent crawl gait. This particular gait was described as one of the best way to move on steep slopes, and consists in a lateral (in the case of ibex) locomotion where the two frontlegs move in sequence, followed by the two hind limbs. The footfall pattern is completely different by any kind of walking.

The maximum uphill gradients of the paths travelled by the animals were in inverse proportion to body mass (102% for medium size adults, 143% for small size and 155% for kids). The maximum downhill gradients were 123% for medium size ibex and 157% for small adults and kids. The climbing performance of Alpine ibex appeared to be negatively influenced by body mass, while the friction coefficient between their hooves and concrete was high, like rubber on solid surfaces.

In geology, a “safety factor” is used to assess if a standing rock on a mountain slope will probably run down, or slip down or be stable. This factor basically depends on the slope, the angle of friction and a geometric factor. In the case of an animal standing on a slope, the geometric factor would be the ratio of the distance between the contralateral feet and the height of the body centre of mass (bCOM). The higher the geometric factor, the more stable is the subject at the same gradient. As a consequence, animals with shorter legs and lower bCOM, like females and kids, could negotiate steeper paths with a lower probability to slip or run down. Further, the larger curved horns carried by males, represent a mechanical impediment as the slope increase.

Local seed crop, squirrel density and macro-regional weather: how do they link-up?

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C120

Climate change and in general weather factors affect both plant and mammal population dynamics. In montane and subalpine conifer forests there is a strong relationship between annual variation in conifer seed production and population density and reproductive output of Eurasian red squirrels (*Sciurus vulgaris*). Seeds of different conifers are the main food source for red squirrels, and seed crops size varies strongly between years, apparently following an unregular pattern. Moreover, a peculiarity of mast seeding species is the synchronous production of seed crops over large areas, this suggests that the causes driving plant dynamics could be climate factors. Therefore, whether changes in weather conditions could be the main factor driving ecosystem dynamics. It is important to understand if weather factors are related both to producer (conifer seed crops) and consumer (squirrel) dynamics: if this is the case then variation in weather conditions could be the key that would allow us to expand weather - seed-crop - squirrel relationships from local situation (Central Italian Alps) to wider areas.

Five red squirrel populations have been studied in northern Italy (Valtellina) over different time-periods (minimum 6 years) between 2000 and 2013. For each population Capture-Mark-

Recapture (CMR) methods and radio-tracking have been used to obtain estimates of spring and autumn density per year. Moreover, several population parameters and data on sex, body mass, body size and reproductive condition were recorded. Each year, cone counts on sample trees of all conifer species in all the study sites allowed us to record cone (seed) production and estimate total seed-crop size, expressed in food energy availability (kJ/ha).

The most important weather factor driving seed crop size seems to be temperature at different time-lag. For squirrel population dynamics, the bests models show that squirrel population growth rate is strongly density dependent and is influenced by availability of food energy. Growth rate is also affected by weather factors, such as summer and winter temperature of the previous year, therefore temperature could be the key factor to understand the dynamics of the ecosystem. Selected models will be also useful to understand the effect of climate change on squirrel populations, by driving them with the outputs of appropriate climate models. The study has been realized within PRIN project (PRIN 2010-2011, 20108 TZKHC).

IX Congresso Italiano di Teriologia

Italian hotspots of mammal species vulnerable to climate changeM. PACIFICI¹, P. VISCONTI^{1,2}, C. RONDININI¹¹Global Mammal Assessment program, Department of Biology and Biotechnologies, Sapienza Università di Roma, Viale dell'Università 32, I-00185 Rome, Italy²Microsoft Research Computational Science Laboratory 21 Station Road, CB1 2FB, Cambridge UK

C092

The effects of recent climate change on mammals are increasingly well documented, and a large number of methods have been developed to predict the potential impacts of further climate change in the coming decades. A variety of studies have demonstrated that species displaying certain ecological and life history traits (e.g. low dispersal, large body mass, low reproductive rates) are more vulnerable to extinction based to climate change than others. Despite these efforts, little is known about how to represent species vulnerability to climate change due to biological traits. Here we present a framework for assessing three components of vulnerability: exposure, sensitivity and adaptability. We developed two indices for each Italian terrestrial mammal (64 species) by considering a) life history traits which make a species more sensitive and less adaptable to climate

change, and b) the areas with the greatest exposure (differences between current and projected future climate) by using three different climate scenarios. Then, we combined these indices in order to obtain an overall vulnerability index and find hotspots of vulnerable species in Italy. We found that the most vulnerable species are concentrated in the orders Cetartiodactyla, Rodentia and Carnivora, and that hotspots of vulnerable species are located in the Central and Calabrian Apennines, the Po Valley, the Dolomites and the Alpine chain. Our approach represents a powerful tool for identifying priority species and assess species-specific responses to climate change, both at local and global scales. The identification of vulnerable species can be used to inform spatial priorities for conservation actions aimed at mitigating climate change impacts.

IX Congresso Italiano di Teriologia

Cranial size has increased over 133 years in a common bat, *Pipistrellus kuhlii*: a response to changing climate or urbanization?A. TOMASSINI¹, P. COLANGELO¹, P. AGNELLI², G. JONES³, D. RUSSO^{3,4}¹Dipartimento di Biologia e Biotecnologie "Charles Darwin", Università degli Studi di Roma "La Sapienza", Roma, Italy²Museo di Storia Naturale dell'Università di Firenze, Sezione di Zoologia "La Specola", Florence, Italy³School of Biological Sciences, University of Bristol, Bristol, UK⁴Wildlife Research Unit, Laboratorio di Ecologia Applicata, Dipartimento di Agraria, Università degli Studi di Napoli Federico II, Portici, Italy

C063

Bats are promising candidates for studying morphometric responses to anthropogenic climate or land-use changes. We assessed whether the cranial size of a common bat (*Pipistrellus kuhlii*) had changed between 1875 and 2007. We formulated the following hypotheses: (1) if heat loss is an important reaction to climate warming, body size will have decreased in response to the increased temperatures, because small bats have a larger surface-to-volume ratio and dissipate heat more effectively; (2) if water loss is the main driver, body size will have increased in response to the temperature increase, because larger bats will lose water more slowly through a reduced surface-to-volume ratio; (3) the energetic benefits provided by urbanization (food concentration at street lamps, warmer maternity roosts in buildings) will lead to a general body size increase in *P. kuhlii*; and (4) because street lamps impair moth antipredatory manoeuvres, cranial size

may have selectively increased as an adaptive response to handle larger prey (moths) in artificially illuminated sites. Ours is the first study to assess temporal trends in bat body size and climate or urbanization over more than a century as possible causal factors. Our study was set in mainland Italy. We used traditional morphometrics to compare seven variables of skull size in 117 museum specimens (75 female, 42 male). Cranial size increased after 1950, but this change was not paralleled by an increase in body size, measured as forearm length. This selective increase matched a rapid increase in electric public illumination in Italy. Street lights are crucial foraging sites for *P. kuhlii*. The directional change that we found in cranial size might represent a microevolutionary adaptive tracking of a sudden shift in food size, making more profitable prey available.

IX Congresso Italiano di Teriologia

Adapting to climate change in alpine areas: how can climatic and environmental conditions affect current and future bat distribution?

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CI139

During the last century rapid climate change has affected many animal populations and plant communities, changing their phenology, distribution and survival at a local scale. One of the greatest threats is the loss of native habitats and the consequent movement towards new favorable areas following a latitudinal or altitudinal gradient: this can lead to local extinctions and fragmentation. We studied the climatic and environmental variables affecting the altitudinal distribution of bats in the Alps, using them to predict future changes in population dispersal.

We focus the analysis on roosts, a key resource for bats. Climatic conditions at a small scales around roosts can vary according to future climate changes, thus affecting species reproductive success and survival during winter.

We recorded data about 31 roost of 14 species, grouped by their biogeographic pattern (mediterranean, temperate, boreal), during summer 2013 in Stelvio National Park. Variables that affected most roosts distribution inside the study area are elevation, temperatures (Tmax, Tmin, ΔT) and presence of urban settlements, where most bats found their refuge. We observed a roost partition between boreal and mediterranean species, the latter selecting roosts located under 1000 m a.s.l. (above 1200 m a.s.l. for boreal species) with a great temperature range. In

particular we noticed highest maximum temperatures for mediterranean species, with a range of 16-22° C compared to 11-16° C for boreal ones. Temperate species showed a high degree of plasticity selecting a wide range of roosts with different climatic and environment conditions. Inner roost temperature and humidity, recorded with data loggers inside three nurseries, showed a great temperature and hygrosopic range between day and night, with high daily temperatures and low humidity. Both minimum and maximum temperatures inside roosts were more elevated than the outside ones, granting favorable climatic conditions for lactating females and development of young.

Roost climatic and environmental variables were included in MAXENT models to shape current roost probability distribution for the three biogeographic groups. Mediterranean species showed the lowest range in contrast to temperate ones. We used the same variables to shape the futures roost distribution under different scenarios of climate change (2050-2070). Selected models will be useful to understand the effect of climate change on the distribution of bats roosts over an altitudinal range, considering in particular the possible range contraction of boreal species that are limited in their southern distribution by the presence of suitable climatic conditions in alpine areas.

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Impatto dei cambiamenti climatici sulle comunità di micromammiferi (Mammalia: Soricomorpha, Rodentia) del Delta del Po

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CO51

Le frequenze delle specie preda del barbagianni (*Tyto alba*) rilevate nei boli alimentari (borre) raccolti in sette siti (roosts) nel Delta del Po in tre periodi diversi (T1=1975-1989; T2=2006-2009; T3=2011-2012 Progetto Climaparks) sono state confrontate per individuare, sulla base dei dati climatici dell'area di studio, se le variazioni climatiche degli ultimi decenni hanno influenzato le composizioni delle comunità microteriologiche di questo territorio. La struttura delle comunità di micromammiferi nel territorio del Delta del Po ha subito cambiamenti rilevanti negli ultimi trent'anni individuando notevoli variazioni delle frequenze di alcune specie bioindicatrici. Il confronto dei dati relativi agli anni settanta e ottanta del Novecento con quelli di campionamenti recenti risalenti all'ultimo millennio

mostrano l'aumento di specie termofile e la diminuzione di quelle mesofile. L'aumento delle temperature di quest'ultimi decenni riscontrato nell'area di studio potrebbe aver avuto un ruolo determinante sull'aumento delle frequenze del mustiolo (*Suncus etruscus*) fra i Soricomorfi, del topolino domestico (*Mus domesticus*) e del ratto nero (*Rattus rattus*) fra i Roditori, tipiche specie termo-xerofile favorite dal riscaldamento globale. Al contrario le specie appartenenti al genere *Sorex* che presentano un elevato grado di mesofilia in questi ultimi trent'anni hanno subito un drastico decremento delle loro abbondanze nelle comunità dei piccoli mammiferi del Delta del Po. Tali variazioni sono confermate dall'incremento significativo degli indici di termoxerofilia nei tre periodi di monitoraggio.

Tell me your habitat and I'll tell your future. A contribution to the assessment of expansion potential of introduced *Callosciurus erythraeus*M.V. MAZZAMUTO¹, M. PANZERI¹, D. SONZOGNI¹, H. SU², M. SPADA¹, L.A. WAUTERS¹, D.G. PREATONI¹, A. MARTINOLI¹¹Unità di Analisi e Gestione delle Risorse Ambientali - Guido Tosi Research Group, Dipartimento di Scienze Teoriche e Applicate, Università degli Studi dell'Insubria, Varese, Via J.H. Dunant 3, 21100 Varese, Italy²Forestry College of Guizhou University, Huaxi District, Guiyang City, Guizhou Province, China

The introduction and subsequent range expansion of invasive alien species (IAS) is the second most important cause of loss of biodiversity worldwide. In Mammals, alien species can become a threat for the long-term survival of native species by different ecological mechanisms: predation, parasitism and interspecific competition. As far as the latter is concerned, the model system of competition replacement of native Eurasian red squirrels (*Sciurus vulgaris*) by introduced Eastern gray squirrels (*Sciurus carolinensis*) in Great Britain and North Italy has been well documented. However, little is known about how red squirrels interact with other invasive alien tree squirrel species.

In the province of Varese, North Italy, there is a large population of *Callosciurus erythraeus*, an invasive alien tree squirrel with a wide distribution range in South-East Asia. This population is being monitored by removal trapping since 2011 and, more recently also by radio-tracking. In the area actually occupied by this alien species, native red squirrels seem to occur at very low densities, suggesting a negative impact of the alien species through interspecific competition. However, the mechanisms of competition are not known.

C. erythraeus appears to be very successful in this area, composed mainly of mixed deciduous forests (*Castanea sativa*, *Fraxinus ornis*, *Quercus robur*, *Quercus petrae*, *Robinia pseudoacacia*, *Alnus* sp., with understory of *Corylus avellana*). Such high success in adaptability is likely to be linked to habitat selection. Wildlife habitat studies explore the distribution of individuals among habitats types, which is supposed to be largely determined by habitat selection. Moreover, population size and growth rate of the alien species may vary as functions of the relative proportion of different habitat types available. Here we use habitat selection analysis to obtain basic information on ecology of *Callosciurus erythraeus*. Knowing which habitat types contribute most to the expansion of the new population will be useful in managing the alien species by targeting control in the "best" habitats.

So far, 16 *C. erythraeus* were radio-tagged over 6 months. To

analyse the forest type of the study area we used the vegetation map created for the SIT-FAUNA project of the province of Varese. Home range size and contours were calculated using the Fixed Kernel Estimator. To characterize the degree of selection we used the Ivlev's Electivity Index exploring habitat selection at two levels. For macro-habitat selection we used the proportion of each forest type in the whole study area (bounded on the North-West of Lake Maggiore and the South-East by the State Road 394) as a measure of availability and the proportion of that habitat type inside the contour of all home ranges as measure of utilisation. At the smaller level, we used the proportion of each forest type in the contour of all home ranges as a measure of availability and the proportion of radio-locations (fixes) in that habitat type as measure of utilisation. We found a positive selection for deciduous chestnut woods (*Castanea sativa*) and for forests with prevalence of *Robinia pseudoacacia* and *Prunus serotina*. These forest types might be selected for high levels of food availability from spring to autumn and because *R. pseudoacacia* is often used for nesting. Birch woods (*Betula pubescens*) and moist areas with prevalence of *Alnus glutinosa*, *Populus* sp. or *Salix* sp. were avoided. The vegetation types in which home ranges are included represent the 83% of the total study area investigated demonstrating the possibility of expansion of the alien species in the rest of the area. These are preliminary results on habitat selection by *C. erythraeus* and a more detailed vegetation study on micro scale is needed to understand smaller-scale (tree species) selection and how this affects the current and potential future distribution of the introduced alien species. Furthermore, habitat selection studies should allow us to predict patterns of habitat occupancy under different scenarios of control and expansion of this IAS producing data useful for managing the alien squirrel and in targeting the critical habitats to be controlled to avoid colonization of new areas. The study has been partially financed by PRIN project (PRIN 2010-2011, 20108 TZKHC) and LIFE project NAT/IT/00095.

Multiple molecular and statistical approaches to identify the effects of environmental variables and human infrastructures on the genetic structure of the Sardinian wild boar

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Landscape features inevitably influence gene flow within mammal populations. Presence of landscape elements, of natural or artificial origin, can act as a barrier to individual movements, inducing genetic fragmentation and deviation from panmixia. As a consequence, locally differentiated demes can arise which are more sensitive to the risk of bottleneck and local extinction caused by stochastic events.

Here, we show the impact of natural features and anthropogenic infrastructures on the genetic structure of a geographically – but not genetically – isolated wild boar population. Due to its value as game species, wild boar populations are heavily managed and their genetic make-up is often influenced by direct human intervention. Such aspects can affect the population genetics of this species and were also considered in this study.

The Sardinian wild boar population originated during the early Neolithic and is classified as a distinct subspecies (*Sus scrofa meridionalis*). A previous study proved the occurrence of genetic introgression from continental wild boars and domestic pigs, which was mainly concentrated in the northern and eastern part of the island, and the occurrence of a strong genetic structure in the population. The genetic diversity across the island was investigated using two different marker systems: a set of 16 polymorphic microsatellites and a panel of around 50000 SNPs. In a first step, introgressed individuals were identified by comparison with reference populations and removed from the data set.

Sources of introgression were continental (both Italian and foreign) wild boars and domestic pig breeds. For both classes of molecular markers a sharp pattern of population structure

was found. Three different subpopulations were disclosed: one occupied the eastern part of the island and two highly pure and disjointed subpopulations occurred in the western side of the island. Isolation-by-distance appeared to do not be sufficient to explain such genetic differentiation, although it played a role. Indeed, both isolation-by-resistance and isolation-by-barrier were detected in the island. According to the knowledge of wild boar spatial behaviour, we modelled the effects of land cover categories and infrastructures, like main roads, on animal movements and the ultimate effect on gene flow. Both correlation statistics and Bayesian modelling methods were used. Our results showed that the correlation between genetic and spatial distance was stronger when environmental characteristics and the presence of a motorway crossing the island from north to south (SS131) were taken into account. In particular, anthropogenic barriers seem to have a slightly greater influence on gene flow than natural components. Noteworthy, results obtained with the two different classes of nuclear markers were widely consistent, giving stronger support to the identified causes of genetic substructuring.

Furthermore, data highlighted the possible role of the motorway in preventing the spread of introgressed genes to the western subpopulations, thus giving a conservation perspective to our results.

This study emphasizes the utility of landscape genetics approaches in getting insightful information on the causes of local differentiation and population fragmentation, which should be taken into consideration in the future management of wild species.

Habitat use of *Marmota marmota* in the Adamello Brenta Nature ParkA. MUSTONI¹, G. FERRARI², D. SCARAVELLI^{2,3}¹ Adamello Brenta Nature Park, via Nazionale 12, 38080 Strembo (TN)² CdL Produzioni Animali e Controllo della Fauna Selvatica, Università di Bologna³ Dipartimento di Scienze Mediche Veterinarie, via Tolara di Sopra 50, 40064 Ozzano dell'Emilia (BO) e Museo Ornitologico F. Foschi, via Pedriali 12, 47121 Forlì (FC), Italy, e-mail dino.scaravelli@unibo.it

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Marmota marmota (Linnaeus, 1758) is an emblematic rodent species of the Alps, where it plays an important role in the ecology of high altitude pastures and seems also to be a sensible witness of climate changes. For the role in high mountain ecological landscape and in the trophic nets, the alpine marmots has been monitored for long time by Adamello Brenta Nature Park (Trento Province, Italy). In 1997, an extensive census was carried on and rodent presence areas were mapped. In detail, the direct sampling area was 8462 ha wide (northwestern Brenta Massif, orographic left side of Rendena Valley). A new specific research project started in 2013 in order to verify changes in marmot's distribution and the ecological requirement of the colonies.

Between July and September 2013 a visual census of the colonies was performed over standardized transects: using maps and GPS tools, spatial coordinates were assigned to each colony, which was also described in composition.

Data were later inserted into a GIS to be analyzed. Criteria used to characterize marmot's habitat were: elevation, exposure, solar radiation, geology, vegetation and land use, re-categorized by discrete classes. For each class, the available surface included within the study area and the area used by the species were calculated in order to identify the more selected fractions.

An Evaluation Environment Model was projected on the whole Park territory on the base of a 10×10 m grid, considering the different land use parameters between 1750 and 2750 m a.s.l. and also above the wood vegetation belt.

The model, useful to better understand the criteria of land use by marmots, was validated using the field observations and shows a good robustness in the entire calcareous Massif of Brenta Dolomites.

Comparing 1997 to 2013 census, it appears a decrease in the marmot distribution in the northern part of Brenta Massif and an increase in its central part. The distribution is, instead, similar in the southern portion of the study area.

The model implemented shows that territories between 2000 and 2250 m a.s.l., over tree line, are the most suitable areas for the rodent, and that dens are south-southwest oriented.

The best foraging areas are represented by sub-horizontal pastures dominated by *Sesleria* sp. and *Poa alpina*.

The aim is to further implement, in the next years, the present study, extending it to the granitic part of the Park: this will allow to define the model also for such environment and to provide a good provisional tool to monitor the species in the future, also in the scenario of climate changes.

The effects of pulmonary deficiencies on a vulnerable Apennine chamois population require a cautionary immobilization protocol

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The Apennine chamois (*Rupicapra pyrenaica ornata*) is an endemic subspecies which survives in some massifs of Central Italy. Although its IUCN conservation status has been down-ranked from Endangered to Vulnerable, this chamois still faces major threats such as those associated with its limited population size and number of subpopulations, low genetic variation, and competition with other ungulates. Because the Apennine chamois found in the Abruzzo, Lazio and Molise National Park (Central Italy) – hereafter abbreviated as PNALM – constitutes the last remaining autochthonous population, it has an especially high conservation value.

Since 2005-2006, the PNALM population size has shown a negative trend and a growth rate decrease, mostly due to the high winter mortality of kids in the first year. This population may be subjected to density-dependent processes caused by several factors (e.g. high intraspecific local-density, reduced carrying capacity due to changes in production and species diversity, and to interspecific competition for grazing pastures). One of the effects of these conditions is the high level of parasites recently found to affect this population. Parasitological analysis of 405 droppings collected in 2011 and 2012 revealed a 68.4% occurrence of bruncopulmonar strongyles, 62.5% gastrointestinal parasites and 88.9% coccids. Larvae/oocysts/eggs counts in faeces showed a highly skewed distribution in the population and unusually high peaks of intensity. Both prevalence and intensity were significantly higher than those of two other Apennine chamois populations (Majella and Gran Sasso National Parks), where chamois density is likely to be much lower. The occurrence of strongyles and coccids at PNALM was also significantly higher than that recorded 15 years ago.

In addition, after over twenty years during which no mortality was recorded, in 2006 two individuals died on the same day during translocation from PNALM to the Sibillini National Park, as part of a reintroduction project to the latter area. In 2008 and 2009 another two individuals captured in PNALM, apparently in excellent body conditions, died during anesthesia. Moreover, the post mortem examinations of 17 chamois retrieved between 2010 and 2013, including 3 juveniles, highlighted for most of them (84.2%) a poor pulmonary condition caused by high infestations of bruncopulmonar strongyles. These clinical conditions, broadly occurring in the population, represent a potential risk in case of immobilization and manipulation and cannot be predicted from a visual assessment of the subject's external conditions.

Within the ongoing project LIFE09 NAT/IT/000183 "Coornata", we evaluated which of two anesthesia protocols usually applied by PNALM staff is more appropriate to reduce the risks for the animals. For the purpose of our study, and in accordance with the aforementioned findings, we distinguished between two

periods: 1990-2005 and 2006-2013. Each of the two protocols was applied both before and after 2006.

A total of 104 chamois immobilizations have been carried out since 1990, 83 using Xilazine-Ketamine (XK) and 21 using Medetomidine-Ketamine (MK). Before 2006, XK was used 57 times and MK 11; since 2006, XK was used 26 times and MK 10 times. The parameters considered were the following: induction time (IT, in minutes), i.e. the period from darting to complete immobilization (head down); recovery time (RT, in minutes), i.e. the period from induction of the antidote (Atipamezole) to standing; age, sex and weight of the animal; dosage (mg) of first drug injection; heart rate (HR), respiratory rate (RR) and the first rectal temperature (T) recorded after recovery.

We found no correlation between induction time and injection site (chamois were immobilized by intramuscular injection into the rump, hip or thigh) in any of all the possible comparisons. There was also no correlation with body weight, sex, age and first dosage, so all data were treated together.

None of the mortality events occurred (3 for each protocol) was related to a specific anesthesiological aspect. Prior to 2006 we found no significant difference for IT between the two protocols. Following 2006, we did find a strong difference as IT (\pm s.d.) for MK was significantly much shorter than it was for XK: 4.9 ± 1.9 vs. 12.9 ± 10.3 (Mann-Whitney, $U=124.5$, $p<0.05$). IT differed significantly between the two periods for both protocols, but with an opposite trend: it decreased for MK (before 2006: 6.8 ± 1.4 ; Mann-Whitney, $U=19$, $p<0.05$) maintaining the same dosage, whereas it increased with XK (before 2006: 7.0 ± 3.0 ; Mann-Whitney, $U=144$, $p<0.05$) despite a 100% increase of Xilazine dosage. This quite odd result awaits an explanation and it might be due to a different anesthetic action on receptors in relation to a changed stress condition of the subject. On the other hand, we found no difference between the two protocols for RT (Mann-Whitney, $p=n.s.$). Mean HR was 55.9 ± 15.0 for XK and 51.2 ± 8.4 for MK, mean RR was 66.3 ± 23.4 for XK and 69.9 ± 18.8 for MK, both in accordance with previous results in the same area. HR and T did not correlate with the time since immobilization for both the protocols; RR showed a significant negative correlation for both protocols, but the relationship for MK was stronger ($r=-0.47$ vs. $r=-0.28$, $p<0.05$). A less variable decreasing RR is usually associated with a deep anesthesia and consequent decreasing stress level or adaptation to stress.

According to our results, MK protocol yields a minor induction time, thus allowing to get quicker immobilization. It would also allow the measures required to be started sooner, thus minimizing the sanitary problems that may occur during the anesthesia. Moreover, MK protocol seems to be more effective to obtain a deeper anesthesia because of the higher regularity of some anesthesiological parameters (RR in particular).

IX Congresso Italiano di Teriologia

Causal relationship between heterozygosity and fitness related traits in Alpine ibexA. BRAMBILLA¹, I. BIEBACH², A. VON HARDENBERG³, B. BASSANO³, G. BOGLIANI¹¹ University of Pavia² University of Zurich³ Gran Paradiso National Park

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Inbreeding may arise in wild populations after bottlenecks and its deleterious effects can last for long time. Heterozygosity-Fitness Correlations (HFCs) are a common tool used to investigate inbreeding depression in absence of pedigree data. We tested the correlation between heterozygosity and fitness-related traits (horn growth, body mass and parasite load) in male Alpine ibex (*Capra ibex*) of Gran Paradiso National Park population which suffered a severe bottleneck at the end of 18th century. We found a relationship between standardized Multilocus Heterozygosity (MLH) and body mass and horn length, which are known to be

important fitness-related traits, and with parasite resistance. Our results indicate the presence of inbreeding depression in Gran Paradiso Alpine ibex population. Moreover, using confirmatory path analysis, we showed that the effect of MLH on horn length was mediated by body mass. We also highlighted a direct causal link between MLH and fecal counts of nematode eggs (FEC) suggesting a direct effect of genetic factors on parasite resistance. Using confirmatory path analysis, we disentangled the causal relationships between Heterozygosity and fitness-related traits to distinguish between direct and indirect effects.

IX Congresso Italiano di Teriologia

Changes after 10 years in small mammal community of an agricultural site in Romagna by *Tyto alba* pellets

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Small mammals are useful bioindicators of landscape composition and climate change due to their key roles in terrestrial ecosystems, complex community structure relate to different trophic guild and wide range of modern and past information on successful use in qualitative and quantitative ecosystem and biogeographic assessment.

The great changes in agriculture during the last decades, impressive urbanization and changes in land use as well as alien species widespreading and the creation of thousands partitions in ecosystems due to human related constructions and activities seems to had a strong effect on local small mammals communities.

Barn owl pellet analysis was applied in order to study the small mammal community in selected sites in the agricultural landscape of Ravenna plains, close to the town of Alfonsine, in the mosaic of extensive cereal fields, orchards, roots crops and forages side by side along river Reno banks.

Collections of pellets were performed in 2003 and 2013, allow to ensure after 10 years the possibility to study changes in the community. Pellets were dry dissected and the skulls and mandibles were identified at specific level and later analyzed by known methods.

In 2003 were collected 1169 specimens belonging to 11 species and in 2013 the collection provide 701 specimens of 10 species. In 2003 the community was characterize, in percentage, by

the presence of: *Microtus savii* (29.26), *Crocidura suaveolens* (17.96), *Crocidura leucodon* (14.88), *Apodemus sylvaticus* (13.52), *Suncus etruscus* (10.18), *Mus domesticus* (7.44), *Sorex samniticus* (5.13), *Microtus arvalis* (0.94), *Micromys minutus* (0.26), *Rattus norvegicus* (0.26), *Talpa europaea* (0.17).

In 2013 were found the following results: *M. savii* (55.34), *C. suaveolens* (14.39), *A. sylvaticus* (13.8), *C. leucodon* (9.5), *S. etruscus* (2.37), *M. domesticus* (2.37), *S. samniticus* (0.89), *M. arvalis* (0.89), *R. norvegicus* (0.15), *R. rattus* (0.3).

According to these data the Shannon Index was 1.9349 in 2003 and 1.392 in 2013 and a evennes of 0.733 and 0.611 respectively. Also the Contoli index TX increase dfrom 0.893 to 0.953.

The vole *M. savii* dominate the communities and shows an increase of 26 percentage points that compensate a general decline of Soricomorpha as well as the disappearance of *M. minutus*.

The changes can be related to a general increasing of temperature that favorite the more steppe related species due to the lacking of tree coverage and loss of small gardens and ditches with the last small remains of natural vegetation.

Is impressive also the impact on the more sensible species as *M. minutus* and *A. amphibius*. The analysis of small mammals community is providing an effective tool to monitoring landscape and, eventually, climate change and need to be based on a historical series. On the other way the conservation of the fast declining predators as the Barn owl need to be pursued.

Roost characteristics of maghrebian mouse-eared bats *Myotis punicus* (Chiroptera, Vespertilionidae) in northeastern AlgeriaM.L. BENDJEDDOU¹, E. BERKANE^{1,4}, A. ABIADH², D. SCARAVELLI³, Z. BOUSLAMA¹¹ Ecology of Terrestrial and Aquatic Systems (EcoSTaQ), University of Badji Mokhtar, BP12, Annaba 23000, Algeria, e-mail amine_bendjeddou@yahoo.fr² Unité de Recherche 05/UR/09-10. Biodiversité & Biologie des Populations, Faculté des Sciences de Tunis, Université El Manar II, 1092, Tunisia³ Dipartimento di Scienze Mediche Veterinarie, via Tolara di Sopra 50, 40064 Ozzano dell'Emilia (BO) e Museo Ornitologico F. Foschi, via Pedriali 12, 47121 Forlì (FC), Italy, e-mail dino.scaravelli@unibo.it⁴ Association pour le développement durable et l'écologie militante (ADDEM), Ain el Beida, Algeria

Mouse-eared Bat *Myotis punicus* Felten, 1977 was for long time controversially attributed as a subspecies of *Myotis myotis* (Tomes, 1857) but genetic and morphometric analysis bring it to a full species rank. The species occurs from North-west Africa in Morocco, Algeria, Tunisia, to western Libya and is also present in Corsica, Sardinia, and Malta islands. In Algeria *Myotis punicus* is found in small groups roosting in natural caves and in human made different kind of structures, both under- and over-ground, but the knowledge about its precise distribution and ecological niche is still poorly known.

Starting in 2011 field explorations were carried out in the region of northeastern Algeria in order to locate and ecologically describe the roosts of this species.

The preliminary results of the study here presented increase the number of known localities as well as recognize some of the ecological relationships with occupied roosts.

Maghrebian mouse eared bat was found in 38 localities located between 0 and 1177 m above the sea level. About the possible categories, in 7 cases the roosts are used all year around for the different phenological phases, in 7 are used as nurseries, 5 for mating aggregations and in 4 for hibernation. The other cases are actually known just for the presence of the species. The "all year" roosts are for 57% in caves, 29% in tunnels and 14% in mines. Nurseries are for 43% in caves, 43% in buildings and in one case in a cellar. Mating quarters are for 80% in caves and 20% in buildings and all the hibernation sites are in caves. One of the most interesting localities is the subterranean lake Bir Osman with a temperature inside that varies between 27 to 38° C in summer

and 10 to 20° C in winter. This spectacular site is used both for reproduction and hibernation, when more than 4500 animals were found also with the presence of large numbers of *Rhinolophus blasii*, *Myotis capaccinii* and *Miniopterus schreibersii*.

Considering the numbers, hibernacula can reach 4500 specimens but also small groups of 7-50 were found in caves over the 1000 meters of altitude. Nurseries count between 2-10 to around 400 specimens. If all the categories are grouped together there are groups of less than 10 animals in 17 sites, between 10 and 100 in 11, between 100 and 200 in 5, 2 roosts of around 400 bats and 1 over 4000.

In elevation, hibernacula were founded between 487 and 1132 meters, the mating sites are at low altitude between sea level and 148 meters, meanwhile nurseries were found in all the altitudinal belts until 1177 meters, but 57% are in lower than 400 m asl locations. The human made roosts are mostly chosen at higher altitudes and represented by bridges or abandoned buildings and inside them few individuals were found in different seasons.

Myotis punicus has a limited areal and also seems not to be widely distributed among Maghrebian countries as well as in strong decline in Corsica, Sardinia and Malta islands. In Algeria, as for all other species of bats, *Myotis punicus* profits of the protection under the law but mainly theoretically. The effort to identify at first the species refuges and protect them raising meanwhile the local awareness for this important wildlife heritage is also the aim of the international team actually investigating the local ecology of the Maghrebian mouse eared bat.

Progetto convivere con il lupo: conoscere per preservare. La tutela del lupo nell'Appennino meridionale

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Il progetto, finanziato dal Ministero dell'Ambiente e della Tutela del Territorio e del Mare, ha coinvolto 6 aree protette dell'Italia meridionale (Parco Nazionale dell'Alta Murgia PNAM, del Cilento Vallo di Diano e Alburni PNCVDA, del Gargano PNG, del Pollino PNP, dell'Aspromonte PNA e dell'Appennino Lucano e Val d'Agri Lagronese PNALVAL), Legambiente e ISPRA. Finalità del progetto è stata la necessità di colmare il gap di conoscenze sul lupo nelle aree protette meridionali, alcune delle quali considerate tra le ultime roccaforti nel periodo di massima contrazione della popolazione, altre invece aree di nuova colonizzazione.

La ricerca è stata effettuata nel 2013 attraverso l'applicazione delle seguenti metodologie standardizzate: (i) campionamento di materiale biologico per analisi genetiche, (ii) fototrappolaggio, (iii) *wolf-howling*.

Nel periodo che va da agosto a novembre 2013 sono stati percorsi un totale di 1439.7 km (288 ± 266 km, $n=5$, \min_{PNAM} 105 km – \max_{PNP} 715 km) con la raccolta di 150 campioni biologici derivanti da escrementi (137) e da campioni salivari (13); inoltre, sono stati campionati parti di tessuto muscolare da due carcasse attribuibili al lupo. Il 48% dei campioni raccolti e analizzati ha permesso l'identificazione di 43 individui, 18 di *Canis familiaris* e 25 di *Canis lupus* (19 e 6; 5 ind. PNA, 3 ind. PNALVAL, 12 ind. PNP, 5 ind. PNAM).

Lo sforzo totale mediante fototrappolaggio è stato pari a 56056 ore (14514 ± 6079 h, $n=4$, \min_{PNALVAL} 6480 h – \max_{PNA} 20808 h) e sono stati ottenuti 181 contatti indipendenti di lupo (45.3 ± 20

contatti, \min PNAM 27 – \max PNG 67). Considerando il numero massimo di individui fotografati contemporaneamente e la distanza di settori indagati è stato stimato un numero minimo di individui pari a 45 (\min_{PNAM} 6 – \max_{PNG} 17). Inoltre, considerando i valori di *trap rate* (numero di contatti indipendenti a 1 h/sforzo 10^{-3}) come indice sintetico di abbondanza, nelle singole aree sono stati ottenuti i seguenti valori: PNALVAL=4.6, PNG=3.9, PNA=2.7, PNAM=2.

I rilevamenti tramite *wolf-howling* sono stati effettuati nel PNP e nel PNA da agosto alla metà di settembre, monitorando rispettivamente 53 e 19 stazioni, effettuando 3 repliche notturne per ciascuna di esse.

Nel PNP sono state ottenute risposte positive in due settori, nel primo settore sono stati stimati 3 adulti e 2-3 cuccioli ad una distanza di circa 1 km, mentre nell'altro sono stati uditi 2 adulti e 3 cuccioli non provenienti dalla stessa direzione. Nel PNA sono state ottenute 4 risposte, 2 singole da parte di lupi adulti e 2 corali nello stesso sito, per due sessioni consecutive, da parte di cuccioli ed adulti, ipotizzando la presenza di un nucleo riproduttivo all'interno del settore nord del Parco.

Lo studio ha confermato la presenza della specie nelle aree protette disposte lungo l'Appennino meridionale dal PNCVDA al PNA, con importanti nuclei riproduttivi nel PNP e nel PNA; a questo si deve aggiungere la neo-colonizzazione da parte della specie di due settori geografici, il Gargano e l'altopiano murgiano di nord-ovest, disgiunti dalla continuità territoriale ed ecologica della dorsale appenninica.

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Ricerca e strategie di conservazione dei Mammiferi nell'area mediterranea

Il bacino del Mediterraneo è incluso nei 34 hotspot di biodiversità nel mondo ed è il più importante tra le 5 regioni climatiche mediterranee, nonostante in quest'area si siano sviluppate alcune tra le più importanti civiltà dell'antichità con conseguente impatto sia sul paesaggio e sia sull'assetto biocenotico, particolarmente in ambito insulare. L'area mediterranea rappresenta anche un centro di endemismo molto importante, dovuto ai cambiamenti climatici del passato (area di rifugio durante i periodi glaciali) e alla gran varietà di lineamenti geografici, geologici e idrogeologici che l'hanno resa un eccezionale laboratorio naturale evolutivo. Inoltre, le condizioni climatiche mediterranee possono favorire l'insediamento di popolazioni vitali di specie alloctone di origine tropicale o subtropicale, con serie conseguenze per il mantenimento della biodiversità autoctona.

Scopo di questa sessione è quello di presentare sia studi volti a comprendere i processi ambientali ed ecologici che possono influenzare le comunità sia ricerche finalizzate ad identificare taxa e aree prioritarie per la conservazione e gestione dei Mammiferi del bacino del Mediterraneo.

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IX Congresso Italiano di Teriologia

Opening Lecture: Bats and environmental change

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Opening Lecture

Ecosystems are changing at unprecedented rates because of anthropogenic impacts. Major impacts arise from climate change and habitat degradation. I will focus on how bats are affected by anthropogenic change, focussing on climate change, urbanisation and deforestation. We have used ecological niche modelling to understand how climate influenced the historical distribution of bat species soon after the Last Glacial Maximum. Bat populations were forced into glacial refugia, which vary in location according to species. Such refugia still harbour the greatest levels of genetic variation, yet future projections of distributions under climate change highlight that mountain range barriers may trap former refugial populations that will become at high risk of experiencing unsuitable climatic conditions in the relatively

near future. Two major threats faced by bats involving habitat degradation are urbanisation and deforestation. An important feature of urbanisation is recent growth in artificial light at night. Some bats are likely to benefit from street lighting as they exploit insects attracted to lights. Other species are light averse, and avoid both existing (e.g. High Pressure Sodium) and emerging (e.g. LED) lamps. Bat populations are also affected by deforestation. We have used GPS tracking to quantify seed shadows for figs eaten by endemic Madagascan flying foxes. We show how bats have the potential to disperse seeds over long distances, and how they can enhance the germination success of seeds, potentially playing important roles in the natural reforestation of degraded habitats.

IX Congresso Italiano di Teriologia

Sociality beyond species: spatial proximity between newborns determines the establishment of heterospecific relationships in bats

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R045

Mixed species groups (MSGs) occur in a variety of social animals and they have been widely investigated in many different orders of mammals. The advantages of MSGs are mostly recognized in improved foraging efficiency, dilution of predation risk, improved information transfer and social thermoregulation. Mixed-species bat colonies are also commonly reported both at tropical and temperate latitudes, where some multiple-species associations are known to occur more frequently than others. Although thermal preferences are often advocated to explain these associations, we hypothesized that they must be facilitated by the development of heterospecific "social" preferences that stem from the spatial proximity between newborns. We manipulated the early social environment of captive *Pipistrellus kuhlii* and *Hypsugo savii*, raising newborns in separate MSGs to simulate conditions in natural mixed-species nurseries; once volant, bats

were allowed to freely interact in a flight room. We measured association patterns among the bats and analyzed the occurrence of social interactions by behavioural observation protocols and social networks analysis. Bats significantly preferred group members for affiliative and cooperative behavioural interactions (allogrooming and clustering) regardless of species membership (which, surprisingly, did not influence such associations) thus showing that "social" bonds may occur between species and that these develop thanks to imprinting-like mechanisms. Our study sheds light on a previously ignored dimension of sociality in bats which overcomes species boundaries. We highlight that our methodology can be applied on other taxa in order to test the general validity of social imprinting in explaining mixed-species associations.

IX Congresso Italiano di Teriologia

Post-mortem examination of eurasian otters (*Lutra lutra*) in southern Italy. Obtaining relevant data to inform conservation

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R209

After a sharp and large decline of otter (*Lutra lutra*) populations, a general recovery has been noted in recent years in several European countries. This positive trend has occurred also in Italy, although otter distribution is still limited to the southern regions. Increasing numbers of dead otters were reported during the last decade in Italy, likely due to increasing population size. Recording locations of death and performing post-mortem (PM) examination of otters found dead provide valuable data that can contribute to assess the status of populations and to identify threats. However, until recent years the collection and PM examination of dead otters were still inadequate in Italy and a relevant amount of information was lost.

In 2009 the RECAL project was started in the National Park of Cilento, Vallo di Diano and Alburni aimed at: 1. collecting mortality data and monitoring health and reproductive status and contaminant body burdens of otter populations; 2. improving the scheme “reporting-recovery-necropsy” of otters in Italy. Later, other protected areas and wildlife rehabilitation centers joined the project and submitted dead otters for necropsy. PM examinations were carried out by a multi-disciplinary team including otter ecologists and animal pathologists, to a standard protocol developed for *Lutra lutra*.

At present 15 otters were examined. Nine otters were collected in the Salerno province, and 6 in the Matera and Po-

tenza provinces. Otters received were sexed and aged based on teeth cementum analysis, body and organs were measured and weighed; tissue and organ samples were taken for genetic, chemical and histological analyses; the nutritional condition and reproductive status were evaluated; parasites were identified and diseases and the cause of death were determined. Most (67%) of otters received were males and 60% was less than 4 years old. The majority of otters died in road traffic accident. One female found dead in June showed 2 placental scars, indication of a recent pregnancy. Three males showed lesions compatible with intraspecific aggressions, that represent a significant cause of death for otters in other countries. In at least three cases the investigation of the scene of death revealed what forced otters to travel out of the water and move over the road, suggesting mitigation measures. Contaminants (PCBs, PAHs, pesticides, dioxins and heavy metals) concentrations in liver or muscle samples of otters revealed relatively high levels of PCBs and Hg and Pb in some otters. However, the sample is still small and results require further confirmation. Nevertheless, for the first time in Italy, contaminant body burdens were measured in otters and tissue/organ samples were stored for future analyses and comparisons. Sample collection is ongoing in order to provide mid-long term data.

IX Congresso Italiano di Teriologia

Range dynamics at the boundary of the otter (*Lutra lutra*) distribution in central Italy

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R136

Spraint surveys remain one of the most valuable methods to monitor otter distribution in a quick and replicable way. During the period May-October 2012 the whole Sangro basin was checked by two surveyors, following the standard otter survey protocol recommended by IUCN/SSC Otter Specialist Group. The study area was recently re-colonized by otter after a strong decline during the '90s. A total of 82 sites were checked for 600 m linear transects of river banks searching for indirect otter signs (spraints, jellies, foot prints). A subset of 40 sites were surveyed twice to estimate species detectability and probability of occurrence. Replicates were also referred to 16 grid cells 10×10 km covering the whole study area to evaluate occupancy at landscape scale. A total of 49 environmental factors and weather conditions were recorded at each site and session and entered as covariates in the occupancy models. Otter were detected at 24 sites (29%). Positive sites were interpolated using ArcMap

Network Analyst setting distance threshold at 7 km. Total length of river course where otter presence was assessed was 205 km, showing an increase of 191 km from 2004, when otters were recorded along only 14 km. This suggests a colonization rate of 23.87 km/year. Detection probability was higher at site scale (P=0.85) than at landscape scale (P=0.43). Detection at site scale was positively influenced by weather conditions in the previous week ($\beta=1.86$; S.E.=0.71), and negatively by water depth ($\beta=-0.54$; S.E.=0.36). No variables significantly affected detection probability at landscape scale.

Probability of otter occurrence decreases with altitude ($\beta=-0.56$; S.E.=0.38) and increased as a function of pools and water barriers ($\beta=1.03$; S.E.=0.42), and woody debris in the river ($\beta=-0.53$; S.E.=0.37). The latter was the only significant factor affecting otter presence at landscape scale.

Key stone areas for the conservation of pine marten (*Martes martes*) in central Italy

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R162

Pine marten (*Martes martes*) is considered a rare mammal in the Italian peninsula with a very less known distribution. Also its ecological features are poorly understood. In fact pine marten is usually associated to mature and well-preserved forests, often without any support of scientific data. But for example, no recent documented data were known for three important protected areas of central Apennines: Foreste Casentinesi, Monte Falterona e Campigna National Park, Monti Sibillini National Park and Gran Sasso and Monti della Laga National Park. Rarely, Italian protected areas have monitoring plans for small carnivores and attendance data are often recorded within the framework of other mammals monitoring or research projects.

In the last five years (2009-2013) the Department of Chemistry, Biology and Biotechnology of University of Perugia carried out many research project in order to define at a high detailed scale, the presence of pine marten in Central Italy. Field research, based on scats collecting, was supported by molecular analysis to distinguish the two "twins" species: pine marten and stone marten (*Martes foina*). 1413 kilometers in six study areas have been covered: 404 in Foreste Casentinesi, Monte Falterona e Campigna National Park (between Tuscany and Emilia-Romagna), 244 in Maremma Regional Park (south of Tuscany), 589 in Gran Sasso and Monti della Laga National Park (between Lazio, Abruzzo and Marche), 37 in Site of Community Importance (SCI) "Monti Amerini" (south of Umbria), 21 in SCI "Selva di Meana" (west of Umbria) and 118 in SCI "Monte Malbe" (hearth of Umbria).

More than 350 scats were collected, geo-referred, and determined through genetic analysis. Among those which have given positive results to the genetic determination, we have found 74 pine martens and 142 stone martens. Data were processed through the IKA (kilometric abundance index) represented by

number of scats/kilometers covered. In Natura 2000 areas (Sites of Community Importance) the pine marten reaches IKA higher than in Protected Areas (National and Regional Parks) with respectively mean values: 0.301 and 0.021. Furthermore we can note another interesting trend: with increasing of pine marten IKA, decreases that of the stone marten. Thus we can assume that locally pine marten can represent a strong competitor for the stone marten, which especially when food resources are scarce could survive at low population density. Amazingly, in Foreste Casentinesi, Monte Falterona e Campigna National Park we have recorded the lowest value of IKA (0.010) among all carried out researches; this area has the typical ecological features deemed suitable and optimum for the pine marten, like extensive beech and coniferous forests. Conversely pine marten was abundant in the Natura 2000 areas of Umbria, characterized by coppice of oak. Even in hilly areas of Monti Amerini there is an exclusive presence of pine marten. This allow us to assume that the species is not so closely linked to particular preserved habitats, and perhaps its current range in Central Italy is the result of the persecution to which it has been subjected in the past decades. As we have demonstrated, Natura 2000 sites could represent a key stone areas for the conservation of pine marten in central Italy. For this it is necessary to strengthen and enforce, if possible, the legislation that regulates the Sites of Community Importance and continue with monitoring, as foreseen by Habitats Directive. At the same time, research and monitoring programs specifically dedicated to this carnivore (hopefully with the use of genetic tools) should be implemented in the protected areas (National and Regional Parks), since the pine marten, as well as being protected by national legislation, it is also included in the annexes of the Habitats Directive.

Stima di densità di capriolo italico *Capreolus capreolus italicus* e interazione con i bovini nel Parco Nazionale del Gargano

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R089

I bassi valori di densità e l'isolamento geografico sono tra i più importanti fattori di criticità che potrebbero compromettere la conservazione del nucleo autoctono di capriolo nel Parco Nazionale del Gargano (PNG). La stima dei parametri di abbondanza del capriolo mediante l'uso di metodiche tradizionali risulta difficoltosa per la morfologia dell'area d'indagine, che rende il metodo della battuta già applicato, particolarmente oneroso e adottabile soltanto a porzioni modeste del complesso e strutturato territorio garganico. Mediante l'utilizzo del fototrappolaggio, nel corso del quadriennio 2009-2012, sono stati perseguiti i seguenti obiettivi: (i) stima della densità del capriolo del PNG mediante l'applicazione del REM (*Random Encounter Model*); (ii) analisi dell'interazione del capriolo con i bovini, mediante il confronto tra i ritmi di attività e l'utilizzo dello spazio nell'area di studio.

Durante il periodo territoriale e riproduttivo del 2011, con uno sforzo di 31200 h (8 sessioni), sono stati ottenuti 89 contatti di capriolo. La stima di densità, ottenuta applicando il REM, è risultata pari a 8.7 capi/100 ha (I.C. 95% \pm 2.7). Tale valore non differisce significativamente dalle stime ottenute tra il 2007 ed il 2009 mediante conteggi in battuta ($\chi^2=4$; $p>0.05$; K-W

H-Test).

Per lo studio delle interazioni tra capriolo e bovini su un lungo intervallo temporale (2009-2012, per un totale di 103523 h) sono stati analizzati 863 contatti di capriolo e 1011 di bovini. L'analisi dell'attività del capriolo e dei bovini podolici, allevati allo stato brado, ha mostrato un elevato grado di sovrapposizione temporale con *overlap* del 79% (*overlap Package for R*); questa condizione, con molta probabilità, ha innescato una separazione spaziale ($F=0.09$, $p>0.05$, *sample corr.=0.02*; modified t-test - *Package spatial for R*), al fine di minimizzare le interazioni di tipo competitivo.

Il fototrappolaggio, attraverso l'applicazione del metodo REM, si conferma un metodo idoneo alla stima di densità di specie rare ed elusive, e particolarmente adatto all'utilizzo in contesti ambientali impervi; inoltre, dal presente studio emerge come il metodo del fototrappolaggio possa rappresentare uno strumento per il monitoraggio di fattori, anche di origine antropica, potenzialmente compromettenti la conservazione delle specie. Nello specifico, la presenza dei bovini allo stato brado potrebbe rappresentare un ulteriore e rilevante fattore limitante per la conservazione del capriolo nell'area del PNG.

ToscoBat as a cooperative data collection tool between bat experts and speleologists

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R076

For the high costs and time needed, bat specialists generally sample bat colonies properly once or twice a year just in few underground sites among the many caves they should visit. Moreover, there are a lot of caves with bats that specialists do not even know or they are technically a challenge. Nevertheless, artificial and natural underground sites, like caves and mines, are focal habitats for bat conservation, even in the Mediterranean area. Therefore a proper knowledge of the presence and abundance of bats in caves during the year in a given area is a primary tool to develop a useful conservation bat plan at local and lower scale. Collection of such data is a great concern for bat specialists that often ask for help to speleologists that visit caves more frequently than them.

In Tuscany the cooperation between bat experts and speleologists increased in the last years, where free training meetings on biospeleology are yearly held by experts. During those meetings bat experts speak about the biology of cave animals, also making speleologists aware about the best practices during underground explorations. By the other side, speleologists realize the key role of bats in the underground habitat, and when they find significant bat observations, they contact bat specialists.

To strengthen and make easier this collaboration at a local scale, we developed an online database (ToscoBat) to share with speleologists. The database aims to collect data about bat presence in the caves of Tuscany. Thanks to the collaboration of IMSEO

s.r.l. that practically developed our online tool, and the help of Federazione Speleologica Toscana that tested it, the database was released in spring 2014. Providing personal information, any speleologist may sign up to ToscoBat, which contains geographical information about all the known caves in the area.

Registered speleologists, called "speleusers", that during their exploration in caves or mines observe bats or at least their traces, after safely returning to their home, may login and fill a simple form giving information about site, time and object of their observations. Speleusers can also upload pictures about bats and the investigated caves. The information collected by speleologists will be validated by experts to reduce input errors. By the other side, speleologists can consult the database to check the presence of bats in caves they wish to visit during the various periods of the year. Speleusers can also read the conservation measures suggested by experts for each cave, included the periods in which the exploration is preferably avoided.

We are currently analyzing and processing the first information collected thanks to the help of speleusers and we look forward to an increase of registered users to our tool towards the speleological world is showing a growing interest. In the end, we strongly think that sharing knowledge and experience between people that enjoy the unkind but fascinating underground habitat is the only way toward its effective conservation.

How to be a male at different elevations: ecology of intra-sexual segregation in the trawling bat *Myotis daubentonii*

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R069

Sexual segregation is observed in many bat species of temperate areas. Besides its ecological and evolutionary interest, sexual segregation has also significant consequences for species management as its knowledge may be crucial to tailor appropriate conservation plans. Daubenton's bat *Myotis daubentonii* constitutes an interesting model species as in several regions of Europe, including Italy, adult males are disproportionately abundant at higher elevations, while females are restricted to lower altitudes, where they may exploit productive foraging habitats and warmer roosting conditions. Low-altitude males share summer roosts with females and have been found to take advantage of this proximity by mating in summer too besides autumn.

We studied the ecology of intra-male segregation in a *M. daubentonii* population by exploring differences in body condition, thermoregulation, use of space and habitat selection between two altitude zones (respectively > 1000 m a.s.l. and < 900 m a.s.l.). The study area was the Sangro River, in the Abruzzo, Lazio and Molise National Park and its buffer zone. We tested the following hypotheses:

1. To minimize energy loss in less productive, colder environments, high-altitude males (hereafter termed HM) will show a deeper daily torpor than low-altitude males (LM);
2. LM will have a better body condition because they feed in more productive areas;
3. HM will be more flexible in habitat selection to best adapt to a less productive environment;
4. One controversial issue is whether HM are excluded from lower elevations by intraspecific competition with resident bats, or alternatively they deliberately select areas located higher up. To test this, we translocated 10 HM to a low-altitude roost. If such HM will stay in the new area, the competition hypothesis is disproved.

Heterothermy was assessed by tagging bats with LB-2T Holohil temperature-sensitive radio-transmitters. HM used prolonged and deeper torpor according to our hypothesis as their Heterothermy Index (HI) was higher (N=22, GLM ANOVA, $p < 0.05$). HI showed a negative correlation ($r = -0.57$) with ambient temperature ($p < 0.005$).

Our hypothesis regarding body condition was partly confirmed. Scaled Mass Index measured for 198 bats captured in 2000-2013 showed that LM have a significantly better condition than

HM (GLM ANOVA, $p < 0.005$); season (classified according to reproduction time in the area as pre-birth and post-birth) had no effect on this factor but showed a significant interaction with elevation ($p < 0.01$). This effect reflected the fact that although in late spring LM had a better body condition, this dropped over the season, possibly because of energy loss due to reduced opportunities to use torpor.

We assessed habitat selection by radiotracking 23 bats. Data were analyzed with compositional analysis. At high elevation, we obtained the following ranking (where significant differences occur, habitats are separated with >>>): River-riparian vegetation on both banks > Lake shore-no riparian vegetation > Lake shore-riparian vegetation > Lake core > River-riparian vegetation on one bank > Flooded *Salix* woodland >>> River-no riparian vegetation.

At low elevation we obtained what follows: River-riparian vegetation on both banks >>> Lake shore-riparian vegetation > Lake shore-no riparian vegetation > River-no riparian vegetation > River-riparian vegetation on one bank > Lake core > Flooded *Salix* woodland. LM mainly selected riparian vegetation whereas HM were more generalist as almost all habitats except one ranked as most preferred.

Eight out of ten translocated bats moved back to high elevation in one or two nights, two stayed at low altitude but roosted separately from resident bats and were less active or selected marginal habitat. Although we do not really know whether bats were excluded from low elevation by conspecifics roosting there, our data cannot disprove the competition hypothesis.

Overall, the more selective and diurnally homeothermic LM show a better body condition in late spring (possibly as a consequence of higher food availability in that period and / or hibernating in milder climate) but then they lose weight. HM prove more flexible as they forage in a broader range of habitats and make a larger use of daily torpor, strategies that in the long run appear rewarding as unlike LM at least they showed no body condition drop over summer. We conclude that the main benefit for LM is not energetic but probably reproductive as they may increase fitness by extra-mating. However, a better body condition following hibernation might also imply a higher survival likelihood of LM at that time of year.

IX Congresso Italiano di Teriologia

Analysis of the distribution of hibernating bats in old gypsum quarry tunnels in relation with temperature variation

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R100

The use of a GIS modelling of environments parameter for animal distribution is tested researching possible correlations between perceived temperature and location of hibernating populations of bats. Choosing a hibernating position is one of the key factors for individual survival in a species that could pass also 4 months per year in lethargy.

The backdrop where this study has been realized is the system of tunnels, largely disused, of gypsum quarry of Monte Tondo at Borgo Rivola (RA). There are around 15 km of large tunnels, resulting from past mining workings in the operating mode of "tunnels and diaphragms". This network of undergrounds work up on four altitude levels. Within these tunnels it is possible to recognize areas with different values of temperature, humidity and air flow that influence the vital functions of the community of bats. It is interesting to note that despite the quarry is still active with noises and tremors, the colonies are all year round present in the system that offers a wide variation of temperature and relative humidity conditions.

The species presents are *Miniopterus schreibersii*, that repres-

ents the largest group that and can reach the 4000 specimens during the reproduction period, *Rhinolophus hipposideros*, *R. ferrumequinum*, *R. euryale* also reproductive, *Myotis myotis* and *M. blythii* with few hundreds individuals during the breeding season.

Infrared cameras that incorporate temperature measurement (FLIR E30, Pergam Italy) were used in order not to disturb the hibernating bats. Every month, from December 2012 to the end of the hibernation, individuals or groups temperature have been measured to 0.1° C.

In nearly every case the temperature of bats proved to be the same temperature as the surrounding bedrock. Values of 7.5° to 8.5° C in bodies are the most common during the deepest hibernation. Collecting measurements of temperature values of all individuals and evaluating the setting of roosting, will make possible in the future to represent the area of study like a semi-continuous variation of thermal values thus providing a model of the spatial-thermal distribution of individuals and groups in relationship with the microclimatic conditions of tunnels.

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The role of interspecific interactions in shaping small mammal communities in fragmented landscapes

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R087

Habitat fragmentation is one of the main threats to biodiversity. This process directly influences individual populations by modifying, degrading and disrupting their natural habitats; it also alters interspecific relationships by modifying the competitive advantage of one species over the others. Theoretical models predict that generalist species may benefit from habitat fragmentation, increasing their competitive advantage over more specialized species, which are expected to decline. Nevertheless, very few empirical studies assess the actual role of interspecific interactions in determining the coexistence of species in fragmented landscapes. Understanding the ecological mechanisms underlying the effects of habitat fragmentation has relevant consequences for the conservation of animal species and communities as it allows to focus conservation efforts to the proper target. We studied a model system of three sympatric and potentially competing small mammal species (*Apodemus sylvaticus*, *A. flavicollis* and *Myodes glareolus*). Our aim was to understand the role of interspecific interactions, compared to habitat and landscape factors, in shaping small mammal communities in fragmented landscapes.

The study area included 29 wood patches in a fragmented landscape in central Italy; wood patches were selected following a gradient in size and habitat characteristics so as to be able to evaluate the response of each species to environmental factors. We surveyed the populations following a capture mark-recapture (CMR) protocol from April 2011 to February 2013, with trap-

ping sessions every two months for a total of about 50000 trap-nights. Due to the strongly dynamic demographic pattern that these populations naturally experienced during the study period, we could directly measure the response of each species following a reduction or increase in the competitors. By conducting a CMR-based demographic study we measured the actual performance of individuals and populations on several biological parameters (survival rate, recruitment, reproduction rates, body mass, population density). We analyzed data with robust design CMR models (abundance estimates, survival rates and recruitment) and generalized linear models (density of individuals, body mass, reproduction rates).

We captured a total of 4645 individuals (1468 *A. sylvaticus*, 2056 *A. flavicollis* and 1121 *M. glareolus*). Our results support the hypothesis of spatial segregation of competitors, which responded to different environmental factors. More detailed analyses, however, revealed that the degree of interference between species was low, with negative effects at the individual level (e.g. body size, survival) that were not translated into population-level effects.

Our results suggest that the actual role of competition in shaping communities in fragmented landscapes may be weaker than expected, or may indicate that other mechanisms intervene in regulating the interaction between species before detrimental effects are expressed.

Paleobiogeografia di *Lepus corsicanus*P. VISMARA¹, F. RIGA², B. SALA¹, V. TROCCHI²¹ Dipartimento Biologia ed Evoluzione, Università di Ferrara² Istituto Superiore Protezione Ricerca Ambientale

Le prime presenze del Genere *Lepus* in Italia risalgono al Pleistocene medio (almeno 500000 anni fa) con reperti fossili inizialmente non classificati a livello specifico, oppure indicati come *Lepus europaeus* o *Lepus timidus*. Infatti, i reperti già descritti come *Lepus valdarnensis* e *Lepus etruscus*, del Villafranchiano, si sono rivelati appartenere a *Oryctolagus lacosti*, un coniglio ora estinto. Dopo la riscoperta di *Lepus corsicanus* è sorta però l'esigenza di una generale revisione del materiale fossile per tentare di ricostruire l'origine e la distribuzione pregressa delle lepri in Italia. Una prima analisi qualitativa su pochi reperti è stata realizzata da Trocchi e Riga (2005) su materiale della Grotta Romanelli e di Melpignano (LE) ed ha confermato la presenza di *L. corsicanus* al termine dell'ultimo periodo glaciale.

Per realizzare un'analisi sistematica mancava, tuttavia, uno strumento diagnostico per discriminare i reperti di *L. corsicanus*, *L. europaeus* e *L. timidus* potenzialmente presenti nei siti della Penisola. Scopo del presente lavoro è stato di colmare tale lacuna conoscitiva attraverso la definizione di una chiave dicotomica di discriminazione odontologica che prendesse in considerazione il 2° e 3° premolare superiore (P² e P³) e il 3° premolare inferiore (P₃). Sono stati esaminati n. 1031 denti di individui recenti appartenenti a *L. corsicanus* (176), *L. europaeus* (750), *L. capensis* (32) e *L. timidus* (73), reperiti presso il Museo ISPRA (ex INFS), il MCSN di Milano e il *Naturhistorisches Museum* di Vienna. Sui 3 tipi di denti analizzati è stata effettuata un'analisi comparata della morfologia della superficie occlusale al fine di identificare i caratteri diagnostici delle 4 specie. L'analisi ha permesso di identificare 12 caratteri morfologici, sui tre denti considerati, che consentono di discriminare con sicurezza le 4 specie presenti in Italia.

La seconda parte dello studio ha preso in considerazione il

materiale delle collezioni fossili di *Lepus* di alcuni siti della Penisola (n. 9), riferibili a un intervallo cronologico compreso tra il Pleistocene medio e l'Olocene, al fine di attuare una revisione dei *taxa* applicando la chiave di discriminazione morfo-odontologica precedentemente creata.

I risultati ottenuti attestano che fin dall'inizio del Pleistocene superiore e poi durante l'Olocene *L. corsicanus* era la sola lepre presente nell'Italia meridionale, con una distribuzione analoga a quella attuale. Inoltre, *L. corsicanus* è stata trovata anche nel Nord Italia durante il Pleistocene medio (Visogliano, in livelli datati tra 445000 e 383000 anni fa). I reperti di Visogliano rappresentano la prima comparsa del genere *Lepus* in Italia, antecedenti quindi l'arrivo di *L. europaeus*. È stato infine possibile circoscrivere l'arrivo di *L. europaeus* in Italia (siti della provincia di Verona: Montorio, Sant'Anna d'Alfaedo, Castello Soave e Buso della Catina) in un momento di fine Pleistocene medio, forse proprio corrispondente al passaggio dal Galeriano al Post-Galeriano. L'ipotesi di una prima colonizzazione da parte di una popolazione ancestrale di *L. europaeus* era stata avanzata anche studi genetici e confermata sulla base di dati filogenetici, e collocata nel tardo Pleistocene.

I risultati relativi a *L. corsicanus* rappresentano una prima conferma dell'ipotesi scaturita dagli studi filogenetici che riconoscono in *Lepus castroviejoii* (dei Monti Cantabrici in Spagna) una "forma sorella" (*sister taxa*) di *L. corsicanus*, a testimonianza di un'unica antica popolazione d'origine, che doveva essere diffusa almeno tra la Penisola Italica e quella Iberica. Il ritrovamento di Visogliano rappresenta il primo passo per la ricostruzione dell'areale originario di *Lepus corsicanus-castroviejoii*. In questo lavoro non sono stati analizzati campioni di *L. castroviejoii*.

Unduplicated counts of females with cubs in the core Apennine brown bear (*Ursus arctos marsicanus*) population: 2006-2013

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R127

Apennine brown bears (*Ursus arctos marsicanus*) occur in a small, isolated population living in the Abruzzo, Lazio and Molise National Park (PNALM) and adjacent areas. Whereas formal estimates of population size have been produced only recently (2004, 2008, and 2011), the first records of reproductive females were collected by park wardens since 1960, even though their interpretability suffers from the lack of a standardized protocol and of reliable criteria to distinguish different family groups. As a part of an on-going project to evaluate trends of this bear population, from 2006 to 2013 we conducted unduplicated counts of females with cubs (FWC) with the aim to: 1) develop a standardized approach for the efficient application of this technique in the long term; 2) develop population-specific spatiotemporal criteria, based on daily movements of GPS-equipped adult females, to differentiate unique FWC; 3) to obtain reliable counts of the minimum number of FWC on an annual basis, useful to aid interpretation of the overall population trend. Annual counts of FWC are being implemented in several European and North American brown bear populations in order to evaluate their reproductive success. According to conservative criteria, one basic assumption of this technique is the uniqueness of each of the family groups which are individually counted (i.e., unduplicated counts). We considered as distinct two family groups if they were observed simultaneously or, alternatively, if they featured unique characteristics (i.e., radio-collars, ear-tags, natural marks). For all other cases (i.e., sequential sightings of unmarked family units), we applied spatiotemporal criteria based on the upper 95% CI limit of seasonal ranges' diameter ($D_{\max}=11$ km), or on the upper 95% CI limit of hourly movement rates ($V_{\max}=1.46$ km/h). In addition, to optimize the efficiency of the technique, we conducted simultaneous observation sessions in July-September at alpine buckthorn (*Rhamnus alpinus*) areas, where bears seasonally aggregate and where FWC sightability is highest. Each year, from 3 to 6 simultaneous observation sessions have been replicated from 14-46 vantage points, involving research staff, PNALM wardens, Forestry Service personnel, students and volunteers. To increase the coverage of the population, observations were also conducted opportunistically, incidentally to other field and/or patrolling activities, and to verify sightings reported by local people or tourists. From 2006-

2013, we recorded on average (\pm DS) 32 (\pm 21; range: 6-58 FWC) FWC sightings/year, corresponding to an average minimum count of 3.6 (\pm 1.8; range:1-6) FWC/year. The total FWC counted in the overall period (n=25) corresponded to 40 pairwise comparisons, most of which (60%, n=24) were resolved based on unique characteristics, 18% (n=7) on simultaneity of sightings, 15% (n=6) on spatiotemporal criteria, and 7% (n=3) on *ad hoc* criteria. As a measure of validation of our spatiotemporal criteria, most (n=12) of unique FWC whose distinction had been based on unique characteristics were also tallied as unique according to spatiotemporal criteria only. However, if 0-2 FWC each year lacked individual marks, we would not have tallied them in the unduplicated counts, as they were not observed simultaneously and had largely overlapping home ranges. This underlines how simultaneity of sightings, and the availability of marked females in the population are both essential requisites to prevent this technique from rendering overly conservative counts in our study area. Annual observation effort (i.e., total hours) was comparable among years (Kolmogorov-Smirnov one sample test, $p=0.30$), and no correlation was detected between annual FWC counts and bear sighting rate (no. of bear sightings/100 hours of observations) (Spearman's $r=0.29$, $p=0.53$), lending confidence that the annual variability in FWC counts (lowest counts in 2011 and 2013, and highest in 2008 and 2012) was real and not an artefact of uncontrolled survey factors. In total, we tallied 49 cubs in 26 litters, corresponding to a minimum average of 6.7 (\pm 3.0; range=3-11) cubs/year produced by the bear population in the PNALM, and to a mean apparent litter size of 1.88 (\pm 0.71; range 1-3) cubs/reproducing female/year. On average, the number of females with yearlings we detected each year was lower compared to that expected based on FWC counts in the previous year, possibly a result of an early age of weaning, cub mortality, or both. Based on direct observations of marked females, we also attempt indicative estimates of some reproductive parameters useful for population projection (e.g., interbirth interval, reproductive rate, age of weaning). However, we stress the urgency to establish a long-term study based on a large sample of marked adult females through adequate methods (i.e., telemetry) in order to accurately assess critical reproductive parameters of this endangered bear population.

Small population paradigm and the Apennine brown bear conservation: need of a “cautious intermixing”?

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R038

In a seminal paper of 1994, Graham Caughley distinguished two main threads in species conservation; the small population paradigm and the declining population paradigm. However, he wished that an integration was possible, and he mentioned a conservation program for the island endemic Lord Howe woodhen *Tricholimnas sylvestris* as a specific positive example.

It has been argued recently that infusion of small population theory could be extremely beneficial to the conservation strategy of the highly threatened Apennine brown bear. Instead, the current strategy is apparently based on a very pragmatic declining population paradigm with little theoretical underpinning.

The call for captive breeding and *ex situ* conservation efforts (i.e. cryopreservation of sperm and eggs, artificial insemination etc.) first and foremost means recognizing an unique taxonomic and ecological status for the isolated Apennine brown bear *Ursus arctos marsicanus* Altobello. This approach is challenged by initiatives such as the recently released Italian IUCN Red List in

which both *marsicanus* and *arctos* subspecies are classified as CR (Critically Endangered), even if the latter includes the thousands outside the Italian border. While we strongly advocated a “cautious intermixing” of the two Caughleyian paradigms, a cursory review of the National Action Plan for the Apennine bear suggests that such document needs integration and updating regarding several aspects of bear’s social behavior of high management relevance.

The integration of an *ex situ* component into the conservation strategy of *U. a. marsicanus* means involving professionals with a zoo-biology background and strengthening the international collaboration between public and private institutions under a unique technical–scientific consortium.

Furthermore, successful reintroductions of captive-bred bears may be accomplished looking at experience gained by practitioners releasing bear cub orphans of different species around the world.

Workshop - Interventi concreti di conservazione dell'orso bruno: il Progetto LIFE ARCTOS (2010-2014)

L'orso bruno (*Ursus arctos*) è presente in Italia con tre distinti nuclei: nelle Alpi Centrali, in particolare nel Trentino occidentale, nel Tarvisiano e zone di confine tra Friuli Venezia Giulia e Slovenia, e nell'Appennino centrale, in particolare nel Parco Nazionale d'Abruzzo Lazio e Molise. Gli attuali nuclei alpini sono frutto di uno specifico progetto di reintroduzione effettuato nel Parco Naturale Adamello-Brenta, e di una espansione della popolazione slovena, mentre la popolazione appenninica, costituita da poche decine di individui, costituisce una entità sottospecifica di particolare interesse, soggetta a un alto rischio di estinzione. Il progetto LIFE Arctos (LIFE09/NAT/IT/000160) riunisce diversi soggetti istituzionali con l'obiettivo di avviare una serie di interventi strutturali, sia sulle Alpi che in Appennino, in linea con quanto previsto dai piani d'azione sviluppati per la tutela dell'orso, ossia favorire la tutela della specie, sostenerne l'espansione numerica, attraverso l'adozione di specifiche misure gestionali, la riduzione dei conflitti e la veicolazione di adeguate informazioni finalizzate alla sensibilizzazione dei principali *stakeholder*.

Le azioni di progetto hanno consentito una analisi più approfondita di alcune delle criticità individuate nei Piani di azione e l'elaborazione di documenti ed interventi concreti utili al loro superamento, oltre che alla mitigazione dei conflitti innescati dalla presenza di grandi carnivori. Obiettivo del *workshop* è presentare una sintesi delle attività svolte nell'ambito del progetto, ponendo in evidenza le azioni di interesse conservazionistico che potranno proseguire oltre la naturale scadenza del Progetto LIFE.

Coordinatori

Luigi BOITANI, Università "la Sapienza", Roma

Cinzia SULLI, Parco Nazionale d'Abruzzo Lazio e Molise

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Orso senza confini? Il contributo di ARCTOS alla gestione condivisa della popolazione alpina di Orso bruno

G. NADALIN, E. TIRONI, E.M. ROSSI, C. GROFF, S. MACCHI



W007

Il progetto di reintroduzione dell'orso nel territorio del Parco Adamello Brenta (*Life Ursus*) unitamente alla progressiva migrazione di orsi provenienti dalla confinata Slovenia nel territorio del Friuli-Venezia-Giulia, stanno portando, sull'arco alpino, ad una presenza sempre più dinamica del plantigrado.

Il PACOBACE ha delineato, anche per i territori potenzialmente frequentati dall'orso, una serie di indicazioni utili alla conservazione e gestione degli orsi sulle alpi: dando seguito a tale accordo, siglato nel 2007, il progetto LIFE ARCTOS si è posto, fra gli altri, anche l'obiettivo di trovare strumenti attuativi che agevolino la gestione condivisa fra Enti territoriali amministrativamente diversi. All'interno del progetto trovano quindi spazio due azioni dedicate alla analisi e messa a sistema di protocolli operativi di monitoraggio e archiviazione dati (azione A4), che possano permettere, anche in futuro, la valutazione della popolazione di orso nell'area alpina (azione E4).

Nascono così la Banca Dati Genetica, che ha permesso di normalizzare le banche dati presenti a livello regionale e provinciali e creare un unico archivio nazionale omogeneo, e GeOrso, un

applicativo in ambiente web che, al momento, permette per gestire in tempo reale la dislocazione degli indici di presenza degli orsi sul territorio regionale lombardo, ma che potrebbe avere interessanti sviluppi su territorio più ampi.

Gli strumenti di archiviazione dei dati sono accompagnati da un Codice Deontologico, che regola lo scambio dei dati a livello nazionale per favorire il passaggio di informazioni e promuovere forme di gestione "a livello di popolazione", a cui hanno aderito i partner progettuali.

I diversi livelli di monitoraggio attuati sulle Alpi italiane, in cui si inserisce il protocollo di monitoraggio di Regione Lombardia, attivato nell'ambito di LIFE ARCTOS, trovano un punto di incontro nel Protocollo di analisi dei dati minimi condivisi fra le Amministrazioni, ove partecipano, oltre ai partner progettuali, anche altre amministrazioni italiane.

Il processo di condivisione iniziato con LIFE ARCTOS vuole essere di stimolo ad una visione più vasta, e sono stati pertanto promossi workshop internazionali, che hanno visto il coinvolgimento della Convenzione delle Alpi.

Dai conflitti con la zootecnia ad una gestione della zootecnia

C. SULLI, R. LATINI, C. GENTILE, D. D'AMICO



W008

La protezione dell'ultima popolazione di orso marsicano è strettamente correlata con la gestione di alcune attività antropiche presenti nella core-area della specie. Tra queste, la zootecnia è sicuramente una di quelle che può entrare in conflitto con la presenza della specie se non opportunamente gestita.

All'interno del progetto ARCTOS è stata effettuata una analisi approfondita della pratica zootecnica nelle aree protette dell'Appennino con l'obiettivo di acquisire le conoscenze necessarie per elaborare delle linee guida. Le linee guida rappresentano un approccio integrato che, dando una serie di indirizzi chiari per una migliore coesistenza tra l'attività zootecnica e la presenza dell'orso marsicano, dovrebbe consentire di superare i conflitti esistenti in favore di una gestione chiara e condivisa.

La prima criticità evidenziata dall'analisi condotta sul comparto zootecnico ha messo in evidenza che le aree protette operano in assenza di un piano di gestione dei pascoli e dell'attività zootecnica. Questa criticità diviene quindi il primo obiettivo da raggiungere per migliorare la gestione del territorio: il Parco Nazionale d'Abruzzo, Lazio e Molise, approfittando della felice coincidenza data dalla redazione del Piano di Gestione dei siti Natura 2000, ha dato incarico all'Università della Tuscia di analizzare la situazione dei pascoli dal punto di vista vegetazionale e della capacità produttiva e avanzare una ipotesi di gestione degli stessi.

Il piano dei pascoli dopo una ricognizione e descrizione degli habitat e una valutazione delle capacità produttive delle varie tipologie di pascolo si è focalizzato innanzitutto su quei contesti in cui le pratiche pastorali estensive risultano ancora attive sul territorio. Lo studio ha quindi fornito delle raccomandazioni di carico minimo e massimo e di prassi zootecniche proprio con l'obiettivo di razionalizzare l'uso delle risorse pascolive garantendone la conservazione anche in termini di biodiversità. Si tratta di indicazioni a carattere sperimentale per cui un corretto monitoraggio tramite un apposito sistema di indicatori potrà verificare nel corso del tempo l'efficacia delle soluzioni proposte e permettere di portare eventuali aggiustamenti nelle prassi gestionali delle risorse zootecniche in una logica di gestione adattativa.

Contemporaneamente, nell'ottica di un percorso condiviso, è stata formata una commissione pascoli all'interno della quale, oltre al Parco, sono presenti anche rappresentanti del mondo degli allevatori e rappresentanti degli amministratori locali. Con loro si intende costruire un percorso partecipato che porti alla redazione di un piano di gestione del comparto zootecnico in cui vengano favorite pratiche di conduzione del bestiame rispettose delle esigenze di conservazione della popolazione di orso marsicano e che non penalizzino le attività delle aziende zootecniche presenti.

La gestione degli orsi problematici in area alpina dal PACOBACE agli strumenti di ARCTOS

G. NADALIN, U. FATTORI, E. TIRONI, E.M. ROSSI, L. SAMMARONE



W009

Le gestione di esemplari di orso bruno, definiti problematici o confidenti in base al Piano d'Azione per l'Orso bruno delle Alpi Centro orientali (PACOBACE), ha rappresentato fin dall'attuazione del progetto di reintroduzione della specie nel territorio del Parco Adamello Brenta (*Life Ursus*), una delle principali minacce alla buona riuscita del progetto stesso, perché sono proprio questi soggetti a rappresentare il principale elemento critico nel rapporto con le popolazioni locali.

Tuttavia, né il progetto *Life Ursus*, per sua natura limitato all'area trentina, né il PACOBACE, avevano consentito, se non in linea teorica, di delineare ed individuare le procedure operative e le risorse, soprattutto umane, con cui gestire la criticità in aree diverse da quelle centrali rispetto alla core area della popolazione reintrodotta nelle alpi centro orientali.

Il progetto Life ARCTOS, avendo come obiettivo l'attivazione di procedure per la gestione degli orsi problematici (Azione C4), ha

invece consentito di affrontare con una logica di "area vasta", ovvero dal Friuli orientale alla Lombardia, gli aspetti connessi all'organizzazione di un sistema operativo funzionale ad assicurare interventi efficaci nella gestione di eventuali criticità relative alla presenza di orsi confidenti.

A seguito di specifici protocolli ed intese tra gli Enti direttamente coinvolti (Regione Lombardia, Regione Autonoma Friuli Venezia Giulia, Regione Veneto e Corpo Forestale dello Stato), si è così proceduto alla definizione di procedure codificate, alla formazione di unità qualificate ed alla definizione di un coordinamento operativo con le altre strutture territoriali coinvolte nella gestione di un orso confidente, dando così concreta attuazione alle misure ipotizzate nel PACOBACE e superando così definitivamente una carenza strutturale che ora andrà solo gestita, valorizzando ulteriormente le esperienze comuni condivise tra gli Enti coinvolti.

La mitigazione del conflitto: strumenti diversi con esiti diversi

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W010

Tra i principali impegni del progetto LIFE Arctos quello di promuovere azioni volte a facilitare e favorire la convivenza con questo grande carnivoro. Difatti ovunque nel mondo come nel contesto nazionale il conflitto tra i grandi carnivori e le attività umane, con particolare riferimento alle attività zootecniche, costituisce la più importante ragione delle continue persecuzioni dell'uomo nei loro riguardi e rappresenta pertanto una delle principali, se non in alcuni casi la principale, minaccia per la conservazione di queste specie nel lungo periodo, ciò è ancora più vero in ambiti territoriali con una elevata presenza umana. La risoluzione del conflitto rappresenta un passaggio imprescindibile per lo sviluppo di adeguate politiche di conservazione in ambito nazionale e per specie chiave come l'orso bruno (*Ursus arctos*) elemento di elevatissimo valore conservazionistico del nostro patrimonio di biodiversità.

Nel lavoro svolto il termine conflitto è stato inteso come il risultato della interazione tra diverse attività umane, non solo l'allevamento zootecnico, e il nostro plantigrado, ciò ha comportato l'analisi di una serie di problematiche e attività che più o meno sono risultate avere una qualche incidenza nella conservazione dell'orso bruno in Italia. Una particolare attenzione è stata rivolta nello sviluppo di una Indagine approfondita dei danni al patrimonio zootecnico e sulla efficacia delle politiche di gestione del conflitto portate avanti in quegli ambiti amministrativi e aree protette interessate dalla presenza dell'orso ed in alcuni casi coincidenti anche con la presenza di un altro importante predatore presente in Italia quale il lupo. L'evoluzione di questa analisi è stata la redazione di un documento di indirizzo che potesse fornire indicazioni per la gestione del conflitto da porre all'attenzione di enti ed amministrazioni e lo sviluppo di un attività di messa a sistema di adeguati strumenti di prevenzione utili a contenere il fenomeno dei danni e mitigare il conflitto. Con lo sviluppo di questi interventi di sostegno alle diverse attività agrosilvopastorali si è promossa la cessione in comodato d'uso gratuito di recinti elettrificati ad aziende del ramo agro-zootecnico e a privati nei territori interessati dal progetto. L'analisi qui di seguito presentata è però stata promossa in via

sperimentale solo nei territori del PNALM e aree limitrofe e sarà valutata la possibilità di estenderla anche in altri contesti.

Nelle aree del PNALM e della sua ZPE tra il 2009 ed il 2013 sono stati complessivamente consegnati 189 recinti elettrificati, tra stanziali ed amovibili, utilizzati nei diversi compartimenti produttivi (allevamento, agricoltura, apicoltura etc). Il 74.61% di questi risulta essere attualmente operativo (efficacia di funzionamento per anno = $74.49 \pm 9.12\%$). Di questi è stato selezionato un campione in base alla riconosciuta funzionalità dello strumento e alla sua reale e costante utilizzazione.

È stata operata una suddivisione dei dati in base alle richieste di indennizzo per anno ed alle somme elargite per specie per anno. In entrambi i casi si evidenzia che la specie che interessa il maggior numero di richieste e di indennizzi reali è il lupo (mediamente il 66.30% delle richieste annue ed il 65.40% dei risarcimenti per anno), mentre l'orso interessa una frazione minore sia delle richieste di indennizzo (mediamente il 29.87% per anno) che degli indennizzi elargiti (mediamente il 33.07% per anno).

Efficacia comparto allevamento: Sono stati considerati in tale contesto 136 recinti amovibili, di cui 114 messi in funzione ed operanti costantemente, ad un totale di 128 aziende o persone giuridiche richiedenti operanti nel campo dell'allevamento, di cui 45 interessate da danni. È stata pertanto considerata, al fine di evidenziare l'efficacia dei recinti, la media annua dei danni prima e dopo l'entrata in funzione dei recinti rilevando una efficacia molto alta, con una riduzione, tra i due periodi, dell'82.64% delle richieste di indennizzo liquidate, e una significativa differenza tra i due periodi ($\chi^2=278800.6$ df=106 $p<0,000001$; Wilcoxon matched pair test $Z_{107}=5.50$; $p<0.00001$).

Efficacia comparto agricoltura: Sono state considerate 24 aziende o persone fisiche che hanno avanzato richieste di indennizzo, liquidate, alle quali sono stati consegnati dei recinti. L'analisi dei dati evidenzia una efficacia molto alta, considerando la media annua dei danni per azienda prima e dopo l'utilizzo dei recinti, con ottiene una riduzione del 81.25% degli indennizzi.

Sanitary monitoring within the Apennine brown bear *Ursus arctos marsicanus* areal: from guidelines to an integrated management plan

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W011

Protecting the residual Apennine brown bear (*Ursus arctos marsicanus*) population is strictly connected to the proper sanitary management of the ecosystems where this specie lives. This small, isolated population is not probably able to afford unexpected environmental changes, as the introduction of new pathogens or an increase of the existing pathogen strength can be.

As a part of C2 Action of LIFE+ ARCTOS (LIFE09NAT/IT/000160), and based on “*Guidelines for an effective sanitary management of Apennine brown bear population*” developed in previous technical meetings at Health Ministry, has been draw up a “*Management Plan Proposal for dealing with sanitary aspects linked to Apennine brown bear conservation*”. Primary seven diseases were highlighted as potential hazards for bears: brucellosis, canine distemper virus (CDV), canine parvovirus (CPV), Aujeszky’s diseases, leptospirosis, canine hepatitis, toxoplasmosis.

While livestock disease such as brucellosis are constantly monitored by Azienda Sanitaria Locale (Public Sanitary Agency), dogs (CDV, CPV, leptospirosis, canine hepatitis) and wild boar diseases (Aujeszky’s diseases) are not, representing a serious danger for bears.

Twenty meetings were organized with different stakeholders (vets, hunters, farmers) in order to show the Management Plan and raise public awareness on the importance of a sanitary monitoring for domestic species and wildlife.

Seventy samples of lung, spleen and liver has been collected from wild boars harvested by hunters in the External Protection Zone (ZPE) of the Abruzzo Lazio and Molise National Park (PN-ALM), in order to monitoring Aujeszky’s diseases, brucellosis, leptospirosis in wild populations. Most of the sampling effort was conducted in the part of Molise Region adjacent to PNALM. Thousands samples of blood has been collected so far from breeders dogs during a serologic survey and free vaccination campaign of dogs, organized in association with the Istituto Zooprofilattico Sperimentale of Teramo. Thanks to Life Arctos funds, was possible to purchase 7000 vaccines destined mostly to breeders dogs. Veterinarians belonging to ASL and Protected Areas and the no profit association *Save the Bear* were involved in this initiative. At the same time, in association with PNALM and with the patronage of FNOVI (National Federation of Italian Vets) has been carried out the awareness campaign “*The dog... bear’s best friend*”, aimed at press the dogs owners resident in the bear habitat to vaccinate their pets and keep them under control.

The ongoing Action C2, want to create, within the Apennine bear habitat, an enduring monitoring sanitary network, robust enough to change in relation to the extreme variability and mutability of the pathogens and to be truly effective not only for bear conservation but also for the protection of other keystone species (e.g. wolf) and the maintenance of rural traditional activities (breeding, tourism, hunting, truffles searching).

Communicating brown bear: actions realized and lessons learnt through LIFE ARCTOS - Comunicare l'orso: attività intraprese e lezioni apprese nel LIFE ARCTOS

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W012

L'orso bruno (*Ursus arctos*) è una specie straordinaria: nella lunga storia di coesistenza con l'uomo, i plantigradi hanno infatti suscitato sentimenti ed emozioni contrastanti e del tutto uniche nell'immaginario collettivo. Coerentemente con gli sviluppi sociali e culturali delle popolazioni umane, gli orsi sono stati di volta in volta considerati animali nocivi e pericolosi, nemici del genere umano e addirittura minacce alla nostra supremazia sulla natura, prima di divenire simboli dell'ecosistema alpino e addirittura della natura incontaminata, in un percorso lungo il quale la specie è divenuta oggi uno degli emblemi del rinnovato rapporto tra uomo e ambiente.

Quali che siano le ragioni di questo duplice rapporto tra uomini e orsi, continuano ad essere i pregiudizi a minare la corretta e oggettiva conoscenza della specie, che è a tuttora basata più su miti e leggende che su assunzioni di ordine biologico ed ecologico. Sebbene il cambiamento economico, demografico e culturale delle regioni alpine e appenniniche abbia gradualmente modificato la percezione e sensibilità nei confronti della natura e dell'ambiente, l'immagine dell'orso bruno nell'opinione pubblica rimane spesso scorretta dal punto di vista scientifico e ciò influenza profondamente la sua accettazione sociale.

L'entità del fenomeno descritto è tale che, attualmente, il fattore che maggiormente limita l'espansione dell'orso bruno sulle Alpi e sugli Appennini, mettendo a rischio la conservazione della specie, è probabilmente proprio l'accettazione sociale da parte delle popolazioni residenti.

Per tutte le considerazioni sopra esposte, negli ultimi 20 anni circa, l'importanza delle iniziative legate alla comunicazione e divulgazione è cresciuta fortemente nel contesto dei progetti di tutela verso il plantigrado, agguadandosi poco meno di un

quinto dei budget previsionali dei progetti LIFE (media riferita a LIFE sui grandi carnivori). Il progetto LIFE ARCTOS si pone in linea con il trend sopra citato: molte attività di sensibilizzazione e disseminazione dei risultati ottenuti sono state previste e realizzate nei 4 anni di progetto, per un ammontare economico pari al 17% circa (€ 620000) del budget previsionale complessivo.

Tra le iniziative che sono state condotte con efficacia tra il 2010 e il 2014 si annoverano principalmente: programmi localizzati di partecipazione delle comunità locali, diffusione di informazioni tecniche, promozione delle azioni del progetto, attività d'informazione e sensibilizzazione nelle scuole, divulgazione di protocolli e buone pratiche allo scopo di facilitare l'espansione della specie.

Sulla base dell'esperienza acquisita grazie all'imponente impegno profuso in ambito comunicativo, si possono trarre alcuni insegnamenti, utili per chi debba occuparsi della conservazione dell'orso e degli altri grandi carnivori nel prossimo futuro. In primis, il progetto ha confermato che "comunicare l'orso" non è semplice. Al fine di aumentare l'efficacia e l'incisività delle azioni in questo ambito, risulta dunque opportuno dotarsi di un nuovo approccio comunicativo, che si basi anche sull'emotività, e di tecniche innovative, ossia di nuovi metodi di coinvolgimento e partecipazione pubblica che si vadano ad affiancare ai canali di comunicazione più consueti. E' peraltro emersa con estrema evidenza la necessità che tutte le attività vengano ricomprese in un piano strategico di comunicazione, basato su una analisi specifica e dettagliata della situazione e sviluppato in sinergia tra esperti nel settore della comunicazione e tecnici faunistici/zoologi.

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A multiscale landscape approach for variable selection in species distribution modelling

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P211

Organisms perceive their habitat at different scales in relation to different ecological requirements. Species Distribution Models are well known as a useful tool to address conservation issues. However, understanding at what scale variables influence habitat selection may contribute to obtain a more realistic picture of species ecology. To address this issue we implemented an analysis on a regional scale developing a habitat suitability model for *Nyctalus noctula* through a multiscale landscape approach for variable selection considering three spatial scales: 1, 5 and 10 km. The analysis was set in a district of central Italy (Tuscany) and as a model species we selected *N. noctula* because of its migratory behavior and consequently its potential sensitivity to multiple spatial scales. To build the presence-only model we used 58 records. We decided to use only data derived from the active period (spring and summer) obtained from bat detector surveys, roost inspection and captures as the selection of hibernacula is associated to different environmental requirements, mainly roost structure and microclimate. Variables were derived from topographical and habitat maps with a 100 m resolution: Digital Terrain Model (DTM), hydrographic map and CORINE

Land Cover 2006 (CLC). From CLC we computed 13 landscape indices using Fragstats 4.1, 8 calculated at class level (for each category of CLC) and 5 at landscape level, considering three moving windows set at the three spatial scale: 1, 5, and 10 km. To include the three spatial scales in the analysis of DTM and hydrography we calculated for each layer a focal statistic using Arcmap 10. Overall we obtained 380 variables. For the variable selection, for each variables we developed univariate models using BIOMOD and selected the ones (68) whose AUC was ≥ 0.8 . To avoid employing correlated variables we applied a correlation procedure to exclude variables whose correlation was ≥ 0.5 . In this way we obtained 10 variables which pointed out that *N. noctula* selected two scales as seven variables were at 10 km and three at 5 km. The multivariate model was robust as its AUC was ≥ 0.8 . The variables selected are all related to landscape indices underlining the importance of landscape structure for species distribution. Our approach represents a significant step towards the development of an effective approach to region-scale planning of land management for bat conservation.

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Survival, dispersal and habitat selection of brown hare (*Lepus europaeus*) in protected areas of northern Italy

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P207

Hunters and game managers in Province of Piacenza (Italy) have been remarking an overall decline of brown hare populations for the last 10 years. In 2012 we started a monitoring program from a sanitary, genetic and population dynamic point of view, with the aim to investigate the direct or indirect causes of the decline. In this poster we present the preliminary results of a monitoring of two hare populations through radiotracking. Between December 2012 and July 2013 we captured and radio-tagged 34 hares in two protected areas. We collected 2 diurnal fixes per hare per week. Data on mortality were used to carry out survival analyses with Kaplan-Meier curves. Dispersal parameter were evaluated calculating the distances between fixes. We estimated home range and core area of each individual with kernel analyses, respectively 95% and 50%. For each home range and core area we measured the usage proportions of land-use categories and we compared them with proportion of availability in the study

area. For each land-use category we calculated the Manly α index of selection to evaluate habitat selection. The effects of size of home range and core area and of dispersal parameters on survival were investigated through Cox regression analyses. The average survival (\pm SE) was 121.6 days (\pm 15.02) and the survival probability was 35.6% (\pm 12.8). The average home range (\pm SE) was 56.0 ha (\pm 12.3), the average core area was 11.9 (\pm 2.5), no significant difference emerged between sex, age and study area. At the home range level, the hares selected positively scrublands, meadows and uncultivated lands while avoided tree rows and cereals. At the core area level they positively selected meadows, uncultivated lands and woodland while avoided all the other variables. The only significant variables that affected the survival were the average distance between consecutive fixes, with a positive effect, and the maximum distance between consecutive fixes, with a negative effect.

Influenza dei fattori ambientali e sanitari sulla dinamica di popolazione del cervo sardo nell'areale di Montevecchio-Arburese

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P200

Nell'ambito della gestione dell'areale storico del Cervo sardo di Montevecchio-Arburese sono state condotte negli ultimi anni diverse azioni di gestione faunistica all'interno delle quali sono stati effettuati anche diversi controlli sanitari della popolazione. Gli esami sanitari sono stati condotti su campioni di sangue prelevati direttamente sugli animali vivi catturati in teleanestesia negli ultimi 6 anni. Il numero dei cervi campionati è stato complessivamente di 21 esemplari di cui 10 maschi adulti e sub-adulti e 11 femmine adulte e sub-adulte. Tra i diversi esami biologici a cui sono stati sottoposti gli animali campionati sono stati eseguiti gli esami delle feci, il riscontro dei parassiti esterni, l'esame del DNA su sangue e su pelo, la ricerca sierologica di diverse agenti patogeni dei ruminanti tra cui: Blue tongue, Malattia emorragica del cervo, Brucellosi, Salmonellosi, Chlamydiosi, Rickettiosi, Leptospirosi. Gli esami delle feci e quelli sierologici sono stati eseguiti dal laboratorio accreditato dell'Istituto Zooprofilattico Sperimentale della Sardegna. Dai risultati ottenuti si evidenzia che tra i patogeni ricercati sono state riscontrate positività soltanto per la *Salmonella abortus ovis* e per il virus della Blue tongue; nello specifico sono risultati positivi per *Salmonella abortus ovis* il 50% dei campioni esaminati e il 22% per il virus della Blue Tongue. Dall'analisi dei dati sanitari ottenuti, se da un lato possiamo affermare che le positività per la Blue Tongue non sono clinicamente rilevanti in quanto su questa specie il virus non da sintomatologia clinica, dall'altro possiamo affermare che la salmonella può causare aborti nelle femmine e quindi conseguenti scompensi riproduttivi sulla popolazione. In questo areale normalmente il periodo degli accoppiamenti è fine agosto-metà settembre, infatti la frequenza dei bramiti dei maschi dominanti è elevata in questo periodo e diminuisce sino a scomparire naturalmente già dagli inizi di ottobre. Nello

stesso areale abbiamo notato un numero elevato di bramiti fuori stagione più frequente che negli altri areali storici. Questo scempenso riproduttivo è causato anche dall'elevata percentuale di positività alla *Salmonella abortus ovis* che determina aborto nelle femmine con conseguente ritorno del calore nei mesi successivi all'aborto. Quindi i bramiti fuori stagione sono dovuti alla stimolazione dei maschi dai feromoni emanati dalle femmine ritornate in calore successivamente all'aborto.

Probabilmente questo scempenso riproduttivo non è dovuto soltanto alla *Salmonella abortus ovis* ma a diversi fattori ambientali tra cui l'elevato bio-accumulo di metalli pesanti presenti nel territorio. Questo areale storico del Cervo sardo, infatti, coincide con la ex zona mineraria di Montevecchio-Costa Verde nella Sardegna sud-occidentale (SIC Monte Arcuentu e Rio Piscinas ITB040031), ricadente all'interno del Parco Geominerario, Storico e Ambientale della Sardegna, dove si è protratta per diversi secoli l'estrazione mineraria anche a cielo aperto che ha lasciato sul territorio una pesante eredità ambientale, dovuta in particolare alla mobilitazione di elementi altamente inquinanti come piombo, cadmio, zinco, rame, alluminio con successivo accumulo nelle acque, nei vegetali e con conseguente assorbimento dagli organismi animali.

Poichè da precedenti esami biologici da noi effettuati sui cervi dello stesso areale alla ricerca di contaminazione da metalli pesanti è risultata un'elevata contaminazione dei tessuti e considerando che il cadmio determina un abbassamento delle difese immunitarie degli animali e che è anche in grado di potenziare l'azione dei batteri (soprattutto della *Salmonella abortus ovis*) si può concludere che con l'elevata positività alla salmonella entrambi i fattori interferiscono sulla dinamica della popolazione.

Wolf, human and their game: using remote cameras to describe temporal and spatial relations between species

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P012

Studying animal behavior has been a topic of interest to evolutionary biologists, conservation biologists and wildlife managers. Direct observation of the target animal is a time-tested tool for evaluating its behavior and activity, but human presence can produce an alteration of natural processes. Remote camera systems (i.e. camera traps) are the newest, non invasive and economic tools for researchers examining both animal behavior and activity patterns.

From December 2012 to October 2013, we performed 12 sessions of video-trapping in 93 monitoring stations (traps sites) within six areas currently occupied by wolf on the territory of Liguria Region. Traps sites choice was based on knowledge, gained during five years of monitoring program, about most frequented areas and wolf viability, in order to maximize the "capture" of the species. All data were digitized using the software ArcGIS 10.0.

We recorded 1910 videos about wolves, humans, domestic animals, wild ungulates, other carnivores and hares. Firstly, we examined whether the sampling effort was adequate to detect

every species present in the study areas using the Diversity Index of Shannon-Wiener. Then, we analyzed data to assess temporal segregation between human & wolf, human & hunted species and wolf & its prey through cross-tabs for seasonal, monthly, weekly, diurnal and nocturnal activity. We also investigated the relations between these subjects and environment, within a buffer around each stations, using Relative Abundance Index. We finally built age pyramids and sex ratio for each detected species in each traps sites.

Despite some problems related to equipment malfunction, operators inexperience during the installation and theft, the use of camera traps allowed us to collect a lot of information about animal populations and improved surveys quality avoiding misidentification and false absences bias. Cost-benefit balance is definitely moved on profits. In addition, by adjusting sampling design to specific goals allows large-scale monitoring, state of occupancy and density estimation. Technological advances and innovation will lead camera traps to play an increasingly important role in the study of wildlife behavior and activity.

Wolf presence monitoring in the Gran Sasso and Laga mountains National Park

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Within the framework of the LIFE EX-TRA project (2009-2012) a wolf presence monitoring programme was carried out in the Gran Sasso and Laga Mountains National Park, a protected area of about 150000 ha in central Italy. Research techniques used were wolf-howling and snow-tracking, and in the last two years we started using camera trapping.

Field work involved a large number of operators: 50 officers of the National Forest Corps (CFS), 11 project's technicians, and 5 staff from the Scientific Service of the National Park.

Wolf-howling was used in summer in order to estimate the number of reproducing packs. Following the protocol of Harrington & Mech (1982) and similar experiences in Italy (Ciucci et al. 2007), a saturation census approach was applied. We made a systematic survey of the study area, through the selection of 22 howling circuits and a mean of 176 ± 17.49 howling stations used each year. The study area was divided into 5 sectors, each one including 3-5 howling circuits repeated for 3 consecutive nights. At the end of the systematic survey we made some additional howling sessions in order to investigate in more detail those areas where we obtained wolf responses in the past and in order to better discriminate between different packs. These additional howling sessions were carried out from August to October. Each year we obtained a mean of 23 ± 3.16 responses including pups and 13.25 ± 2.06 responses from adult wolves. On the basis of the simultaneity and localization of the responses obtained we estimated a presence of 12.88 ± 1.03 reproducing packs/year.

Localization of responses from reproducing packs was analyzed in terms of site's environmental characteristics and in terms of

site fidelity between different years. We assumed an error ± 1 Km in the estimated location of howling responses.

In winter, snow-tracking was carried out only in the southeastern part of the Park, where at least 4 reproducing packs were detected through wolf-howling. A set of 11-14 trails was opportunistically selected on the basis of: the probability to detect wolf tracks, a significant coverage of the territory, the accessibility of the sites, and the number of available personnel. 24-36 hours after the snowfall all selected trails were simultaneously covered, and, once wolf tracks were intercepted, they were followed until it was possible. The next day we continued to follow wolf tracks in an attempt to reconstruct the cycle of the animal's activity. In each winter session, at least 3 simultaneous surveys were carried out, and wolves' tracks were followed for about 120 km in the whole study period.

The use of camera trapping was limited to gather additional information on pack size and composition and to obtain preliminary data on animals' phenotypes, in relation to the potential threat of hybridization with dogs (Ciucci 2012).

The present results and those gathered in previous studies carried out in the Park, allowed us to obtain important information about wolves' distribution and reproductive success in the protected area, and especially on rendez-vous sites, in terms of recurrence of use and selection of certain environmental features.

Finally, an assessment was made on the effort involved, in terms of staff, necessary resources and cost, against its sustainability over time, considering the importance of the information acquired in terms of management decisions.

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Sex-age differences of vigilance behaviour in fallow deer *Dama dama*

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Vigilance behaviour has traditionally been considered as functioning primarily for antipredator protection, but it may depend also on social factors. In ungulates, information is contradictory on differences of vigilance between individuals of different sex/age class.

Sex-age differences of vigilance were investigated in fallow deer *Dama dama*, in a protected area (Maremma Regional Park, central Italy; mid November-March 2006-2008 and 2012-2013), at feeding, through behavioural observations. Controlling for group size, females (>1 year old) tended to show (1) a significantly lower proportion of time foraging, (2) a significantly greater proportion of time in vigilance and (3) a significantly greater alertness rate (n. head-lifts/min) than adult (>4 years old), subadult (2-4 years old) and young (1 year old) males. However, when in large groups (i.e. >20 individuals), proportions of time foraging/in vigilance and alertness rate were

comparable between females and young males.

We also evaluated group size effects on foraging and vigilance behaviour. For females, adult males and subadult males, the proportion of time foraging increased significantly, while both proportion of time in vigilance and alertness rate decreased, with increasing group size. Conversely, in young males, increasing group size had no effect on foraging/vigilance behaviour. Most likely, female fallow deer tended to reduce the predation risk for their offspring through a comparatively greater duration and frequency of vigilance postures, with respect to males. Young males showed a comparatively great alertness and, for these individuals, increasing group size did not lead to a reduction of duration/frequency of vigilance bouts, which may depend on intraspecific competition in large, unisexual groups. Most likely, antipredator and social factors could explain sex-age differences of vigilance in fallow deer.

IX Congresso Italiano di Teriologia

EBHS in the province of Trento (Italy): state of the art

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P008

European brown hare syndrome (EBHS) is an acute and severe, necrotizing viral hepatitis affecting European brown hares (*Lepus europaeus*) and mountain hares (*Lepus timidus*) both free-living and captured. Currently it is endemic only in European countries. The causative agent is a Calicivirus correlated to the rabbit haemorrhagic disease virus (RHDV).

In the province of Trento, during 2005-2006 an outbreak of EBHS in a free living hare population occurred, which caused high mortality rates (up to 80% in some areas). Analysis after this outbreak (2006) showed average prevalence higher than 50%. As a result of this episode, an active monitoring plan in collaboration with forest rangers and local hunting association has been set. During the regular hunting seasons, hare samples (organs and cardiac clot) were collected and serological and virological investigations (ELISA tests) were performed. Moreover, a passive surveillance was maintained on hares found dead in the study area.

Between 2007 and 2010, we described a progressive decline of seroprevalence, accompanied by low antibody titers and by the detection of sporadic (13/692) (2%) virological positive samples. In 2011 no disease or virus outbreak were identi-

fied and seroprevalence was only 24% with low antibody titers (1:10).

During 2012, 98 organ samples (liver and/or spleen) and 92 sera obtained from cardiac clot of hunted hares were tested. Three animals (3%) resulted positive for EBHS virus and 33 hares (35%) resulted positive for antibody (with titers of 1:10 and only one with titers of 1:40). Anyway, the virus did not cause yet relevant mortality rates: only 12 carcasses were delivered from passive surveillance to the lab and all of them were tested negative for both virus and antibodies detection.

These results demonstrate a progressive reduction in antibody and virus prevalence among hare population in the province of Trento from 2006 up to now. Collected samples come from few reserves of the province and do not represent the whole territory: this suggests to implement a more uniform sampling plan throughout the province. No data are available about hare density in each monitoring area and it would be interesting to collect this information for the future in order to know the real risk of new outbreak. Moreover it will be important to pay specific attention to hare passive surveillance in order to have a clearer outline of EBHS status.

Management of chemical immobilization of brown bear (*Ursus arctos*) in the Abruzzo, Lazio and Molise National Park on 235 cases from 1990 to 2013

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P128

235 chemical immobilizations, 44 on captive and wild brown bears (*Ursus arctos*, n=5) and 171 on Marsican brown bears (*Ursus arctos marsicanus*, n=44) were recorded.

Age and body weight (mean±standard deviation) of captured animals were 9.81±6.28 years and 149.25±62.29 kg and 9.68±6.15 years and 147.54±60.71 kg in brown bear and Marsican brown bears respectively.

The following anesthetic combinations were injected intramuscular by a remote equipment: medetomidine 0.05-0.09 mg/kg and ketamine 3-7 mg/kg (group MK: n=209); xylazine 7-13 mg/kg and ketamine 3-8 mg/kg (group XK: n=17); tiletamine-zolazepam 4-8 mg/kg (group TZ: n=9). In MK and XK groups, atipamezol was administered at the end of the procedure.

Bears were darted after physical restraint (Aldrich snares or tube trap) or in free ranging situations. Complete anesthetic record, including heart rate (HR), respiratory rate (RR), rectal body temperature (T) and saturimetry (SpO₂), and biometric

data form were filled in. The first physiologic parameters were recorded within 20 minutes from darting, as soon as adequate depth of anesthesia allowed safe handling of the animal, and were compared between groups with ANOVA test. Statistical significance was set at p< 0.05.

Anaesthesia induction time was similar between groups and ranged from 7 to 11 minutes. HR was similar in groups MK and XK but higher in TZ group; HR was higher in wild than captive bears. RR was similar between groups. Recovery time was shorter in MK and XK than TZ group.

Peri-operative complications were reported in 16/235 immobilizations and included vomiting and respiratory complications: 7.1%, 5% and 0% of complications were reported in group MK, XK and TZ respectively. All recoveries were uneventful. Knowledge of the target species biology, trained personnel, deep knowledge of advantages and disadvantages anesthetic drugs is mandatory during wildlife chemical immobilization.

L'analisi genetica non invasiva per il monitoraggio di *Martes martes*: pregi e difetti

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Lo studio delle specie rare ed elusive come la martora implica spesso l'utilizzo di tecniche di monitoraggio non invasive.

La raccolta e lo studio dei depositi fecali rappresenta una fonte inesauribile di informazioni: l'identificazione certa della specie a cui appartiene fornisce dati sulla sua presenza in una determinata area e in un determinato ambiente, l'analisi dei contenuti da indicazioni circa il comportamento alimentare, la ricerca di endoparassiti permette di valutare lo stato di salute.

Nel caso della martora però i depositi fecali sono morfologicamente identici a quelli della conspecifica faina, ma sono anche sovrapponibili con quelli di puzzola e volpe.

Nel 2007 il gruppo di ricerca ha messo a punto un protocollo di analisi genetica per l'identificazione dei depositi fecali appartenenti al genere *Martes*. Per i motivi sopra elencati tale protocollo prevede 4 specie *target*: martora, faina, puzzola e volpe.

Da quel momento il protocollo è stato utilmente impiegato in molti progetti per il monitoraggio della martora: nel 2007 nei Siti di Interesse Comunitario (SIC) della Provincia di Terni; nel triennio 2009-2012 nel Parco Nazionale del Gran Sasso e Monti della Laga e per lo stesso periodo in alcuni SIC della Regione Val d'Aosta; nel 2010 nell'Azienda Faunistico Venatoria di Montepetriolo (PG) e nel Parco Naturale della Maremma; nel 2011-2012 nel Parco Naturale delle Alpi Marittime; dal 2012 fino ad oggi nel Parco Nazionale delle Foreste Casentinesi, Monte Falterona e Campigna ed infine nel 2013 nel SIC di Monte Malbe (PG), per questi ultimi due la ricerca è ancora in corso.

Il programma di ricerca prevede tre fasi: 1) di campo per la raccolta dei depositi fecali morfologicamente attribuibili al genere *Martes*, 2) di *screening* dei campioni per verificarne l'idoneità all'analisi successiva, 3) di laboratorio per l'applicazione del protocollo genetico sui campioni abilitati.

Nel 63% dei casi il protocollo ha dato risultati positivi, cioè ha identificato una dei quattro carnivori. Tra i progetti quello che presenta il valore più alto di diagnosi positive è l'AFV di Montepetriolo (95%) mentre quello con il valore più basso è il Parco della Maremma (45%). Quest'ultimo dato può essere giustificato dal fatto che la raccolta dei depositi fecali, per

esigenze progettuali, è stata effettuata nei mesi più caldi e asciutti dell'anno (da Aprile ad Agosto), portando di conseguenza ad una maggiore disidratazione dei campioni.

La martora è stata rilevata in tutti i progetti, mentre nessun campione è mai risultato appartenente a *Mustela putorius*. Tale situazione non è facilmente spiegabile: può parzialmente dipendere dalla non prevalente prossimità dei percorsi-campione ai corsi d'acqua, così come dalla molto verosimile rarità della puzzola in aree con abbondanze elevate di volpe e/o faina e/o martora, capaci di esercitare un'accentuata pressione competitiva sul carnivoro di minor taglia. Il prosieguo degli studi consentirà di saggiare le anzidette ed altre ipotesi.

Il rapporto tra le due *Martes* è favorevole per la martora in metà dei progetti, tre dei quali svolti in Umbria e uno nelle Alpi Marittime. Al contrario, nel Parco della Maremma, nelle Foreste Casentinesi e nel Parco del Gran Sasso - Laga la faina domina significativamente sulla martora.

Il dato che colpisce maggiormente è relativo ai depositi fecali che risultano geneticamente appartenenti a volpe. Infatti, su un totale di 836 depositi fecali analizzati 230 risultano appartenenti al canide, corrispondente al 28% dei campioni. Le aree che presentano le percentuali più elevate di reperti attribuiti a questa specie sono le Alpi Marittime, il Parco delle Foreste Casentinesi e i SIC della Val d'Aosta.

In base a quanto esposto si può affermare che il programma di ricerca risulta essere un efficace metodo per il monitoraggio della martora. Il protocollo genetico è di semplice esecuzione e conduce a diagnosi chiare e sicure. La raccolta dei campioni rappresenta la fase più delicata, capace di rappresentare un pesante "difetto", perché da essa dipende la buona riuscita delle analisi di laboratorio. Lo stato di idratazione del campione è la caratteristica principale per una buona estrazione del DNA e quindi per un'alta positività del protocollo. Un'adeguata esperienza di campo sulla discriminazione morfologica dei depositi fecali è fondamentale per diminuire il più possibile la frequenza di campioni appartenenti a volpe.

Bat community ecology at “Gola del Furlo” natural reserve (province of Pesaro-Urbino)P. PRIORI^{1,2}, D. SCARAVELLI^{2,3}¹ Dipartimento di Scienze della Terra, della Vita e dell'Ambiente, Università di Urbino, Campus Scientifico, loc. Crocicchia. 61029 Urbino, e-mail

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PI04

The Natural Reserve “Gola del Furlo” managed by the Province of Pesaro-Urbino, cover 3600 ha along the gorge of the Candigliano River flowing between Mount Pietralata (889 m) and Mount Paganuccio (976 m). The area is mainly covered by broadleaves woods and large pastures on the tops of the two massifs. Around 40 km far from the Adriatic coast is the first step of the Apennine in the area. After a first short survey carried out in 2010, in 2013 a research was supported by the Province in order to obtain a faunistical and ecological assessment of bat present in the area. After exploration of potential human made and natural roosts, 8 nights were spent in different types of land use from April to June 2013 to evaluate species and their frequencies by bioacoustics. The territory has been subdivided by land use: open pasture, Mediterranean shrubland, broadleaf wood, xeric wood with *Pinus nigra*, river banks, woodland edge, agricultural lands and small or large lakes. Listening points were settled and repeated sessions of 10 min each were performed using Pettersson Elektronik D244x and D1000 detectors and recording the sounds in time expansion mode.

Out of 8 abandoned buildings checked only two showed tracks or resting specimens, both of *Rhinolophus hipposideros* and in one case also of *R. ferrumequinum*.

Overall 1922 minutes of recording were collected, with 265 contacts belonging to 11 taxa: *Pipistrellus pipistrellus*, *Pipistrellus kuhlii*, *Hypsugo savii*, *Eptesicus serotinus*, *Nyctalus noctula*, *Nyctalus leisleri*, *Rhinolophus hipposideros*, *Tadarida teniotis*, *Myotis daubentonii*, *Myotis mystacinus* e *Plecotus* cfr. *austri-*

acus. Adding also the sighting of an individual of *Rhinolophus ferrumequinum* the total number of species reaches 12 taxa.

Considering the whole bulk of data the recorded number of passages per hour moves to 5 p/h at the beginning of April to 12.75 p/h in the mid May and 6 p/h in June.

The most numerous contacts regard *P. pipistrellus*, followed by *P. kuhlii*. *H. savii* represents the third species in density. All the other species show occasional passages at the listening points, except *M. daubentonii* and *T. teniotis* that concentrate their activity with numerous passages on the lake.

Considering the number of species per habitat, the small lake, representing a drink source in the middle of the woods, collected the largest number (9). Seven species were found in the open pastures and in the woodland edge, 6 at the large lake in the gorge, as well as in the xeric woods with *Pinus nigra* and in river banks habitats, and only 5 species in agricultural lands, Mediterranean shrublands and broadleaf woods.

P. pipistrellus represents the most euryoecious species while *N. noctula* was found only foraging in the pastures and at the wood border. Also *M. mystacinus* was contacted only in the broadleaf woods and drinking in the small lake.

These new informations are available to the local managers' disposal and can be used to improve the availability of environments for bats as well as to provide important bioindicators of the success of the incoming managing plan of the protected area.

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Non-invasive wildcat surveying in northern Latium (central Italy): lessons from five years of sampling

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P166

Wildcat (*Felis silvestris silvestris* Schreber 1775) is a species of community interest in need of strict protection. It has been widely reported in Latium (Central Italy) in the Natura 2000 Standard Data Forms. However, most of the information included in the Data Forms were based only on expert opinion. To fill this gap, in 2009 we started a survey of wildcat in five Sites of Community Importance (SCIs) that coincide with regional reserves in northern Latium. Our goals were: i) to ascertain the presence of wildcat; ii) to compare different surveying techniques; iii) to shed light on the genetics of wildcat. We present here only preliminary results of the study. Study sites covered on average 2265 hectares (st. dev. 1256) each and were occupied by almost continuous forests surrounded by agricultural matrix. Due to economic and logistic constraints, the study started at different times among the sites. The survey was carried out using camera traps; some cameras were associated to scented lure and hair trap for non-invasive hair collection for genetic analyses. From 2009 to the end of 2011 we carried out opportunistic survey using one camera per point, with one of three

types of scented lure, different types of hair traps and different working time of cameras (min. 10 days, max. 415 days); in 2012 we adopted a systematic sampling over a 2.5 km grid with one camera per point, one type of lure and about 90 working days per camera; in 2013 we used a 2.0 km grid with three cameras per point, one type of lure and a working time of 12-15 days. We also collected dead animals along the roads crossing or surrounding the sites. We ascertained the presence of wildcat in all the sites; camera traps captured cats in 4 sites and dead animals were found in 4 sites. However, detectability was very low. Lures seem to have no effects on the attractiveness of the trap. No differences were found between opportunistic and systematic sampling. Hair traps never worked. Genetic analysis was carried out by now only on mtDNA and revealed 1 hybrid mtDNA and 4 wild mtDNA. The next steps of the study will be the analysis of nuclear DNA, a statistical analysis able to put together data coming from different sampling designs, and the application of a new sampling design able to solve the problems of low detectability and presence and pseudo-absence data.

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Efficiency of ligurian protected areas on wolf conservation (N-W Italy)

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P014

In Italy wolves are fully protected by the Habitat Directive (Annex II, IV and V), the Bern Convention and national law 157/92. Despite the presence of an Action Plan at the national level, enforcement and implementation of the laws is left to the Regions, which provide conservation actions and monitoring programs as well as compensation for damages to livestock. Wolf recolonized Ligurian Apennines during the '80s, becoming a stable presence after a decade; for this reason, Liguria Region started the monitoring project "Wolf in Liguria". This region represents an ecological corridor for wolf between Apennines and Alps, so it is a key area for its expansion through the Alps. We monitored wolf presence in Liguria from 2009 to 2013 by the Tessellation Stratified Sampling method (TSS): the study area has been divided into 10×10 km sample units, each containing at least one transect randomly selected among the existing footpaths. We covered every transect four times a year (once a season) in order to collect wolf and prey presence signs. We mapped and digitized presence signs by ArcGis 10.0. By means

of Kernel Analysis we defined wolf core areas throughout five monitoring years, in order to identify stable pack territories. We overlapped KA result and datas of dead wolves to Ligurian Protected Areas map, in order to assess their efficiency in wolf conservation. We formulated an habitat suitability model following an approach presence vs. absence by Binary Logistic Regression Analysis (BLRA) taking into account environmental variables (altitude, slope, exposure and land use) and relative abundance of prey. We validated this model by K-Fold Cross Validation and ROC curves.

Our analysis reveals the high suitability of this Region, as well as its inadequate level of protection. Many areas belonging to Natura 2000, namely Sites of Community Importance (SCI) and Special Protection Areas (SPAs), seem to be inefficient for wolf conservation, because of lacking hunting restrictions: among the main causes of killed wolves there is wild boar hunting with bay dogs.

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Sanità animale e conservazione della biodiversità (in collaborazione con SIEF)

È ampiamente dimostrato come alcune patologie o la gestione di altre, possa produrre profonde perturbazioni a carico della dinamica di popolazione delle specie ospiti, incluse quelle minacciate di estinzione. Inoltre le specie a vita libera possono essere coinvolte in cicli di trasmissione di infezione comuni agli animali domestici con implicazioni di salute pubblica la cui gestione potrebbe risultare problematica per le specie più sensibili all'intervento umano. Infine, ma non di minor importanza, l'eterogeneità sia delle specie recettive sia delle popolazioni delle specie colpite rappresenta un fattore chiave nell'equilibrio di trasmissione delle infezioni, assicurando meccanismi di "autocontrollo" sia per l'emergenza sia per la diffusione di nuove patologie.

La sessione intende affrontare i temi coinvolti nella definizione dello stato sanitario delle popolazioni a vita libera con particolare attenzione alle implicazioni ecologiche e faunistiche e al legame esistente tra conservazione della biodiversità e rischio di infezione.

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IX Congresso Italiano di Teriologia

Opening Lecture: The ecological consequences of wildlife disease control

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Opening Lecture

Disease in wildlife populations can have adverse impacts on the health of domestic animals and humans, with consequent costs to our agricultural and public health systems. Wildlife diseases may also have profound impacts on species of conservation concern and hence reduce the benefits that global biodiversity brings to humankind. However, interventions to control wildlife diseases, such as culling, vaccination and changing contact behaviour, can have both positive and negative effects. Behavioural and demographic responses of wildlife populations to

intervention can give rise to complex epidemiological outcomes. In addition, the manipulation of a single host population for the purposes of disease control can have far-reaching effects on other components of the ecosystem, with potential implications for epidemiology, economics and biodiversity. There is a strong case for the use of ecological impact assessment approaches to determine the likely outcomes of proposed interventions to manage disease in wildlife populations.

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Wild boar (*Sus scrofa*) and MTB complex, something new: spatiotemporal and biological patterns of *M. microti* infection in wild boar

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S099

Tuberculosis is a chronic disease caused by mycobacteria belonging to MTB complex that include, *M. microti*, the causative agent of the vole tuberculosis. Due to the slow growth in vitro of the bacteria on primary isolation, *M. microti* prevalence, geographical distribution and host range has been probably underestimated.

This study aims to firstly describe the epidemiological trend of the infection of *M. microti* in free-living wild boar and to identify the host risk factors linked with its occurrence. Tuberculosis like lesions of 3041 hunted wild boar coming from 5 different hunting areas were analysed through IS6110 PCR and the positive ones were subsequently analysed by gyrB-RFLP assay in order to identify the presence of *M. microti*.

From 2008 to 2012, 190 examined wild boar showed TBL only

at submandibular lymph nodes. PCR gyrB assay identified the presence of *M. microti* in 99 free-ranging wild boar (P=3.26%). The age class distribution of the 99 *M. microti* positive wild boars was: n=11 (11.11%) "young", n=36 (36.36%) "sub adult" and n=46 (46.47%) "adult". The prevalence changed spatiotemporally with a generalized increase over the years of 1.26. Age class and index of abundance influenced the prevalence of *M. microti* infection while sex was not significant. In particular, the probability of being infected was higher in older individuals and in animals coming from area and year with higher wild boars abundances.

The obtained data will stimulate further indications on TB surveillance in wildlife and management of this expanding species regarding tuberculosis infection.

Alpine chamois population dynamics and surveillance of sarcoptic mange in the Paneveggio-Pale di San Martino natural park (TN-Italy)

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The index case of sarcoptic mange appeared in chamois (*Rupicapra r. rupicapra*) in the Parco Naturale Paneveggio-Pale di San Martino (PPPSM) in 2007, spreading from the neighboring areas of Belluno province. Since then, the disease spread further, covering all the park area in 2010.

In this area, of approximately 200 km², sarcoptic mange showed an impact on both chamois and ibex (*Capra ibex*). For the latter species, a restocking project was carried out since the mange epidemic peak had reduced the number of animals under the minimum viable population.

PPPSM represents an important area for wildlife research and conservation, for which the presence and spread of a severe disease as mange raises concerns. Therefore, a remarkable amount of data from passive surveillance were collected by the PPPSM wildlife wardens and made available for analyses, in comparison with the data from the population censuses. Moreover, besides the routine censuses and passive surveillance on the whole park area and its immediate proximities, park wardens implemented, in a specific and more restricted area, an intensive census and surveillance protocol, lasting from 2008 to 2013.

In the present work:

- we analyze the population decrease of chamois during the sarcoptic mange epidemic, on the whole and in the different districts of PPPSM, in the light of the mortality data. Mortality data were divided in classes according to

the relative aetiology, namely: “sarcoptic mange”, “other causes” and “undetermined”, allowing an estimate of the effective impact of mange versus other mortality causes and an estimate of the efficacy of routine and intensive surveillance for a proper diagnosis;

- we compare the results of the routine censuses and surveillance in chamois with the results of the intensive ones, in order to detect possible differences in population structure, mange seasonality patterns and differences in the proportion of mange cases according to gender and age class.

Our results show an evident contribution of other mortality causes, namely starvation and winter mortality, to the main mortality peak of sarcoptic mange. This situation could have been determinant, amplifying the impact of the mange peak and leading the chamois density to values close to the estimated threshold density for the transmission of *Sarcoptes scabiei*. Considering the passive surveillance, intensive protocol increases the probability of a proper diagnosis and confirms the seasonal and gender mange patterns, but its power in detecting cases in the younger age classes (kids and yearlings) in the field is not higher than that of routine surveillance. Besides the harsh conditions of the alpine environment, according to the warden expertise this could be due to the early action of scavenger species, rapidly removing the smaller size carcasses from the field.

Squirrels, invasions and parasites: lessons learnt and future perspectives

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As a consequence of the increase in infectious disease emergence in wildlife due to translocations of hosts and pathogens, in recent years the interest about the role played by parasites in alien species settlement and in their interactions with native species is growing.

Here, we used native Eurasian red squirrels (*Sciurus vulgaris*) and alien Eastern grey squirrels (*S. carolinensis*) as model system in a broad study aimed at shedding light on host-parasite relationships in the context of biological invasions. First, we investigated macroparasite fauna of red squirrels over a wide geographic area, showing that the species has a poor parasite community (both in terms of species richness and diversity across habitats). In particular, the gastro-intestinal helminth community of red squirrels is dominated by a single species, the oxyurid *Trypanoxyuris sciuri*, hence, the native host may be particularly vulnerable to parasite spillover from alien species. Indeed, we recorded, for the first time in Europe, the presence of the Nearctic nematode *Strongyloides robustus* in two red squirrels co-inhabiting with alien grey squirrels. We then investigated macroparasite fauna of grey squirrels in Northern Italy, demonstrating that this invasion holds the premises for both spillover and spill-back mechanisms towards red squirrels to occur since grey squirrels introduced to Italy *S. robustus* and acquired the red squirrel's flea *Certhopyllus sciurorum*. Nevertheless, despite the acquisition of some European parasites, the number of parasite species infecting grey squirrels in the introduction range is much lower than in their native range, thus supporting the enemy-release hypothesis. In a third step of the study, through indirect parasitological methods, we compared prevalence of the nematodes *S. robustus* and *T. sciuri* in red squirrels living in presence and absence of the alien congener. Our results show that infection by *S. robustus* is linked to grey squirrels' presence, confirming that red squirrels acquire this parasite via spillover from the invader. Interestingly, also prevalence of *T. sciuri* is higher in populations syntopic with grey squirrels, suggesting an increased susceptibility to infection induced by stress-mediated effects on the immune system. Finally, we conducted a survey of Ljungan virus and adenovirus infection in both sciurids, extending the host spectrum of Ljungan virus (i.e. a potential zoonoses previously thought to infect only small ground-dwelling rodents) to red squirrels and the distribution of adenoviral infections in squirrels to Southern Europe.

Overall, our work highlights the importance of taking into account parasitological aspects when dealing with biological in-

vasions. In particular, despite the role played by macroparasites in invasions is often neglected, we show that it should not be underestimated since they have the potential to mediate interactions between native species and invaders as much as microparasites do. We also show that a complete picture of parasites infecting native species is not only essential to detect alterations caused by invaders, but may also offer insights into their vulnerability to invasions, with hosts having poor parasite communities being more susceptible to competition mediated by parasites. Moreover, we demonstrate that the threat is not only posed by spillover of introduced parasites resulting in apparent competition, but that the presence of alien species may also alter pre-existent host-parasite dynamics and affect native hosts' response to local parasites.

At the same time, our findings opened several new questions that will need to be addressed in the future. First, having confirmed that *S. robustus* spills over to the native species, the next step should be to investigate its impact on red squirrel fitness (i.e. survival and/or fecundity). However, in a parallel study on *S. robustus* infecting grey squirrels, we highlighted a density-dependence between parasite fecundity and intensity of infection, suggesting that the parasite is able to substantially affect immune response of its hosts. Similarly, it would be interesting to test if the presence of grey squirrels leads to an alteration of *C. sciurorum* temporal distribution or to an increase of flea abundance in red squirrels. We also show that grey squirrels lost many parasite species during the introduction process, but to test whether this loss actually translates into an effective advantage for the invading species, an experimental study at the biogeographical scale would be needed. Moreover, our results on Ljungan virus suggest that the role of arboreal sciurids in zoonotic diseases circulation could have been underestimated and should be investigated more deeply without forgetting that, despite we did not detect Ljungan virus infection in grey squirrels, the alien species may act as reservoir for other microparasites, increasing their presence in the environment or altering their dynamics, thus representing a threat for public health.

In conclusion, we feel that similar, broad surveys on the role of parasites in biological invasions, should be extended to other alien vertebrates since they could offer new insights on the processes regulating the competition with native species and a more complete understanding of invaders' impacts on ecosystems and human activities.

Intrinsic and extrinsic factors affecting the macro-parasite fauna of the red squirrel: does habitat quality and fragmentation affect parasite abundance or prevalence?

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S124

Tree squirrels are forest dwelling rodents that are affected by habitat loss and by the fragmentation of forests into smaller and more or less isolated patches. Although Eurasian red squirrels (*Sciurus vulgaris*) occur in relatively small fragmented woods as well as in large contiguous forests, habitat fragmentation has been shown to reduce population density, immigration rate, and genetic diversity. Moreover, reduced genetic variation and increased levels of fluctuating asymmetry have been suggested to be related to increased levels of stress among animals living in fragments compared to those living in large forests. So far, no studies have examined whether fragmentation affects the macro-parasites of the red squirrel, or to what extent variation in habitat quality, food abundance and/or differences in host population density affect differences in prevalence of the most dominant helminth.

In an earlier work we showed that red squirrels host a poor and specialised macroparasite fauna (both in terms of richness and diversity across habitats) as a consequence of their arboreal ecology and their evolutionary isolation from closely-related species. Here we concentrate on factors affecting differences in abundance and prevalence of their dominant helminth *Trypanoxyuris (Rodentoxyuris) sciuri*. We first obtained quantitative data on *T. sciuri* abundance by direct examination of gastrointestinal content in road-killed red squirrels collected in Northern Italy (N=95). Then, we investigated infection status (i.e. presence/absence) in live trapped red squirrels from different populations in Lombardy (N=200) through indirect parasitological methods (i.e. fecal egg counts and tape-tests).

We first explored effects of habitat type (mixed lowland vs.

mountain conifer forest types), habitat fragmentation (fragmented woods <100 ha in size vs. non-fragmented forests), season, sex, and body mass on *T. sciuri* abundance. Parasite abundance was higher in fragments than in larger forests (mean±SE fragment=774±199; non fragment= 249±89; p=0.03), and higher in mixed lowland than in mountain conifer forests (mean±SE lowland=686±154; mountain=302±127; p=0.021). Mean abundance of the parasite was lower in specimens recovered in summer than in spring and autumn.

Among live-trapped red squirrels (336 trapping events of 200 different animals; total prevalence 64%) prevalence of *T. sciuri* varied only slightly between the 6 study areas. In a logistic regression model with presence of *T. sciuri* as dependent variable, there was no effect of season, body mass or body size (hind foot length) or study area. Only the sex effect was significant with more males infected than females (71 and 56% respectively). Results did not change when juveniles were excluded from our analyses. For the three alpine study areas, effects of spatio-temporal variation in host density and food availability on *T. sciuri* prevalence will be discussed.

Our data suggest that red squirrels in fragments were more strongly infected than in larger contiguous forests, independent of lowland or mountain habitat types, suggesting that living in smaller and more isolated habitat patches, with potential increase in home range overlap and more frequent interactions, might increase stress making the animals more susceptible to parasite infections. The study has been partially financed by PRIN project (PRIN 2010-2011, 20108 TZKHC) and LIFE project NAT/IT/00095.

A healthy alien: the case of eastern grey squirrel (*Sciurus carolinensis*) in Umbria, central Italy

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S157

Invasive alien species (IAS) are one of the most important threats for the conservation of biodiversity, second only to habitat loss and fragmentation. IAS may interact with native species through different ecological processes including competition, predation, parasitism, disease vectoring and hybridization. Sanitary issues linked to alien's incursions are an emerging threat that has serious consequences for other wildlife and domestic species and for human health. A well known case of sanitary interaction between non-native and native species is the poxvirus infection carried by the alien grey squirrel in the British islands: the disease is speeding up the extinction of native red squirrel.

Besides the poxvirus, what are the diseases that grey squirrel may convey to other animals or humans? The presence of the alien species in an urban area may represent a public health issue?

In Umbria, grey squirrel was accidentally released in 2003, in a private wildlife park within the Site of Community Importance (SCI) IT5210021 "Monte Malbe", nearby the city of Perugia. The current known presence area of non-native species is at least 50 km² and includes woodland dominated by holm oak and urban areas in the city of Perugia. Considering that grey squirrel attends urban parks and that its confident behaviour could determine direct contact with humans, we considered interesting to investigate the health status of the non-native species and its potential role for public health.

In agreement with the national legal framework and with the support of Institute for Environmental Protection and Research (ISPRA) and the Ministry of Environment, we are carrying out a Management Plan to limit the spread of the alien species and preserve the native ones. Grey squirrels were captured in live-traps baited with mais and walnuts and euthanased with CO₂, in compliance with animal welfare laws. Red squirrels were trapped, handled and released immediately. Traps and handling materials were sterilized after each squirrel capture with Virkon S[®]. In addition to trapped squirrels, road-kills were collected.

Eighty-two grey squirrels were subjected to post-mortem investigation. During the necropsy organs, tissues and cutaneous annexes were collected for performing laboratory exams. In addition to the previous samples, some sera were taken immedi-

ately after euthanasic suppression. We have sought out following pathogens: *Adenovirus*, *Lyssavirus*, *Borrelia* spp. and *Anaplasma* spp., *Yersinia* spp., *Leptospira* spp., *Toxoplasma gondii*, *Chlamydia* spp., *Cryptococcus* spp. and dermatophytes.

All animals were in apparent good health conditions with no evidence of skin and mucosa lesions, except for two grey squirrels. One of them showed a circular lesion of 1 cm diameter in the sacral region. The second one showed an evident alopecia area in the medial part of toes on the right front limb. Lesions were not exudative, and moderate scaling was present. Sometimes the access to the abdominal cavity showed the presence of diarrhea and swelling of the mesenteric lymph nodes. No organ showed signs of malformation.

Laboratory exams have revealed the presence in one squirrel of *Yersinia* spp. with low pathogenicity rate and in two squirrels with skin injuries the dermatophyte *Trichophyton mentagrophytes*.

Identification of dermatophyte was based on its macroscopic (shape and colour) and microscopic (shape of hyphae) features and by molecular analysis.

Overall, results showed a good health status of non-native species. However, the presence of zoonotic agent *Trichophyton mentagrophytes* is a warning bell, because the higher number of people that could come in contact with the infected animals, the more serious will be the threat posed by the mycosis infection. That's why the infection in eastern grey squirrel is so important: the presence of non-native squirrel in high attendance areas (like urban parks) and its confident behaviour towards humans are critical aspects in public health issue. A sanitary risk may be assumed for human in consequence of a direct contact with infected animals or of environmental contamination with fungal arthroconidia or spores.

Health surveys should become an important tool to identify potential sources of sanitary public problems in urban areas. Management plan should take into account also the sanitary outputs to manage the non-native squirrel. Moreover, it is necessary to make aware public opinion about the risk posed by grey squirrel, not just by a conservation point of view but also for a healthcare one.

***Trichinella* spp. infection in wildlife of North-Eastern Italy: focus on last three years monitoring period (2011-2013)**

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S009

The regulation (EC) 2075/2005 reports specific rules on official controls for *Trichinella* in meat and requires the onset of a risk based wildlife monitoring program in those areas where wildlife and holdings applying for *Trichinella*-free status coexist. For this reason, the wildlife monitoring on target animals as red fox (*Vulpes vulpes*), wild boar (*Sus scrofa*) and mustelids has been implemented since 2006. We report the results of the wildlife monitoring for *Trichinella* sp. in three region of north-eastern Italy (Veneto – Friuli Venezia Giulia – Trentino Alto Adige) during 2011-2013, in comparison with those collected during 1958-1960, 1988-2005 and 2006-2010.

Muscles of wild animals were tested for *Trichinella* sp. larvae using a pepsin digestion analysis according to the Commission Regulation EC 2075/2005. Recovered larvae were identified by biochemical or molecular tests since 1988. In a survey performed in 1958-’60 in the same area, 86 foxes out of 275 (31.2%) were found positive for *Trichinella* spp.; prevalence ranged from 15% to 44.4% among provinces. From 1988 to 2005 a total of 2746 wild animals were tested (1639 red foxes, 1035 wild boars and 72 mustelids) and nine foxes resulted positive (0.55%). In the period 2006-2010 a total of 17881 wild animals were

tested (1904 red foxes, 14037 wild boars, 1322 birds and 618 mustelids). *T. britovi* was identified in one fox (0.05%) and in one beech marten (*Martes foina*) (0.16% in overall mustelids). In the last three years a total of 14718 wild animals were analyzed: 3843 red foxes, 9611 wild boars, 1234 mustelids including 525 european badgers (*Meles meles*), 456 martens (*Martes martes*) and 253 beech martens, 5 brown bears (*Ursus arctos*) and 25 corvids. *T. britovi* was identified in six foxes (0.15%). In north-eastern Italy, the decrease of *T. britovi* prevalence in red foxes from the sixties to nowadays is impressive. Comparing the period 2006-2010 with 2011-2013 we can see a little increase of *Trichinella* prevalence in foxes, which is however not statistically significant ($p > 0.05$). In the last 20 years, fox has expanded its distribution areas from mountain to urban habitat; for this reason, the reduction of *Trichinella* prevalence could be related to the mutation of fox feeding behavior from hunting and scavenging to food sources provided by human setting. Anyway it could be interesting to define risk areas where *Trichinella* cycle could be maintained in order to keep monitoring these territories with particular attention.

Influence of age, sex, season and living conditions on body weight in Marsican brown bear (*Ursus arctos marsicanus*) captured in Abruzzo, Lazio and Molise National Park

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S131

The aim of this work is to define the physiological range of body weight in the Marsican brown bear population in wild and captive living conditions.

Data were extrapolated from selected anesthetic records collected during bear captures in the Abruzzo Lazio and Molise National Park from 1990 to 2013.

Forty-four Marsican bears were chemically immobilized on 171 occasions and body weight recorded, for individual marking or for ecologic, genetic, and health reasons. Values were obtained from animals captured in wild (n=83) and captive situations (n=88).

Weight data were analyzed by a linear model including the effects of class of age, sex, wild or captive environment and their interactions. The effects of period of the year and sex on body weight and their interactions were also analyzed by ANOVA tests. Statistical significance was set at $p < 0.05$.

Mean body weight was influenced by age class and sex.

From juvenile and subadult age, weight gain is similar in both males and females; older male bears resulted heavier than females and this difference is statistically significant for both adult and mature age groups.

Moreover, a significant difference in weight (least squares means \pm standard error) was observed in captive adult males (188.41 ± 6.04 kg, n=14) compared to wild adult males (157.89 ± 3.99 kg, n= 32), but not in adult females.

In adults, body weight was influenced by seasonality. Female animals constantly increased their weight from post-hibernation to pre-hibernation period (mean weight gain 7%); males showed a weight loss during the reproductive period (-8%, $p < 0.05$) and a significant weight gain after this period of time (13%). During all the period of time, from the post-hibernation, females have a increase of their initial weight of 23%, males of 16%.

In conclusion, in Marsican bears body weight depends on age, sex, seasonality and living conditions.

Strategie di gestione sanitaria nell'orso bruno marsicano (*Ursus arctos marsicanus*): approcci preliminari di tipo quantitativo

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S135

Nel 2010 è stato condotto uno studio semi-quantitativo attraverso il quale sono stati identificati, secondo criteri di impatto sulla popolazione, i patogeni prioritari per la conservazione dell'orso bruno marsicano (*Ursus arctos marsicanus*). La presenza della maggior parte di questi agenti patogeni è stata accertata nell'areale dell'orso in specie domestiche e selvatiche, e rappresenta quindi un possibile limite alla conservazione della specie. Uno dei punti di maggiore criticità è costituito dalla complessità della patogenosi che si sovrappone più o meno completamente alla nicchia ecologica dell'orso. Tale patogenosi è costituita dalla relazione tra i numerosi agenti eziologici presenti nell'areale di distribuzione dell'orso e delle specie selvatiche e domestiche che ne rappresentano il serbatoio epidemiologico o semplicemente gli epifenomeni. Allo stato attuale la gestione sanitaria della specie non è ancora definita, né lo sono le componenti istituzionali coinvolte e responsabili della sua attuazione. In questo lavoro si è quindi cercato di identificare ed analizzare alcuni degli elementi epidemiologici che sembrano influenzare maggiormente la complessa dinamica delle infezioni nella popolazione dell'orso marsicano, utilizzando un approccio matematico. Dal punto di vista metodologico è stato implementato un modello di simulazione *population-based* a dinamica continua basato su un sistema di equazioni differenziali ordinarie (ODEs) a tre compartimenti: S (*susceptible*), I (*infected*) e R (*recovered*). Il modello ha permesso di esplorare gli effetti di differenti tipologie di agenti patogeni attraverso la simulazione di sistemi che prevedono diverse relazioni tra i 3 compartimenti considerati (SIR, SIRS e SIS) in 3 principali scenari: i) introduzione di un nuovo patogeno nella popolazione di orso completamente recettiva in assenza di un reservoir esterno (poco

realistico ma punto di partenza per la valutazione degli scenari successivi); ii) esposizione continua della popolazione di orso ad un patogeno presente in forma endemica in una popolazione domestica e/o selvatica simpatica che ne rappresenta il serbatoio epidemiologico (es. virus dell'epatite infettiva canina); iii) mutazione di un patogeno in una forma ad alta patogenicità in una specie simpatica e sua introduzione nella popolazione di orso (es. virus del cimurro). Per ciascuno di questi scenari, e per differenti agenti patogeni, è stato stimato l'effetto sulla dinamica di popolazione dell'orso di alcuni dei principali parametri epidemiologici in grado di caratterizzare la relazione ospite-parassita, quali contagiosità (frequenza di contatti e tasso di trasmissione), patogenicità (letalità ed effetto sulla riproduzione), guarigione (durata dell'infezione ed acquisizione dell'immunità protettiva) e perdita dell'immunità (possibilità di reinfezione di individui precedentemente infettati). In questo modo, attraverso l'analisi comparativa di scenari ed architetture compartimentali differenti, è stato possibile individuare alcuni punti critici dell'interazione sanitaria tra la popolazione dell'orso marsicano e le altre specie animali recettive (domestiche e selvatiche), gettando le basi per l'elaborazione di possibili piani di sorveglianza sanitaria ed eventuali interventi gestionali volti a controllare quelle patologie in grado di determinare perturbazioni a carico della naturale dinamica di popolazione dell'orso. Questo lavoro, seppur preliminare e teorico, rappresenta un approccio teso allo sviluppo di una metodologia, oggettiva e riproducibile, per lo studio dei rischi sanitari dell'orso marsicano e della loro possibile mitigazione considerando la complessità delle relazioni ospite-parassita in un ambiente ad elevato grado di biodiversità.

The effects of coyote functional feeding response on *Echinococcus multilocularis* transmission, in Calgary, Canada

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S093

We report results obtained in the framework of the “Calgary Urban Coyote Project”, an interdisciplinary research program developed at the University of Calgary, Faculty of Veterinary Medicine. The project is focused on the transmission of pathogens at the interface between wildlife, domestic animal and humans, giving particular relevance to the transmission of zoonotic *Echinococcus multilocularis*. The parasite transmission relies on an intermediate host being subject to predation by a definitive host. Previous study showed clear evidences of an existing link between predator-prey interaction and parasite dynamic.

The objective of this research is to explore coyote feeding ecology, focusing on predator response to fluctuation abundance of prey species competent for *Echinococcus multilocularis*, and assess the consequences related to the parasite transmission.

In particular we analyze the case of urban coyote functional response in Calgary, focusing on prey species that are competent for *Echinococcus multilocularis*. For this aim we have elaborated diet data correlation to small mammal preys abundance data, using diet data of 181 scat samples and prey abundance

data, collected during four trapping seasons (11 months, from June 2012 to May 2013), that were gathered simultaneously to faecal sample collection.

The bibliographic research underlined that the topics of predator-prey interaction in a multi prey system and predator functional response consequences for parasite transmission are both areas still largely unexplored.

The data analysis concerning the particular case study showed that, in a multi prey system, coyote exhibits different functional feeding responses to different prey species. In more detail, coyote showed a Type II functional response for all voles species, and, on the other hand, the predator showed a Type I functional response for *Peromyscus maniculatus*.

This study lay the foundation for the design of a model of predator-prey interaction in a complex multi prey system. Such a model would permit to assess plasticity of predation behaviour consequences for the transmission of an important zoonotic *Echinococcus multilocularis*.

Global changes and wildlife zoonotic disease emergence: the case of tick-borne encephalitis

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S175

Of all the known zoonotic tick borne diseases, tick borne encephalitis caused by TBE virus (TBEV) is the most common tick borne disease transmitted to humans in Europe and eastern and central Asia. It is now endemic in 27 European countries, and has been declared an international public health problem. Since the virus is also transmissible through raw milk and dairy products of infected goats, sheep or cattle TBEV has the potential to make a significant impact on food security and regional economy, especially in areas using traditional methods of milk collection and processing and the use of un-pasteurised milk for the production of typical local dairy products.

We analysed pattern of TBE emergence in northern Italy combining eco-epidemiological long term and extensive surveys. Major drivers of disease emergence were identified in changes in forest management and the rise of ungulate population. Spatial and temporal variation in infection risk is driven by the interaction of several factors, including local variation of tick host abundance. Although significant progress have been made in our understanding of TBEV ecology, several other factors need a better understanding to improve our ability to predict how the risk of TBE infection would change in the near future under a global change scenario.

Il depopolamento delle specie selvatiche ai fini sanitari: approccio teorico e possibilità pratiche

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S073

Dopo il primo focolaio nel continente europeo nel 2007, non inaspettatamente, la Peste Suina Africana ha raggiunto la Comunità Europea attraverso un viaggio di circa 7 anni iniziato dal porto di Poti in Georgia sul Mar Nero, le foreste delle pianure situate al confine tra Bielorussia, Lituania e Polonia. Il cinghiale ha certamente svolto un ruolo primario nel permettere al virus di attraversare vaste aree a bassa densità di suini (Cecenia, Daghestan) e, per motivi probabilmente legati al commercio internazionale, appare la specie in cui vengono denunciati la maggior parte dei casi di infezione a livello internazionale.

Immediatamente autorità russe competenti, seguite da quelle bielorusse e da poche settimane da quelle lituane, hanno cercato di contrastare la diffusione del virus attraverso una pesante politica di depopolamento della specie ospite, nonostante le rimostranze della comunità internazionale allarmata dalle conseguenze ecologiche che una pesante riduzione delle popolazioni di cinghiale avrebbe prodotto sulla densità dei suoi predatori.

La base teorica su cui si dovrebbero basare queste azioni di depopolamento è definita dal “teorema della densità soglia di invasione”, ovvero sul fenomeno secondo il quale esiste (rebbe) una densità della specie ospite al disotto della quale – attraverso fenomeni di densità dipendenza – un animale infetto non trova un individuo in tempo utile per trasmettere l’agente eziologico, interrompendo così la catena dell’infezione. Nt, la densità

minima che permette l’invasione di una popolazione da parte del parassita, può essere calcolata conoscendo alcuni parametri epidemiologici, molti dei quali estremamente difficili da stimare. Il presente lavoro si pone come scopo quello di valutare l’influenza del depopolamento nel raggiungimento di Nt utilizzando parametri epidemiologici, noti e non, in particolare: coefficiente di trasmissione dell’infezione, tassi di letalità e guarigione nonché lo sforzo di depopolamento. Utilizzando i parametri noti per la PSA appare evidente come l’influenza del parametro “sforzo di depopolamento” sia ben poco influente nel raggiungimento di ipotetiche Nt.

In conclusione, considerando che la stima di Nt non può concretamente essere effettuata poiché non è conosciuto il coefficiente di trasmissione del virus, che le stime delle popolazioni di cinghiale sono relativamente imprecise e del minimo contributo del depopolamento, si ritiene che le azioni di cieco depopolamento siano controindicate e controproducenti rispetto ad altre misure di controllo quali aumento della biosicurezza, divieto di caccia e minimizzazione del contatto tra biocenosi silvestre e allevamento suino.

Infine si ritiene che l’approccio qui presentato, pur passibile di miglioramenti, debba costituire la base per valutare il successo e la coerenza di ogni azione di riduzione delle popolazioni per motivi sanitari.

Faecal testosterone and cortisol metabolites in relation to life history traits of male of Alpine ibex (*Capra ibex*)

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S172

Endocrine changes affect diverse important aspects of growth, development and reproduction of animals. Several researches have shown the influence of testosterone on development and growth of secondary sexual characteristics of polygynous ungulate males. It is also proven its direct correlation with aggressive and agonistic behaviours; consequently a lot of studies have been focused on its relationship with dominance status. Another class of steroids hormones, the glucocorticoids, are important mediators of different physiological processes that tend to suppress both reproductive and immune function in order to favour immediate survival. The aim of this study was to describe the hormone variations of male Alpine ibex (*Capra ibex*), throughout the year, assessing the effects of age and social rank. From May to October of two years (2012-2013) we monitored testosterone and cortisol levels of Gran Paradiso National Park population by means of

faecal metabolites analysis. We collected samples of more than 50 marked individuals aged from 2 to 17 years. The specimens, frozen quickly after deposition, were analysed with two validated enzyme immunoassay (EIA). In order to evaluate the hierarchical order of individuals, we recorded all agonistic interactions with *ad libitum* observations. The identification of dominant and submissive displays was used to assess the winner of the dispute. The frequency of the agonistic interaction decrease as the season progresses. Hormone levels are related to the males’ social rank and to their reproductive success. Our findings contribute to understand the role of sociality on hormone levels and *vice-versa*, highlighting the costs (immunosuppression) and benefits (current reproduction) related to maintaining high social rank positions.

Epidemiological investigation of *Toxoplasma gondii* in Alpine red deer (*Cervus elaphus*): spread and effects on pregnancy

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6818

Several animal species can be infected by the widespread protozoan *Toxoplasma gondii* contributing to maintain both domestic and sylvatic parasite lifecycle and favouring the raise of public health issues related to its zoonotic value. As wild ungulates can be source of *T. gondii* for humans through consumption, manipulation and evisceration of carcasses, risk of infection should be evaluated in relation to the amount of game meat available from harvest plans every year. Therefore in Italy the attention should be focused on red deer (*Cervus elaphus*) because of the intense hunting activity in many Alpine areas and since this species is the most frequently consumed raw or undercooked. In particular, despite the well documented zoo-economic losses in livestock, little is known about the epidemiology of *T. gondii* infection in red deer particularly regarding any impact on populations' dynamics. Besides no assessments are reported about *T. gondii* associated-reproductive pathologies in this species although vertical transmission recorded in white tailed deer (*Odocoileus virginianus*) and natural transplacental toxoplasmosis documented in a stillborn reindeer (*Rangifer tarandus*) foetus point out the hypothesis that also red deer could be affected. In addition just few studies have investigated the effect of parasitism on fecundity of ungulates in natural conditions.

Here we performed a sero-epidemiological investigation of *T. gondii* in red deer from two areas in Stelvio National park (Italian Central Alps), and three Generalized Linear Models were set up to evaluate: (1) the epidemiological factors influencing the probability to get infected; (2) if the infection is acquired before the breeding season or in early pregnancy and (i) could cause early abortion and drive hinds to lose reproduction, (ii) may influence hinds' fertility through a delay in the physiological development of foetus.

During two consecutive weeks between the end of November and the beginning of December 2012, 81 red deer sera were collected during the culling management plan scheduled by the park, for each subject age, sex, location and morpho-biometric measures were recorded. In females, lactation and pregnancy were also registered together with foetus body weight and length. Sera were tested for the presence of anti-*T. gondii* IgG using a

commercial ELISA kit (IDVET, Montpellier, France).

An overall seroprevalence of 39.5% emerged, giving evidence to the circulation of the pathogen in the study area. In particular, a significant effect of age class (calves, 1-year-old and >2-year-old deer) was recorded: the probability to contract infection is significant lesser in calves than in the two others. No significant difference emerged between 1-year-old and >2-year-old deer pointing out an equal infection in these age classes supporting the hypothesis of a high level of environmental contamination. Considering the sporadic presence of lynx (*Lynx lynx*) in Italian Alps, feral and semi-domestic cats are the only definitive hosts responsible for *T. gondii* spreading. Calves did not contract the infection, apart just one female, and this fact suggests an almost total lack of vertical transmission in the studied population. *T. gondii* infection seems not to prevent hinds to become pregnant or to cause early abortion, leaving females apparently barren although a negative effect of the pathogen on foetuses development of 2-3 year-old hinds and of hinds from area 1 was recorded. These results highlight that the pathogen could anyway affect pregnancy supporting the hypothesis that these hinds had acquired the infection before the breeding season or in early pregnancy. In particular *T. gondii* seems to have influenced their fertility through a delay in the physiological development of foetus or to have affected hinds' breeding season provoking a delay in mating or in pregnancy.

Data arisen give evidence to a high level of *T. gondii* environmental contamination with horizontal transmission as the only route of infection in the study area. In this sense a widespread exposure to infection is supposed and should be taken into account in relation to the parasite zoonotic potential. The recorded negative impact of *T. gondii* on foetus development of both 2-3 year-old hinds and females from area 1 points out that under specific conditions the pathogen could give an impact on population dynamics of this intermediate host. Further analysis are needed to evaluate the distribution, densities and *T. gondii*-sero prevalence of semi-domestic and feral cats in order to define their role in environmental contamination and thus their effect in red deer infection.

Lungworms in an Alpine ibex colony of north-eastern ItalyR. CASSINI¹, E. STURARO², C. FILIPPINI¹, M. MOSCONI¹, A. FRANGIPANE DI REGALBONO¹, M.A. PARRAGA², L. ROSSI³, M. RAMANZIN²¹ Department of Animal Medicine, Production and Health, University of Padova, Italy² Department of Agronomy, Food, Natural Resources, Animals and the Environment, University of Padova, Italy³ Department of Veterinary Sciences, University of Torino, Italy

Lungworm infections are commonly asymptomatic, but they may occasionally cause severe pneumonia and fatal cases in domestic and wild ungulates. Limited data are published on lungworm epidemiology in mountain ungulates from the European area. The few studies available on lungworms of alpine ibex (*Capra ibex*) reported the presence of protostrongylid infection, with different prevalence values among genera. The objective of the present research was to examine prevalence and intensity of bronchopulmonary nematode infection in an isolated colony of alpine ibex in the Marmolada massif group (Dolomites - 46° 26' 13" N, 11° 51' 54" E), and to improve available techniques to count the larval stages in faeces, so as to use them as a non-invasive tool to study host-lungworm relationships in wild ruminants.

A total amount of 179 faecal samples were collected from July to November 2013 from the study area. For each sample, age class (kid, adult), sex and sampling date were recorded. A qualitative analysis for the detection of bronchopulmonary nematode larvae was implemented, performing a modified Baermann technique, here described. Two grams of faecal sample were suspended in a Falcon[®] 50 ml conical tube (30×115 mm), filled with water up to 40 ml. After standing for 16-24 h, the faeces were discarded and the fluid in the tube reduced to a final volume of 10 ml. Liquid in the tube was gently mixed and 1 ml was moved into an Eppendorf tube, added with 4 drops of Lugol solution and then placed into 4-5 slides for examination under a microscope at a magnification of 40× and 400×, respectively for detection and identification of larvae. Different genera of lungworms were identified based on the linear lengths and the morphology of the tail. For each genera, the total number of larvae identified was multiplied by 5, in order to obtain the number of first stage larvae per gram (L1/g). When no larvae were found in the 1 ml aliquot, about 2 ml were aspirated from the bottom of the tube and observed at 10× in a stereomicroscopy. Larvae possibly present were identified at microscopy (400×) and the sample classified as positive below the threshold with an estimated larval output of 2.5 L1/g.

Prevalence and intensity of infection among different groups (kids and adults; males and females; sampling months from July to November) were compared using respectively the Pearson Chi-squared test (or the Fisher test, if more appropriate) and the Mann-Whitney U test (or the Kruskal-Wallis test, when more than two groups were compared). The measure of parasite aggregation was obtained estimating the parameter k of the negative binomial distribution.

Considering the entire ibex population, 151 (84.4%) individuals were infected with larvae of the genus *Muellerius*, whereas other protostrongylid genera showed lower prevalence values: 16 positives (8.9%) for *Protostrongylus*, 8 (4.5%) for *Neoststrongylus* and 2 (1.1%) for *Cystocaulus*. No samples were found positive to dictyocaulids genera. Statistically significant differences in prevalence values were identified only between age classes, with adults (87.0%) more infested than kids (58.8%) for *Muellerius* ($p < 0.01$) and, on the contrary, kids (41.2%) more infested than adults (5.6%) for *Protostrongylus* ($p < 0.001$).

The average larval output of infested animals was 145.3 L1/g for *Muellerius*, 18.8 L1/g for *Protostrongylus*, 17.2 L1/g for *Neoststrongylus* and 10.0 L1/g for *Cystocaulus*. *Muellerius* showed an increasing trend during the sampling period, with significant differences among months and the higher output in November. Differences between age classes confirmed the opposite trend of *Muellerius* and *Protostrongylus*, with higher larval output in adults for the former ($p < 0.001$), and in kids for the latter ($p < 0.001$). *Muellerius* showed also significant higher output of L1 in males, compared to females ($p < 0.001$). The differences between age classes were confirmed also after excluding males from the analysis and comparing only kids and adult females. The parameter k calculated for *Muellerius* was 0.204, which is indicative of an aggregated distribution.

The genera of protostrongylids encountered in this population and their prevalence values, the absence of the genus *Dictyocaulus* and the seasonal trend of *Muellerius* are in agreement with the few studies conducted on other populations of the Alps. No data on larval output intensity is available for alpine ibex, however different Authors reported in Spanish ibex similar or lower values to what encountered in this alpine ibex population. In conclusion, lungworm parasite community of the studied ibex population is dominated by the genus *Muellerius* that is well adapted to cold climate conditions. Its aggregated distribution is indicative of a stable host-parasite relationship, but additional quantitative studies are needed for fine tuning of this relationship at the individual and herd level. Interestingly, very few authors studied with a quantitative approach the lungworm infections of the mountain wild ruminants (chamois and ibex) in Europe, whereas gastro-intestinal nematodes are widely and deeply investigated with this ecological approach, and McMaster technique is an international standardized approach for quantification of eggs output. Our study developed a possible approach for this kind of studies, adding useful information to the knowledge of this group of parasites.

I risultati della sorveglianza diagnostica sui mammiferi marini della rete regionale spiaggiamenti della Calabria

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S013

Con Decreto del Presidente della Giunta Regionale n. 104 del 29 Luglio 2013 recante “Linee guida operative per la costituzione di una rete minima d’intervento tesa alla gestione degli spiaggiamenti di fauna acquatica sulle coste della Regione Calabria. Obiettivo SVET”, la Regione Calabria ha istituito la Rete Regionale Spiaggiamenti volta a gestire, secondo le linee guida del MATTM, gli eventi di spiaggiamento di animali marini che avvengono lungo le coste calabresi. Il Decreto, oltre ad affidare alle Aziende Sanitarie Provinciali competenti per territorio il coordinamento delle operazioni da effettuare in caso di spiaggiamento di un esemplare, coinvolge nell’espletamento delle attività il Centro Studi Cetacei. Tale ultimo aspetto si è rivelato decisivo sia ai fini di un corretto svolgimento dei compiti di sorveglianza sanitaria sui cetacei spiaggiati, sia ai fini della realizzazione di una esaustiva raccolta di dati relativi a detti eventi. I biologi specializzati del CSC, infatti, raccolgono per ogni animale spiaggiato i dati biometrici e quelli relativi alla specie, provvedendo inoltre, nel caso di esemplari vivi alla stabilizzazione degli stessi e alle opportune operazioni di recupero secondo le direttive impartite dal CERT e nel caso di esemplari morti al supporto nell’effettuazione della necropsia da parte del personale veterinario (in loco per le grandi taglie, presso la sezione provinciale dell’Istituto Zooprofilattico del Mezzogiorno per piccole taglie).

La costituzione della Rete Regionale Spiaggiamenti rappresenta il riconoscimento ufficiale da parte delle Istituzioni del lavoro di squadra proficuamente svolto, sin dal 2011, dai biologi del CSC in collaborazione con i Servizi Veterinari delle Aziende Sanitarie Provinciali, le Capitanerie di Porto, le Sezioni Provinciali dell’Istituto Zooprofilattico del Mezzogiorno.

Gli animali censiti nel biennio 2011-2013 sono stati in totale 33: 24 *S. coeruleoalba*, 2 *Ziphius cavirostris*, 2 *T. truncatus*, 2 *Physeter catodon*, 2 *Grampus griseus*, 1 *Globicephala melas*.

In particolare, sono stati censiti 9 esemplari di *S. coeruleoalba* sullo Jonio (4 F – 4 M – 1 Ind) e 15 sul Tirreno (8 F – 6 M – 1 Ind); gli animali spiaggiati sullo Jonio si presentavano in uno stato di conservazione migliore di quelli del Tirreno (grado di conservazione medio compreso tra 2 e 3 per lo Jonio e compreso tra 3 e 4 per il Tirreno), anche e soprattutto perché per la maggior parte di essi la morte è sopraggiunta soltanto dopo diverse ore dal primo spiaggiamento.

Rispetto ai dati espressi dalle linee guida del NOAA, 7 soggetti (1 sullo Jonio, 7 sul Tirreno), pari al 29.1% del totale, hanno una lunghezza inferiore a 150 cm, quindi probabilmente un’età inferiore all’anno. 3 soggetti (12.5%, tutti sul Tirreno) mostrano una lunghezza compresa tra i 150 e i 175-180 cm, corrispondente ai 5-7 anni; 4 soggetti (16.7%, 3 sullo Jonio, 1 sul Tirreno) una lunghezza compresa tra i 180 e i 190 cm, quindi 8-9 anni; 10 soggetti (41.7%, 5 sullo Jonio, 5 sul Tirreno) una lunghezza superiore ai 190 cm, quindi un’età superiore ai 9-10 anni. Dai dati esposti si evince che circa il 90% degli esemplari rinvenuti sullo Jonio aveva raggiunto la maturità sessuale, mentre sul Tirreno la percentuale scende a circa il 50%.

Tali stime effettuate utilizzando la curva del NOAA saranno comunque soggette a verifiche effettuate mediante l’esame microscopico del dente; infatti gli operatori della Rete provvedono a effettuare tali campionamenti in maniera sistematica, inviando i reperti all’IZSM come da protocollo.

Dai rapporti di prova forniti dall’IZSM si evince che le cause principali di mortalità sono ascrivibili al *Dolphin Morbillivirus* per gli esemplari spiaggiati sul Tirreno e ad una parassitosi da *Anisakis* per quelli spiaggiati sullo Jonio; le analisi hanno evidenziato, inoltre, diversi casi di *Photobacterium damsela* e altre parassitosi da ritenersi corresponsabili delle morti, soprattutto negli animali rinvenuti particolarmente defedati.

Dalla correlazione tra le cause di mortalità e le età dei soggetti spiaggiati si deduce che l’*Anisakis* ha colpito prevalentemente gli esemplari adulti, mentre il *Morbillivirus* ha aggredito prevalentemente la popolazione più giovane, conclusioni che risultano confermare sia quanto sostenuto nel “Rapporto IZS 2013” che i risultati raggiunti da diversi studi condotti dal CERT.

È da sottolineare, infine, che su 33 esemplari spiaggiati, si sono verificate solo 3 occorrenze in cui è risultata impossibile la determinazione del sesso per motivi di conservazione e nessuna occorrenza di indeterminazione della specie, a testimonianza della tempestività di intervento degli operatori del CSC e del buon funzionamento della Rete.

Il monitoraggio dello stato sanitario degli esemplari spiaggiati risulta indispensabile sia per la salvaguardia della specie che per la tutela della salute pubblica, in quanto questi animali possono essere vettori di patologie a carattere zoonosico.

A GIS approach for epidemiological risk modeling: a case-study on vector-borne diseases

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Valuable and effective tools are available to epidemiologists for modeling and predicting the transmission of communicable diseases. The use of GIS and of georeferenced environmental information (inferred from remote sensing) allow to analyze the complex system of relationships existing between the distribution of a pathogen, of its vectors and hosts, together with the simultaneous presence of favorable environmental conditions for disease spreading.

Within the “Executive program for scientific and technological cooperation between the Italian Republic and the Republic of Serbia for the years 2013-2015” we developed an epidemiological model to evaluate the disease risk of three specific pathogens that are of vector-origin. The epidemiology of these vector-borne parasitic diseases will be modeled by taking into account i) the distribution/abundance of host species, ii) distribution of

competent vectors, iii) environmental characteristics.

The research project is being carried out in Serbia and Italy, to compare the epidemiology of the target parasites in two different environmental/climatic settings. The ultimate goal of the research project is to develop a predictive model of infection risk. These models are particularly valuable to identify critical areas for disease spreading and to focus active wildlife monitoring and disease surveillance. In a rapidly evolving scenario of global climate change and habitat encroachment the monitoring of emerging diseases is of particular concern. A first practical application of such geographic-based models is given by analysing the correlation of environmental factors to Ixodidae tick distribution and associated pathogens (*Babesia* sp., *Ehrlichia canis* and *Anaplasma phagocytophilum*) within the Republic of Serbia.

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Metodi e modelli per l'analisi dei dati faunistici e ambientali: le nuove frontiere della conservazione dei Mammiferi

La conservazione della fauna richiede una conoscenza approfondita della distribuzione e della dinamica delle popolazioni, così come di informazioni sull'ecologia delle specie, in particolare sulle relazioni delle specie con le variabili ambientali e i fattori antropici. Tali informazioni derivano da studi empirici e teorici che devono essere condotti a livello di specie e comunità.

Obiettivo della sessione è quello di presentare le più recenti tecniche di analisi di dati faunistici e ambientali, con una prospettiva allargata a tutte le fasi di sviluppo delle ricerche in ambito teriologico. Potranno quindi essere presentati lavori che riguardano nuove tecniche di studio delle specie sul campo o in condizioni controllate (es. uso di rilevatori GPS, fototrappole e altri sensori, tecniche genetiche applicate ai rilevamenti di campo o allo studio delle popolazioni), congiuntamente all'analisi dei dati raccolti (e.g. modelli predittivi ed esplicativi, nuovi approcci statistici). I lavori presentati nell'ambito della presente sessione non dovranno limitarsi all'esposizione di un singolo "caso di studio", ma partire dalla propria esperienza per discutere in maniera più ampia pregi e limiti dei metodi proposti.

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IX Congresso Italiano di Teriologia

Opening Lecture: Models in ecology: why everybody should be a Bayesian ecologist

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Opening Lecture

In recent years, population ecology has moved toward the application of advanced and rigorous statistical analysis and modeling techniques in the pursuit of robust inference. Models are now recognised as a requirement for a proper quantitative understanding of ecological mechanisms and also for assisting decision making for management. Models are simplified representations of the world and can have various degrees of complexity. Worth noticing is that the most complex models are not necessary the most appropriate ones and models need instead to be tailored made for a particular question and data. There are various statistical paradigms allowing us to use models. The most ubiquitous one is the frequentist one but a powerful alternative one – the Bayesian paradigm – has recently gathered interest and gained support among quantitative ecologists. The Bayesian approach is particularly intuitive as it adopts a way of thinking that everyone follows in every day's life: updating belief (called the posterior) according to new data and previous evidence

(called the prior). The Bayesian approach is also particularly suitable in ecological research, it can handle multiple sources of data and uncertain information in a coherent framework and also easily incorporate simulating mechanistic models. This approach is however more challenging as one cannot simply obtain p-values from standard procedures but instead needs to formalise the likelihood of the data and write (i.e. program in a computer language) a model. The increased availability of specialized analytical software hiding the complexity of Monte Carlo Markov Chains is therefore of great help in overcoming this challenge. My talk will provide a gentle introduction to ecological modelling, pedagogically present the Bayesian reasoning and how it can be applied to ecological questions while being aware of its caveats, and end up with a plea to embrace a Bayesian metamorphosis. The debate between frequentists and Bayesian paradigms has been ongoing since several centuries and my hope is that it will continue during the 2014 ATIT congress!

IX Congresso Italiano di Teriologia

A permutation-based combination of sign tests for assessing habitat selection

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M205

The analysis of habitat use by animals is approached by comparing the portions of use vs the portions of availability observed in samples of radio-tagged animals for each habitat type. Since data are linearly dependent with singular variance-covariance matrices, standard multivariate statistical test cannot be applied. To overcome the problem, compositional data analysis is customary performed via log-ratio transform of sample observations. The procedure is criticized in this paper, emphasizing the many drawbacks which may arise from the use of compositional

analysis. An alternative nonparametric solution is proposed in the framework of multiple testing. The habitat use is assessed separately for each habitat type by the sign test performed on the original observations. The resulting p-values are combined in an overall test statistic whose significance is determined permuting sample observations. The theoretical findings of the paper are checked by simulation studies. Applications to some case studies are considered.

Factors affecting Bias in camera-trapping rate across felidsS. ANILE, S. DEVILLARD¹¹ UMR CNRS 5558 Biometry and Evolutionary Biology lab, University of Lyon, France

M018

Camera-trapping is a widespread tool used to study mammals and to obtain ecological data, for instance as density, abundance and demographic parameters. The majority of Felidae species are identifiable from camera-trap captures due to individual-specific coat-patterns; therefore, camera-trapping is used extensively for felids to build individual capture histories. For those species not individually identifiable, trap-rate is used as an index of abundance, with conservation measures based on this index. However, recent studies note that detection rates can be biased by species-specific behaviour, camera-trapping deployment and by the body-size of the species as larger animals are more likely to trigger the camera-trap.

The current study explores how camera-trapping rates are distributed across the family Felidae and examines using Generalized Linear Mixed Model (GLMM) whether camera-trapping rates are related to body size or camera-trapping approach (species-specific vs. multi-species) accounting for confounding factors such as trapping effort, type of camera, and inter-trap distance.

All available literature provided from primary scientific databases were explored. Search terms included “camera trapping” and both common name and scientific name for all 36 Felidae species. For each study we extracted the number of detections, the trapping effort (trap-days), the camera-trapping approach, the inter-trap distance, the deployment mode of camera (by pair vs. single), the daily monitoring mode (24h vs. less than 24h)

and the camera type (analogical, digital or both). Body mass of females (kg) were extracted from the PanTheria database for each species.

The literature search resulted in 138 relevant cases, from which 374 records for 23 felid species were obtained. On a reduced dataset without missing data, the effects on the confounding factors were first ruled off allowing us to test for the effect of body mass and camera-trapping approach on the overall dataset. Based on AICc model selection, the most parsimonious model retained that the number of detection (accounting for trapping effort) depended on the interaction between the camera-trapping approach and the body mass. Detection rates increased with body mass in multi-species camera-trapping studies whereas the effect of body mass on detection rate is less pronounced in species-specific studies. It resulted that detection rate is lower in multi-species studies, especially for low body mass species, so that, the camera trapping approach did not influence the detection rate for large species (over 100 kg). Hence comparing detection rate across species of different body size and within species with different camera trapping approach might be misleading.

The inclusion of body mass as a variable in the design, and subsequent analysis of camera-trapping data is recommended, in addition to conducting trials to test species-specific camera-trapping response.

IX Congresso Italiano di Teriologia

Land morphology, season and individual activity influence GPS fix acquisition rate in Alpine ibex

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MI168

Fix acquisition rate (FAR) can bias the estimates of movement paths and habitat use in GPS-positioning studies. We evaluated the influence of land morphology, climatic variables and individual activity on FAR in a high mountain area, using Alpine ibex (*Capra ibex*) as study species.

The study area is located in the eastern Italian Alps, in the “Marmolada” massif, with a surface of 5027 ha and elevation ranging between 1364 m a.s.l. and 3338 m a.s.l. Using a digital terrain model we produced raster layers (5×5 m) of slope, terrain roughness index, the percentage of visible sky (sky view) using Spatial Analyst for ArcGIS 10.1[®] and Terrain Analysis algorithms for SAGA Systems 2.0.8[®]. Land cover was classified from photo-interpretation of aerial photographs (1×1 m, WGS84/UTM32) into the following categories: rocks (%; 60.9±25.5), shrubs (%; 19.8±10.1) and forest (%; 19.3±4.2). Daily precipitations (mm) were obtained from the nearest weather station (Regional Agency for Environment Protection of Veneto Region, ARPAV). We used a dataset of 123816 GPS locations from 14 females of Alpine ibex fitted with Vectronic GPS Plus collars, which were monitored (1 scheduled location/hour) during September 2010 to October 2013. Each scheduled fix attempt was classified as successful when a location with X and Y coordinates was recorded, or unsuccessful otherwise. For each attempt, we also recorded the average movements number of the X and Y motion sensors in the 10 min intervals preceding and following it. In order to test the effects of land morphology and cover on FAR, we calculated individual daily minimum complex polygons, and their composition in terms of roughness, slope, sky view and land use. We then calculated daily FAR as successful/attempted (n=24) fixes. We used different logistic models to test the effects

of individual (random variable) month, activity, daily hour, precipitation, land morphology and land use on the probability for an attempted fix to be successful (SFIX) or on daily FAR.

The logistic regression analyses of SFIX gave significant effects of month, daily hour, activity, precipitation and individual. SFIX was higher in April-October: 0.91±0.01 than in deep winter months (November-March: 0.83±0.07), with different circadian patterns: in summer, SFIX showed two peaks in early morning and late afternoon, while in winter it was low during night and early morning, and showed a single peak around mid-day. These peaks closely matched those of activity signals. Effects of individual and precipitation were less marked. In the logistic regression analyses of daily FAR, roughness was excluded because it was highly correlated with slope. Daily FAR decreased with increasing slope and precipitation, and increased with increasing sky view. Land use variables had minor, although significant, effects. The effect of individual was non-significant, suggesting that individual differences are related to the morphological features of areas used.

Our results suggest that in Alpine landscapes land morphology and season, most probably through the effect of climatic conditions on individuals activity, have a remarkable effect on the probability of acquiring a scheduled fix. This may bias fix rate between individuals using different areas, and underestimate the use of micro-habitats providing shelter and the periods of low activity. This hypothesis is supported by preliminary results of stationary collar tests that show a strong effect of sky view and collar position (to mimic an individual standing in the open or lying in shelter) on fix rate.

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Forest management affects individual and population parameters of terrestrial small mammals in central Italy

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MI17

Several studies have shown that forest management (e.g. for timber production) affects mammal communities. However, previous studies were mainly *pattern* based and did not provide thorough insights into the actual mechanisms that affect small mammal populations in managed woodland. The goal of our work was to understand the demographic mechanisms by which forest management exerts its effects on small mammal populations. We here focus on the populations of three terrestrial small mammals (*Apodemus flavicollis*, *Apodemus sylvaticus* and *Myodes glareolus*). Populations were monitored for three years in a continuous forest in central Italy (Province of Siena) subjected to different management regimes. Our study design included: 3 grids located in recently coppiced stands, 3 grids located in stands coppiced 10 years ago, 3 grids located in mature forest (coppiced more than 30 years ago), 3 grids located in a mixed conifers-deciduous forest. We sampled a total of

35280 trap-nights which led to the capture of more than 1350 individuals. Our analyses targeted the following individual and population-level parameters: individual body condition, individual survival, population density (interseasonal dynamics) and population growth rate. Furthermore we gathered extensive quantitative data on the amount of food resources and habitat characteristics in each area since this would help us to identify the proximate causes of the effects of forest management on small mammal populations. We found strong effects of forest management on the target populations and, as expected, the effects were markedly different between the three species. We found significant effects both at the individual and population scale. Our detailed analysis encompassing multiple ecological scales allowed us to highlight some intriguing mechanisms by which forest management exerts its effects on small mammal populations.

Habitat preference of spotted hyaena *Crocuta crocuta* in a West African savannahM. DI VITTORIO¹, J. ADUKO², F.M. ANGELICI³¹ Ecologia Applicata Italia s.r.l., Roma, Italy² Wildlife Division, Forestry Commission, Mole National Park, Larabanga, Ghana³ FIZV, Via Cleonia 20, scala C, 00152 Roma, Italy

M029

The spotted hyaena (*Crocuta crocuta*) is one of the large predator mammals in Africa. This species is adaptable to extreme environments, also inhabits semi-desert habitat, swamp and marshy areas, open woodland, dense dry woodland, and montane forest up to 4000 m altitude. There are scattered populations from West to South Africa with the latter having larger populations. Generally, there is a decreasing trend in the population of spotted hyaena especially in eastern and western Africa. Mole National Park (MNP) is the largest protected areas of Ghana, and covers approximately 4840 km² of savannah habitat in the Northern Region of the country. Widespread burning during the dry season is the most significant direct human impact to park habitats. The park is large and remote, therefore range camps are strategically located in each range to enhance surveillance. Notwithstanding, certain portions of the park especially the northern part, is drier and inaccessible due to hills, escarpments and limited road network. There is limited knowledge on the ecology of the carnivores in MNP. Regardless of the precise status of wildlife populations in MNP, pressure from surrounding human communities is significant as hunting in the park is a challenge for park. The past studies (1968-2001 and 2006-2008) showed the spotted hyaena to be the most abundant in this protected area than other carnivores.

The aims of this study are to determine the factors affecting the habitat preference of spotted hyaena in MNP. Data were collected by Patrol staffs during their routine foot patrols for all the 12 months in 2010. This helped obtained current data as to where in the park spotted hyaenas occurred. Therefore, apart from data collected on patrols by staff, the primary method used for this study was by ground line transects. A Complete Random Design was used to select sample areas for foot transect survey to establish spotted hyaena occurrence and distribution. Grids forming cells were laid over a map of MNP. Within the selected cells (representing 25% of entire park surface) were then laid 1.84 km long transects. To ensure sampling across changing vegetation/habitat conditions, twenty transects were aligned/oriented perpendicular to the major streams and water courses in north-south or east-west directions. The bearings and map reference of each transect were extracted and noted. A total of 137 spotted hyaena observations were made by sightings, scats, foot tracks and other trails. These observations were standardized and georeferenced on a GIS digital shape. For our analyses, 20 Universal Transversal Mercator (UTM) squares intersected with the 137 hyaena observations in the Mole were considered occupied by the specie and analyzed using topographic and land use variables

as independent factors. We selected a grid composed by cells of 6 km side as Minimum Utilized Home Range, obtained using the NNds (nearest neighbor distances) values between sightings. We used Generalized Linear Models (GLZs) to model spotted hyaena habitat preferences. A forward stepwise regression procedure was performed to test the statistical significance of each variable in turn. The significant terms of the explanatory variables selected in the most parsimonious models were analysed in order to determine the comparative influence of each variable as well as the separate effect of interactions. The decomposition of the variation into subsets of explanatory variables was carried out by means of a partial regression analysis. Regarding the land-use subset of variables (fourth level of CORINE Land Cover Classes), the best model evidenced that the probability of spotted hyena occurrence increased with the surfaces of widely open cultivated savannah woodland (6-10 trees/ha), with the surface of grassland with/without scattered tree/shrub while decreased with the surface of closed cultivated savannah woodland (>20 trees/ha), with open savannah woodland (<25 trees/ha), with the surface of riverine savannah vegetation and with the surface of bushfire and a complex combination of spatial terms (longitude and latitude) as the best predictors. Regarding the topographic subset, the model including spatial and topographic variables showed that the probability of presence of spotted hyaena decreased with the elevation a.s.l. of the UTM square and with the latitude. The best fitting of the spatial term including the square function of latitude is the best predictor. According to the hierarchical partitioning of the variance, the analysis evidenced that the largest portion of the variability in the spotted hyena's habitat preferences was explained by the combined effect of land use and topographic variables, followed by the joint effect of spatial components and land-use variables and spatial components and topographic variables.

Densities and distribution of large mammals are influenced by a range of ecological factors, including vegetation. Knowledge of factors that influence distribution and the cost associated with changes in such factors are critical in guiding management and conservation efforts. The most parsimonious explanatory models suggests that the spotted hyaena in MNP prefers low elevation areas surrounded by grassland and low wooded landscape, avoiding high woodland areas of continuous forest, riverine vegetation and burned bush.. Our results show the importance of environmental mosaics created by the presence of open areas, which probably offer preys in abundance, much more than closed areas characterized by high tree cover.

Biological determinant of spreading rate in terrestrial mammals

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M070

The rate of spread is an important measure of species adaptability, and has implications in biogeography, epidemiology and conservation biology. Particularly relevant in conservation is the ability of species to compensate the predicted future habitat loss due to climate change by spreading in new climatically suitable areas. However, given the lack of knowledge in spreading process, predictive models of future habitat loss often rely on extreme dispersal assumptions (no dispersal vs full dispersal).

This project aims to estimate the contribution of different biological traits to the spreading rate of terrestrial mammals.

We built a comprehensive database of species traits, and used it to simulate virtual species by sampling from a trait space following a bayesian approach. Virtual species traits are inter-correlated and lie within the range of values observed in real mammalian species; this method allows to simulate an infinite number of species with realistic trait values. We used virtual species to run two different – and often seen as competitive –

models of population spread: an individual-based model and an analytical model. We then compared the results of the two models and assessed the importance of different traits in influencing the spreading rate.

Although the two models are based on different assumptions, their results are consistent and suggest both a correct model parameterization and the independence of our results from specific modelling assumptions. Our results suggest that demographic traits are the major predictors of spreading rate in mammals with fast life cycles, whereas dispersal distance becomes predominant in species with slower life cycles. These results also highlight how simplistic dispersal assumptions and models, often applied in conservation science, can greatly under- or over-estimate mammals abilities to track climate change. Our results can be used to improve predictive models by using existing species information to provide more robust estimates of the potential future spread in terrestrial mammals.



Where the grey squirrel will become a threat in the Umbrian agriculture?

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M160

Aliens' incursions are one of the main drivers of biodiversity loss at the global scale. Also invasive alien species pose a serious threat to human activities, infrastructures and public health. Only in Europe, DAISIE counts 11000 non-native species, of which 10-15% causes some impacts on ecosystems or human activities with huge economic damages; for example members of the European Union spend at least 12 billion euros per annum. The introduction of the grey squirrel in Europe is one of the best-known cases of biological invasion. The invasive species tends to replace, through a complex process of interspecific competition, identified by the term "competitive exclusion", the native eurasian red squirrel like in the British Islands and northern Italy. Also, grey squirrel in the British Islands causes forest damages through bark-stripping activity to trunks and branches, determining negative impacts on the timber quality. It is estimated that these damages cost the UK timber industry some 17 million euros per annum.

In Umbria, the first sightings of grey squirrel date back to 2003 in the areas surrounding a private wildlife park within the Natura 2000 site IT5210021 "Monte Malbe". The presence of *Sciurus carolinensis* in Umbria represents a serious threat to forest biodiversity of central Italy and a potential source of negative impacts on important sectors of the local agroecosystem such as viticulture, fruit growing, olive growing and chestnut. If it has been already possible to record biodiversity impacts, with the disappearance or extreme reduction of the native red squirrel in the suburb of Perugia, it's much more complicated to predict impacts on human activities. Currently, just a few reports of damage to fruit trees in gardens of private citizens are reported. Therefore the goal of the work is assessing the risk (from a human activity point of view) related to the future spread of the alien grey squirrel in the Umbria region. In this case the product of "probability" and "vulnerability" defines the risk. The areas of potential presence of the grey squirrel in Umbria represent the term probability and the overlapping of themes relating to the sectors potentially affected by grey squirrel impact (chestnuts, vineyards, olive groves, fruit trees and truffle areas) represents the term vulnerability.

All processing was carried out through Quantum GIS (QGIS) and Geographic Resources Analysis Support System (GRASS), free and open source GIS softwares. Map of probability was performed through two steps: application of *Spatially Explicit Population Dynamics Models* (SEPM) and application of

Multi Criteria Decision Analysis (MCDA). SEPM, starting from field data, models the future spread of the alien squirrel taking into account the carrying capacity for the species of *Corine Land Cover* categories and population dynamic parameters, like dispersal range, litter size, proportion females having first litter, proportion females having second litter, adult survival and juvenile survival. MCDA, implementing multicriteria theory, refines previous results with environmental and geographical variables and has been carried out in GRASS through the module `r.mcda.roughset` that requests a decision map and criteria maps. Decision map was the output of the SEPM (at five years step), while multicriteria maps were Normal Difference Vegetation Index (NDVI), woodland areas (WA), average minimum winter temperatures (AMWT), Euclidean distance from the current known range (EDKR), Euclidean distance from the main roads (EDRO) and Euclidean distance from main rivers (EDRI) classified by a gain or cost judgement on the base of ecological preferences of the alien species. NDVI, WA, AMWT and EDRO represent a gain, while EDKR and EDRI represent a cost. The module generates decision rules which may be easily understood thanks to their "if... then..." structure, for example a rule generated is: "if (AMWT \geq 9.117° C) and (EDKR \leq 24634.326 km) and (NDVI \geq 8.000) and (EDRO \geq 3010.399 km) then grey squirrel is present". Vulnerability map was realized through command `r.series` in GRASS and categorizes Umbria region in six classes.

In the end, to get the maps of risk, we joint each probability map with vulnerability one. Thus, a five years step risk map was produced for the coming 40 years.

Risk maps highlight two regional areas that appear at higher risk in the short-medium term: Alta Valle del Tevere and the central portion of the region (municipalities of Torgiano, Assisi, Bevagna and Montefalco). Possible future impacts will concern especially three sectors: chestnut, fruit growing and vineyards. These maps represent an innovative *a priori* modelling of future grey squirrel impact and they are an important decision support system, which can be used for future management actions if the expansion of the species will not be stopped in time. Therefore, it is desirable that the alien species can be removed before the coming of any socio-economic issues, as well as biodiversity one. For this purpose, it is necessary to involve all stakeholders, including certain categories of farming, to raise awareness in the public opinion of the importance of preventive actions.

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Do founder size, genetic diversity and structure influence rates of expansion of North American grey squirrels in Europe?

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C049

This study investigates how founder size may affect local genetic diversity and spatial genetic structure of the invasive American Eastern grey squirrel (*Sciurus carolinensis*) in European areas, namely Piedmont, Italy and Northern Ireland, Northumberland and East Anglia, UK. It also examines whether dispersal propensity and invasion rate may be related to founder size, genetic diversity and structure. Across the invaded range in Europe, 315 squirrels from 14 locations, grouped in 4 main areas, were sampled and examined at 12 highly polymorphic microsatellite loci. We estimated both genetic variation and population structure using AMOVA, Mantel tests and Bayesian analysis. We also estimated migration rates and range expansion rates. Our results show that genetic diversity varied in accordance with numbers of founders across populations. For instance, the Italian population had the smallest founder size and lowest genetic variability whereas Northumberland had high

values for both. Significant levels of genetic differentiation were observed in all the examined regions. Gene flow, migration, and population range expansion rate were also higher in England and Ireland than in Italy. Populations descending from human-mediated releases of few individuals were more genetically depauperate and more differentiated than populations established from a greater number of founders. Propagule pressure is therefore a significant factor in squirrel invasions. There is a trend whereby larger founder sizes were associated with greater genetic diversity, more dispersal, less local genetic differentiation, and faster range expansion rate in squirrels. These findings have important management implications for controlling spread rate of squirrels and other invasive species: good practice should prioritize preventing further releases and the merging of genetically distinct populations as these events can augment genetic diversity.

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Bioacoustic approach to the howling survey

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M123

Biologists face particularly complex challenges in monitoring and managing the recovery of large, wide-ranging mammalian carnivores. As many social canid species use howling for territory ownership, one of the main canid monitoring technique is the howling survey. However, in mostly of the cases, howling sessions end with the only aural extemporaneous estimation of the pack size.

We show here, the advantages of recording canid replies (i.e. wolves, jackals, coyotes) and using bioacoustic analysis in the howling survey technique for determining pack size by visualising and counting contemporaneous voices in the choruses.

The estimation of the pack size by spectrographic analysis is more efficient than the mere aural estimation. On the basis of spectrographic evidence it has been possible to identify up to six contemporaneous voices, while aural estimation is frequently uncertain and failed to count more than three, four animals. This technique requires low budget with respect to other monitoring techniques (i.e. video trapping, genetic analysis and capture) and can be combined with these other sources of information. Moreover, howls recorded and stored as file audio format with good resolution are always available for future investigations without time deterioration.

Vocal repertoire in *Apodemus sylvaticus* and *A. flavicollis*: potential applications to species discrimination

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M044

The wood mouse (*Apodemus sylvaticus*) and the yellow-necked mouse (*A. flavicollis*) are two closely related species that show a similar ecology and often occur in sympatry. Their similar morphology makes field identification challenging. Acoustic communication is widely used by rodents during a wide range of behavioural contexts, (e.g. courting, alarm, agonistic and territorial behaviour) and is in many cases species-specific. In this study we used a bioacoustic approach to 1) assess whether vocal repertoires allow these species to maintain separate communication channels and to 2) explore the existence of readily recognizable acoustic signals which may aid field identification. We recorded audible and ultrasonic vocalizations emitted by the two species in captivity, assessed their co-occurrence with non-vocal behaviours and analyzed distress calls broadcast during handling in the field.

Both species emitted a range of different vocalization types associated with different behaviours (alert, courting, conspecific aggression). We found clear differences in call structure between species, particularly for vocalizations used during social interactions. Distress calls showed significant differences in their acoustic parameters, with frequency of maximum energy, maximum and minimum frequencies being good predictors for species identification (>95% of classification success). Differences in ultrasonic vocalizations seem to be an important mechanism for genetic isolation and specific recognition between these species; distress calls are easy to record during field operations and thus offer a promising way to obtain confident species identification, overcoming the difficulties posed by morphological discrimination of these mice.

Modelling interspecific competition and niche displacement in insular bats

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Species distribution patterns may potentially result from a range of causal factors, historical or current, involving abiotic factors as well as biotic interactions. However, biotic interactions are often disregarded in models exploring species distribution. This study offers a perspective on how presence-only modelling and niche analysis constitute powerful tools to understand distributional patterns otherwise difficult to explain.

In resource-limited geographical sets such as insular environments, competition may be especially harsh so islands offer useful opportunities to test the effects of this factor on species distribution. Bats represent interesting model species to test the effect of interaction between species showing ecomorphological similarities such as in the many strictly related taxa or cryptic groups.

We focus on two bat species, the Mediterranean (*Rhinolophus euryale*) and Mehely's (*R. mehelyi*) horseshoe bats. The two species have similar morphology, both often roost in caves and hunt in wooded habitats. They also broadcast echolocation calls showing a large frequency overlap and offering similar performances for detection range and prey size discrimination. In Italy, *R. mehelyi* occurs almost exclusively on Sardinia. Scattered records are also available for Apulia and Sicily. On the contrary, *R. euryale* is widespread in much of the country yet confined to a small southern portion of Sardinia where *R. mehelyi* is less abundant.

We hypothesize that the confinement of *R. euryale* to a small area of Sardinia is a reaction to strong competition by the numerically dominant *R. mehelyi* and that the former species has undergone a process of ecological niche displacement. To test our hypothesis,

we generated Species Distribution Models (SDM) with Maxent and used several approaches to test for niche similarity and equivalency. Models achieved a high predictive performance according to AUC and TSS. We found what follows:

1. when the analysis is not restricted to Sardinia, significant overlap occurs between the environmental niches of the two species, setting the scene for interspecific competition;
2. the potential distribution of *R. euryale* trained with occurrences from the Italian Peninsula and Sicily (i.e. mostly not sympatric with *R. mehelyi*) and projected to Sardinia covers a much larger area than that actually occupied by this bat, and largely overlaps with the range of *R. mehelyi*.
3. According to a model of niche displacement, the niche of Sardinian *R. euryale* diverges from that of conspecific populations from peninsular Italy and Sicily; this divergence reduces the overlap with *R. mehelyi*'s niche.

The restricted distribution and niche displacement observed in Sardinian *R. euryale* are best explained in terms of competition with the numerically dominant *R. mehelyi*. Noticeably, this niche displacement in Sardinian *R. euryale* is also paralleled by an acoustic character displacement process which had been described for the same population and interpreted as a way to secure private communication frequency bandwidth and avoid heterospecific interferences.

As a final remark, we encourage biogeographers to adopt state-of-art modelling techniques to assess the geographical consequences of biotic interactions on species distribution.

Modelling the cumulative impact of wind farms on bats on a regional scaleF. ROSCIONI¹, M. DI FEBBRARO¹, D. RUSSO², H. REBELO³, L. FRATE¹, M.L. CARRANZA¹, A. LOY²¹ Dipartimento di Bioscienze e Territorio dell'Università del Molise² Dipartimento di Agraria, Università degli Studi di Napoli Federico II³ CIBIO/UP Porto, Portugal

M085

Wind farms are steadily growing across Europe, with potentially detrimental effects on wildlife. When planning wind farm development cumulative impacts besides local effects should be taken into account. To address this issue we developed a regional scale landscape analysis based on Species Distribution Models (SDM) built on presence data for sensitive bat species in an area in central Italy (Molise district) that is currently undergoing a large-scale development of wind farms. Wind farms impacts were evaluated in terms of habitat alteration and barrier effect. The specific objectives of our analysis were: a) to produce risk maps by overlaying the foraging habitat maps with existing and planned wind farms locations; b) to assess changes in the spatial pattern of foraging habitat determined by existing and planned wind turbines; c) to combine SDMs to identify highly vulnerable areas where wind farm construction would be especially harmful to bats and should be avoided; d) to investigate species specific connectivity; e) to identify the most impacting wind turbines that interfere with the most valuable connectivity routes; f) to provide mitigation measures for habitat alteration and connectivity disruption.

The SDMs were statistically robust ($AUC \geq 0.8$ for all species). Changes in landscape patterns consisted of a 7.7% increase in the number of patches and a 10.7% shape index increase and of

a 8.1% decrease in the mean area of foraging habitat patches. Moreover, 21% of turbines were located within 150 m from forest edges, increasing fatality risk. The western part of the region was highlighted as the hot spot of bat species and needs careful consideration in future wind farm planning. We observed important commuting corridors for *N. leisleri* from the western part to the south-eastern part of the region. 15 existing and 8 planned wind farms impact both in term of landscape pattern alteration and barrier effect. According to our results we suggest that at wind speed lower than 7 km/h existing turbines have to be shut down, and the construction of the 6 planned wind farms that fall in suitable areas and encounters high connectivity routes should be avoided or its operation be governed by adequate restriction such as curtailment or even cessation of risky turbines during critical bat season.

Our results provide key information on the impact of the wind farm industry on biodiversity on a regional scale. The novel approach adopted, based on species distribution models and connectivity analysis, could be easily extended to other flying vertebrates and landscapes and constitutes a promising planning tool necessary for harmonizing the development of renewable energy infrastructures with issues of biodiversity conservation.

Using species distribution models to reconcile hunting regimes and bear conservation in Italy: putting predictive ecology in practice

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Species distribution models (SDMs) represent an important tool in conservation and management plans as they can help in resolving/mitigating spatially explicit problems related to conflicts between human activities and wildlife presence, particularly when dealing with threatened species in countries with high human population densities. This is clearly the case considering the Apennine brown bear (*Ursus arctos marsicanus*). The species still survives in a relict population in the central Apennines with no more than 50 animals surviving in the PNALM and its surrounding areas. Wild boar hunting, among other human activities, may represent a risk for bears, due to high chances of erroneously targeting a bear instead of a wild boar. As wild boar hunting in the Apennines has been traditionally conducted in the fall, it may also negatively affect food availability and foraging conditions during hyperphagy. We hereby illustrate a model of habitat suitability for the Apennine brown bear during the hyperphagic period. To define our study area we considered all protected areas in Abruzzo Lazio or Molise in which the presence of the species has been recorded in the last years, and we included in the analyses all municipalities touched by these areas. In order to avoid model overfitting, we calibrated the SDMs considering only the minimum convex polygon built around the available bear locations, thus considering only the areas that have been sampled. Data on bear presence was obtained with different sampling methods from 2005 to 2011, focusing on the PNALM, its outer buffer area and adjacent zones. To calibrate the model, we considered only data collected between September 1 and November 30 of each year, focusing thus on the overlap between the hunting season and the presence of bears in the field. The overall dataset included: (a) 15168 GPS locations collected on 11 adult female and 7 adult male bears; (b) 230 VHF locations collected on 12 adult and 1 subadult female bears, and on 9 adult and 1 subadult males; (c) 1734 other signs of presence (i.e., direct observations, tracks, hair samples, scats) opportunistically collected by experienced personnel. We subsampled the dataset to increase spatio-temporal independence, retaining for model calibration only locations at least 400 m or 24 hours apart from the previous available location. All other records were used in model evaluation. We considered 15 uncorrelated predictor variables (9 environmental variables, 1 anthropogenic factor, 5 topographic variables) available for the entire study area and assumed to be relevant for the ecology of the bear in central Italy.

To map species distribution, we used MaxEnt and we framed our model in an information theoretic context considering 18 alternative models. The AICc values indicated the full model without interactions as the most parsimonious, and this model was extrapolated to the entire study area. To avoid extrapolating outside of the environmental domain effectively sampled with the available points of presence, we performed a multivariate environmental similarity surface analysis, whose results provided a clear indication of the extrapolability of our model to the entire study area. We evaluated the predictive power of the final model considering both calibration and discrimination capacity. The continuous Boyce index (0.91) reflected a good calibration power, indicating our model was able to correctly predict probability of presence along the entire probability gradient. The AUC value calculated for the same model gave a relatively low value (0.668), indicating a limited discrimination capacity of the model (i.e., the model is hardly able to distinguish between true bear presences and background points inside the calibration area). Distance to forest edges, elevation and beech forests were the main factors in determining the species probability of presence. Consequently, the areas with the highest suitability for the species are all located in mountains with forests, avoiding elevations much above 2000 meters and extensive open areas. The margins of the study area, the main plains and cultivated areas are all sharing the same low probability levels. Following a first call by a technical committee under the provision of the Region Abruzzo, we divided the continuous model output into 3 discrete probability classes, each including 33.3% of the continuous probability values. We propose that the different probability classes can be used as indication for a zoning system reflecting habitat suitability for bears and that should represent the basis for a spatially explicit regulation of hunting regimes. We thus provide one of the few examples available in the scientific literature in which the traditional gap existing between predictive ecology and decision/policy makers has been filled. We believe our application of SDMs for the endangered Apennine bear population to inform hunting management, and the functional integration of the model output within a participatory decision making process, may be relevant for similar cases where human activity needs to be effectively managed over large areas for the adequate conservation of endangered species and/or populations.

Assessing tropical forest mammal communities using camera trapping and occupancy analysis: case study from the Udzungwa Mountains of Tanzania

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Tropical forest medium-to-large mammals represent a rich and functionally diversified component of this biome, while being threatened by hunting and habitat loss. Assessing these communities implies studying species' richness and composition, and determining a state variable of species abundance to infer distribution and habitat associations. While a chronic gap persists in standardized data, the Tropical Ecology, Assessment and Monitoring (TEAM) network collects camera trapping data suitable for occupancy analysis, hence representing a standardized framework to assess mammal communities across several sites. In this study we used TEAM data collected in the Udzungwa Mountains of Tanzania, an area of exceptional importance for mammal diversity, to propose an example of baseline assessment. We used 60 camera trap locations and cumulated 1,818 camera days in 2009. Sampling yielded 10,647 images of 26

species of mammals. We estimated that a minimum of 32 species are in fact present, matching available knowledge from other sources. Estimated species richness at camera sites did not vary with a suit of habitat covariates derived from remote sensing, however the detection probability varied with functional guilds, with herbivores being more detectable than other guilds. Species-specific occupancy modelling revealed novel ecological knowledge for the 11 most detected species, highlighting patterns such as "montane forest dwellers", e.g. the endemic Sanje mangabey (*Cercocebus sanjei*), and "lowland forest dwellers", e.g. suni antelope (*Neotragus moschatus*). The study shows that camera trap data analysed with account for imperfect detection can provide solid and conservation-relevant ecological assessments of mammal communities, suitable to standardization across sites.

Workshop - Comunicazione e conservazione dei Mammiferi

Le moderne tecniche di veicolazione delle informazioni contribuiscono a modificare direttamente o indirettamente la percezione dell'opinione pubblica e concorrono a formarne le convinzioni e a variarne la condotta e le propensioni. Questo principio si applica, oggi in modo decisamente più marcato che nel passato, anche alla conservazione della biodiversità: l'opinione degli *stakeholder* e le decisioni degli amministratori di enti con competenze territoriali risultano fortemente influenzate dai messaggi veicolati dai diversi mezzi di comunicazione, spesso prescindendo da un auspicabile approfondimento delle conoscenze.

L'Ufficio di Comunicazione dell'ATIt, istituito in seno all'ATIt nel 2011, ha in questo contesto avviato una indagine conoscitiva sul tema della percezione degli investimenti economici e della loro utilità nel campo della conservazione di specie e habitat; seppur ancora in corso, l'indagine evidenzia un preoccupante quadro a livello nazionale e ancor di più locale sulla scarsità di conoscenze degli operatori della comunicazione rispetto ai temi della conservazione della biodiversità, con una conseguente influenza sull'opinione pubblica che viene indirizzata a interpretare i fondi utilizzati per la conservazione come sprechi di risorse. È necessario quindi, in stretta sinergia con la pianificazione delle strategie di conservazione, riuscire a modificare i contenuti e le forme di comunicazione nel contesto nel quale operiamo, analizzando ed interpretando attentamente l'influenza che la comunicazione riveste nella conservazione dei Mammiferi e il ruolo della comunità scientifica. Non a caso una componente importante nel successo delle azioni di conservazione è la "*human dimension*", che risente fortemente proprio della qualità e delle forme di comunicazione.

Obiettivo del *workshop* è la condivisione di esperienze di comunicazione nel settore della conservazione dei Mammiferi attuate da diversi soggetti, sia interni sia esterni al mondo scientifico, e dei loro successi e fallimenti monitorati nel tempo, con la finalità di analizzare criticità e potenzialità inesprese e mettere a punto un percorso di miglioramento nel settore.

Coordinatori

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Estimated extent of roe deer (*Capreolus capreolus*) poaching in the wild boar hunting areas in the Province of Rieti (Italy)

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P027

This study has been conducted in the large portion of the province of Rieti in which the stable presence of the roe deer (*Capreolus capreolus*) is renowned. The density of the species is locally diversified with values decreasing broadly from Northeast to Southwest, the principal direction of expansion of the distribution. The Southeastern region of the province has been essentially excluded from the study, since the species is still absent or sporadically present there. The main goal of the survey is to estimate the extent of poaching of this species. In the provincial boundary the factors characterizing the phenomenon are widely known: 1) the unlawful activity is almost exclusively exercised during the hunting seasons within the areas of wild boar (*Sus scrofa*) hunting, that are permanently assigned to the teams regularly accredited by the competent provincial office; 2) according to the almost unanimous motivation provided by wild boar hunters, the poaching activity is conducted to eliminate those elements present in the assigned areas given that the roe deer, with its behaviour, distracts the dogs used to pursue the boar. In support of this widespread and deeply rooted in the hunting's world conjecture, hunters argue that the dug-up and chased subjects do not depart quickly and definitively from the dogs. On several occasions roe deers space the dogs a few hundred meters, then stop regularly to observe the pursuers to move away again when they are approaching. The systematic repetition of this behaviour makes the dogs to walk away, too far from the hunting areas. To prevent that dogs acquire this unwanted attitude, in the training phase radio-controlled collars, releasing electrical discharges of modulated intensity, are more and more frequently used. So, when necessary, by issuing pulses of "adequate intensity", the subjects under training are discouraged from pursuing the deer. Thus, according to this view, the roe deer is an inconvenient presence that disturbs the good performance of hunting. A problem that, in many cases, one tries to solve definitively removing the object of the disorder, albeit illegally. The small size of the roe deer, moreover, favours the simple concealment and easy transport of the carcasses. These causes and ways are completely different from those related to the poaching of deer (*Cervus elaphus*), as is clearly emerging from a specific study still in progress. The following data are derived from the processing of the information provided in confidence (and aimed exclusively to contribute to this scientific inquiry) from 15 teams of hunters of wild boar over a total of 123 teams licensed by the Hunting Office of the Provincial Administration (12.2%). The sample, consisting of teams willing to provide reliable data and reliable information on the problem

under study, has a random distribution in the hunting areas. Moreover, knowing the dynamics involved in the hunting world and the real possibility that there may be events of poaching also outside the areas of wild boar hunting, even because of individual poachers, it is believed that the data presented here describe the phenomenon in its minimum certain size. The collected and processed data refer to the five hunting seasons going from 2008/2009 to 2012/2013.

The processing of the data gave the following results:

- a total of 324 subjects have been killed (154; 129; 41 of indeterminate sex);
- the average of episodes per team in five years is 21.6 animals/team (SD= ± 13.8);
- in the 100% of the declared cases the animals have been killed with fire-arms;
- the distribution of the reasons given to justify the killing of roe deer is as follows: 75.4% of the case because they distract dogs from following wild boars; 14.0% of the cases because during the hunt the subjects have been confused with wild boars; in the 8.8% of the cases a double motivation has been given: because they bring away dogs and to supply meat to consume or to sell; in the 1.8% of the cases to expressly sell the meat;
- in the investigated quinquennial period 2 of the 15 monitored teams have never made the poaching of the species;
- for two seasons in the investigated quinquennial period 3 of the 15 teams have not made the poaching of the species;
- for a season in the investigated quinquennial period 1 of the 15 teams have not made the poaching of the species.

During the surveys more information about events of poaching made exclusively on adult males of the species and finalized to sell trophies has been collected. These events, seemingly in progressive diffusion, happen also outside the assigned hunting areas. Assuming a homogeneous distribution of the species and poaching in all areas of wild boar hunting, and considering the results obtained in this survey representative of the whole province, one can estimate that in the province of Rieti each year are illegally killed between 500 and 550 roe deers, with an average density of about 0.8 animals/100 ha. Considering that from some recently conducted studies in some experimental areas of the province the roe deer density is between 7 and 12 animals/100 ha, one can assert that at the provincial level poaching is an important limiting factor for the natural expansion and consolidation of the species.

Livestock damages attributed to the wolf, perception of the phenomenon and conservation strategies: some considerations on the 2010-2013 reports in the Province of Rieti

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P025

The always present conflict between the wolf and livestock activities is one of the main problems in the definition and implementation of a viable strategy for the conservation of the species, against which there is the dutiful safeguard of the farmers who suffer incursions of the predator. In this study, based on analyses of the damages denounced by the farmers, we present the situation ascertained in the province of Rieti in the four years 2010/2013. It is well known that the analysis of the official statistics has obvious limitations of interpretation for an accurate estimate of the wolf-livestock conflict; this study is nonetheless important to assess the operation, the efficacy and the correct application of the legislation governing the compensation for the damages to livestock. In the province of Rieti during the investigated period 301 events of predation have been registered, 300 attributed to the wolf and 1 to the beech marten (killing of 37 head among chickens and hens). The damages have involved 166 farms in 41 municipalities (out of a total of 73). A total of 805 head has been preyed, broken down by species in the following way: sheep 59.3%, cattle 23.6%, goats 6.7%, horses 5.0%, rabbits 2.5%, deer 2.4%, pigs 0.6%. The municipalities with the greatest frequency of predation occurrence are Leonessa (19.0%), Fiamignano (12.0%), Amatrice (8.3%), Orvinio (6.7%), Rieti (6.7%), Borbona (5.0%), Cittaducale (5.0%). In this context a total of 61.7% of predation events has been registered, with damages to the 51.4% of the animals, broken down by species in the following way: cattle 132, horses 13, sheep 252, goats 12, pigs 4. In the 44.4% of predation events multiple kills have been reported (from 2 to 14 head/event), the most significant (14 to 5 head/event) concentrated in the months of April and July (28.6% and 23.8% of the cases, respectively). Being multiple predations generally suffered by sheep, the 26 cases involving cattle are particularly relevant. The highest concentration of these events occurred in Leonessa (1 event with damage of 4 animals and 12 events with damage of 2 animals) and in Orvinio (1 extraordinary event in March 2012 with 6 animals preyed, 1 event with the killing of 3 animals and 4 events with the killing of 2 animals). The confirmation of the presence of more individuals/groups of wolves in the province is given by the concomitant predation in far enough areas. These situations occurred: the 24/04/2010 in Fiamignano and simultaneously in 3 different sites in Leonessa; the 24/05/2011 in 3 sites within the Amatrice municipality and at the same time in Cittaducale and Leonessa. In the actual lack of knowledge on the status of the species this information is far from irrelevant. A careful examination of the certifications produced for the damages from livestock predation has shown a number of altogether singular

cases, which are presented below and deserve further in-depth analysis. The damages to rabbits, deers and pigs are absolutely unprecedented in the studied area. As for the pigs, some recent studies of historical nature, including those based on interviews with breeders of pigs in the wild in the first half of the last century, have confirmed that the pigs were not preyed by the wolf. In fact, tradition dictated that the herds were not guarded by guarding dogs. The predation of rabbits (20 animals) by wolves also appears singular and never previously recorded, while in the investigated area it is known, and studied, the predation of rabbits in cage by the weasel. 10 cases (all occurred in Amatrice between 06/08/2010 and 30/11/2010) are absolutely unique and never previously recorded: 8 different breeders declared to have suffered "cattle damages by stray dogs" and then had from the officials the certification of "damages by wolf" (another similar case occurred in 2011, still in the municipality of Amatrice). The examination of the reports, from which the above data have been derived, has also shown a widespread lack of clarity and completeness in filling the forms. In particular, among the most important elements it was found that: manual compilation of modules in cursive is often with illegible handwriting; some of the required data are missing (location, weight, race, age, signatures, etc.); the indication of the person taking care of the disposal of the remains is missing; there is lack of serial numbers of ear tags (in cases of multiple predation when reported they are often illegible). It is not clear how, despite these defects, all the practices exceed the preliminary inquiry and, although the intolerable slowness of procedures, are fully resolved with the liquidation. It is believed that the return of the reports in paper form and filled out manually is among the main factors that, not favouring clarity and transparency, allow abuses. The problem could be easily solved by requiring the publication of the data acquired in the field on the Web, with the obligation to attach photos of the elements testifying damages by wolf or other species. With regard to the aforementioned total assignment of damages to the wolf it seems appropriate to make a final consideration. A recently conducted investigation on the damages to livestock comparison between what is happening in the province of Rieti (where wolf and stray dogs coexist) and Oristano (where the wolf has never been present and the stray dogs presence is quantitatively similar to that of Rieti) has demonstrated that damages to livestock in the Sardinian province are significantly higher than those in the studied area, where there are no events attributed to stray dogs. This is a possible chance which leaves ample room for doubt in the field of probability.

Red deer (*Cervus elaphus*) distribution area in Rieti Province (Italy), update 2013S. ADRIANI^{1,2}, M. BONANNI², G. CASCIANI², A. MAZZILLI², V. RUSCITTI², A. AMICI¹¹ DAFNE Università degli Studi della Tuscia di Viterbo, via De Lellis s.n.c, 07100 Viterbo, Italy, e-mail adrianisettimio@libero.it² Commissione Ambiente P.L. Fiamignano, Via Rascino 10, 02023, Fiamignano, Rieti, Italy

P026

The Deer (*Cervus elaphus*) is a native species of Italy that was widely distributed in the peninsula until the tenth or eleventh century. Later, because of land cover changes (deforestation and pasture) and hunting, has gradually rarefied and extinguished. In the Apennines, including the territory of the province of Rieti, became extinct in the nineteenth centuries. At the national level in the early twentieth century had been preserved as native only in the Po Delta and in some areas of the central Alps. In the province of Rieti in the early 1900s was still present in a public fenced area (Secordaro in Sabina) and reported as a localized and/or sporadic in the area of Cicolano (Duchessa and Salto-basin). Since 1991/1992, following the re-introduction of 11 heads conducted by the Natural Reserve of Monte Velino (AQ), the species reappeared in the south-eastern portion of the study area. From the first colonization of the areas closest to the release, where consolidated its presence, the species has begun a process of expansion of its range area. The habitat suitability of the eastern areas of province of Rieti favoured the rapid increase of the population. Thus, in the Regional Natural Reserve of the Duchessa Mountains (hereinafter RNRMD) the 16 heads estimated in 2002 increased up to about 130 heads estimated in 2005. Date back to the years following the first studies conducted in the area, regarding the structure of the population (in wintering areas), and the impact on the forest area. The strong increase of the population, which manifests itself recursively in the season of rutting and wintering areas, followed by a further expansion of the distribution, which has been reflected along a main direction (south-east/north-west). The phenomenon has been achieved through the valley of Malito, an area of important ecological connection RNRMD adjacent to where the deer is present with a stable and consistent population. The process of colonization of the Valle del Salto is taking so clearly differentiated in the areas of land separated from the river. In left bank of the river (mountains Navegna and Cervia) the expansion process is hampered by ecological barriers present near the centre of dispersal (highway A24). In this area, where the species is currently reported as sporadic, observations are due to erratic subjects in connection with the original core area of RNRMD. The expansion process is having the most successful way in the south-facing slope: Mountains Cava, Fratta and Nuria. Since the beginning of the early 2000s, in the middle valley of the Salto the presence of signs and sightings of red deer have become more frequent. The presence of new nuclei had become stable, but there had

been no news regarding events outside the area of RNRMD. Only in September 2008, during a monitoring program, the first rutting males were detected in the slopes of Mount Nuria. This event is considered as the confirmation of a new reproductive nucleus, now completely independent from the original one of RNRMD. This situation occurred in the field, is not represented in the documents produced by the National Bank of ungulates, in which the publication of the 2009, but referred to the situation in 2005, in the province of Rieti the red deer is reported only in RNRMD. In the years 2009/2010 there has been a crescendo of reports of the presence of deer also in the areas between the Nuria and Terminillo mountains. At that date also some events of poaching on the western side of Nuria are reported by the CFS and by the local police, that also reported the presence of some subjects in the sulphurous pools of the lower valley of the Velino. The monitoring of the species is concentrated at lower altitudes, in the areas most suitable for the species in the municipalities of Poggio Bustone Cantalice and Rivodutri. In these territories the majority of reports and the discovery of abundant signs of its presence are reported. In these areas are set opportunistic surveys, which tend to confirm objectively the presence of the species and use that does the same territory. The surveys were conducted by camera trapping (to verify the actual presence of the species), and listening sessions in the season of rut (to check whether the site is also a reproductive one). The camera trapping was conducted for 6 months, using contemporary 6 cameras that have been relocated every 10 days. The camera traps were rotated out of 36 points, opportunistically selected on the basis of the indications and signs of the presence, in 3 consecutive rounds. The process of listening was carried out for a month to start from September 10, 2013. 10 stations have been appropriately chosen on the basis of the morphology of the territory and of the total area to be monitored. Field activity was carried out by 5 operators working simultaneously, the frequency of sessions was each 3 days covering all workstations with 2 rounds. Each station has been used five times. In the monitored area the abundance was not estimated but the presence of deer of both sexes, with males of the first and second head (class 3) was ascertained. No reproductive activity was observed. At the present time the distribution of red deer in the province of Rieti is expanding and some groups (still non-reproductive) are now at more than 50 km away from the area of origin of the RNRMD.

Co-occurrence avoidance between two independently evolved groups of insectivore mammals and lacertid lizards in Southern Italy

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P121

The potential role of interspecific competition between Soricid mammals and Lacertid lizards was studied at 72 sites in Southern Italy.

The assemblages were quite distinct depending on the bioclimate variations across sites.

For the Lacertidae, *Podarcis siculus* dominated in the thermo-mediterranean sites and *P. muralis* in the temperate sites, whereas, for the Soricids, *Suncus etruscus* and two *Crocidura* species were dominant in thermo-mediterranean sites and the three *Sorex* species in the temperate sites.

The mean number of Soricids was statistically higher in the temperate sites, the reverse being true for lizards. Co-occurrence analysis revealed that a non-segregated structure was present

in the dataset, whereas RA2 algorithm showed that the assemblage of small mammals and lizards was non-randomly structured, with the frequency distribution of Soricids being non-independent by site from that of lizards.

The number of Soricids captured in each sampling site was significantly negatively related to the number of lizards. There was no evidence of non-random segregation by species within each of the two taxa.

Overall, our data indicated that (i) the assemblage of Soricids and lizards was regulated by interspecific competition dynamics, and that (ii) RA2 is the best randomization algorithm to detect such patterns in generalist insectivorous vertebrate communities.

Last records and state of a critically endangered population of western african lion *Panthera leo senegalensis*

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P028

In West Africa, lion is currently characterized by small populations that are fragmented and often isolated from one another, with virtually no ecological connection. In addition, lion populations are generally declining. In some recent reports, in Ghana the lion has been declared functionally extinct, if not completely eradicated, and recent surveys have made conclusions as to the probable extinction of lions in Mole National Park (MNP) in Ghana's Northern Territory. The aim of this report is to highlight, on the contrary, the continued presence of lion in MNP, an area that must continue to be considered for species conservation, and therefore studied carefully. In April 2011, a young male lion was filmed using camera traps, and some roars was clearly audible three times. Additional records support our data, which demonstrate that MNP could possibly still be considered as an area designated for lion conservation in West Africa, even considering the significant findings based on molecular biology that prove that lions in West and Central Africa are clearly differentiated from other African lions. The population of Ghana is geographically situated in a key location, being a "liaison" between the most important nucleus of western Senegal-Guinea-Mali and the core of most easterly of Nigeria-Benin-Burkina Faso.

During the research carried out in 2012 and in 2013 there have been further confirmations of the presence of the lion in the park. In April 2012 and in May 2013 we heard the night roarings of males in the central region of the park. In addition, during August 2013 was sighted very clearly an adult male by a guard during his service at the entrance of the park, in the south portion of the area. This makes us understand how the last lions possibly prefer the more controlled areas of the park, where surveillance anti-poaching is more continuous, and even where

they insist more potential preys. In the areas to the north of the park, in fact, although these conserve natural characteristics of some importance, surveillance is less developed, and poaching, unfortunately, is still widespread.

The purpose of this report is to present the critical and fundamental problem of the conservation of the last lions of the vital core of Ghana, although this is probably formed by a few individuals. We think that it should stimulate efforts, even with the use of more financial resources from international societies and foundations in order to save this bulwark of this taxon so seriously threatened. Our project continues its activities with strong effort, even if with thousand problems, and the next working operations, in part already active, includes:

1. Intensification of total number of camera-traps used in random points and at strategic points;
2. Use of attractive carcasses placed in raised points and protected, in order to prevent the removal by hyaenas or other predators;
3. Starting sessions using registered vocalisations as a stimulus. It will be used both the roar of adult male lion, the call of the spotted hyaena, and the lowing of the western buffalo. All of these voice calls, for various reasons, cause the vocal reaction of lions that can casually hear these stimuli;
4. Attempt to capture (if this will be compatible with the health and size of the population), some individual, and application of satellite collars in order to be able to control their movements and ecology.

Will be discussed, starting from this specific case, merits and defects of methodologies applicable in a population reduced to the minimum of number of individuals.

The vaccination of dogs as a conservation tool for Apennine brown bear *Ursus arctos marsicanus* population

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PI42

Bears and dogs are evolutionary close. For this reason the contagious of several pathogens between these two species is more frequent. The habitat of the Apennine brown bear (*Ursus arctos marsicanus*) is characterized by a consistent and diverse dogs population that could represent a source of pathogens transmissible to wildlife.

The sanitary interaction among sympatric dog and wildlife population in the interface between human and natural ecosystems enhances the introduction of new pathogens and increases the size of a receptive population responsible of their maintenance in the environment.

During January 2013 inside the Abruzzo, Lazio and Molise National Park (PNALM), core area of the Apennine brown bear population, exploded a canine distemper virus (CDV) epidemic, identified as the cause of death of 20 wolves and hundreds of dogs. Canine distemper is a viral disease, particularly contagious, that strikes mostly juveniles. Even though there are only few recorded cases of deadly events for bears related to canine distemper, the consequences of this virus on a small population are still unpredictable.

In order to face this sanitary emergency, the Nature Conservation Office of Abruzzo Region, in association with the Istituto Zooprofilattico Sperimentale (IZS) of Teramo, has organized several meetings with the veterinarians of National Health Ministry, Abruzzo, Lazio and Molise Regions, Public Sanitary Agency (ASL), Protected Areas, other IZS, aimed to coordinate a common strategy for containing the impact of canine distemper within Apennine brown bear area.

The vaccination of dogs has been detected as the only feasible prevention tool to reduce the incidence of disease, particularly CDV, in the reservoir population. The overall goal of the vaccination campaign is to reduce the number of susceptible hosts for the pathogen and to limit the transmission of the CDV from dogs to wildlife.

A preliminary assessment of the sanitary risk in relation to the different categories of dogs was carried out in order to evaluate which class represents the primary hazard. Breeders dogs stood out as the most risky category because most of them are not registered, not vaccinated, and free to wander around without any

control in some of the most sensitive areas for bear protection. A similar situation was reported for the dogs of the inhabitants of the Park and the surrounding areas.

Less concern was attributed to the dogs of hunters, truffles searchers, and tourists because largely vaccinated. On the basis of these evidences different strategies were carried out: awareness campaign of vaccination for dogs owned by hunters, truffles searchers and tourists through the creation of an informative poster, television and newspaper advertisement, public meetings; a free vaccination campaign was organized mostly for breeders dogs.

Thanks to Life Arctos funds, it was possible to purchase 7000 vaccines mostly devoted to breeders dogs. Veterinarians of ASL and Protected Areas and the nonprofit association *Salviamo l'orso* were involved in this initiative. *Salviamo l'orso* in particular made possible an early start of the immunization campaign providing the funds to buy the first batch of vaccines.

The IZS of Teramo defined the areas where focusing the vaccination plan according to what suggested by technicians of Abruzzo, Lazio and Molise Regions' Protected Areas, and by the Nature Conservation Office of Abruzzo Region. Priority was given to the areas in which the presence of female bears with cubs was proved.

In the area of the Molise Region adjacent to the PNALM and in Sirente Velino Regional Park vaccinations were associated to a serological assessment of the sanitary status of not vaccinated dog population (n=99). Results shows a remarkably exposure of sampled population to CDV with an overall seroprevalence of 69% (IC95%: 59-77%).

It was verified the presence of the CDV with an high prevalence in the yearling class (47%; IC95%: 22-73%) in both the sampling areas even if with different dynamics (p<0.05).

The vaccination of dogs campaign is still ongoing and represent the first attempt to create an integrated disease management strategy aimed to face effectively the sanitary emergency in the Apennine brown bear population. The preliminary results have emphasized the need of a proactive planning and a coordination between wildlife and animal health managers in order to get a prompt and effective disease control.

Group dynamics and local population density of Apennine chamois at the Abruzzo, Lazio and Molise National Park: trend and spatial variation

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P057

The social organization of a species may be influenced by various factors. As a general rule, in ruminants number, size and composition of groups should vary according to population density. Recent studies on the Apennine Chamois (*Rupicapra pyrenaica ornata*) at the Abruzzo, Lazio and Molise National Park (hereafter abbreviated as PNALM) showed that this population may be subjected to density-dependent processes. Over the last 8 years, population size has generally decreased, so we expect corresponding changes in social structure, particularly in group number and mean group size. To test this hypothesis we analyze the detailed summer data on group size and composition collected in 2008-2013 and those collected in 1995-1996 when the population trend was opposite. The study area was the Val di Rose, which hosts one of the most representative herds occurring in the PNALM. Field methods were based on ground counts: systematic and standardized repeated visual scans were performed by 1-2 trained operators along the same routes. During scans, number, size, composition and location of chamois groups were recorded. A group was defined as one or more individuals close to each other and located at least 50 meters from other individuals. Group size classes were defined as follows: 1, 2-5, 6-10, 11-20, 21-40, >40 individuals. Sex and age class of each individual were noted to study group composition and population structure. Local population density was calculated as the number of individuals seen in each scan session in the 100% MCP area based on the locations of all the chamois groups sighted during the repeated counts. Raw data were log-transformed.

Local population density in Val di Rose changed across years ($F_{7,82}=4.1$, $p<0.001$) with a decreasing trend (Spearman, $r=-0.45$, $p<0.05$), dropping from 83.4 to 21.7 heads/km². Mean group size ($F_{7,82}=10.8$, $p<0.001$) and group number (Kruskal-Wallis, $df=7$, $H=21.8$, $p<0.01$) changed as well, the former decreased (Spearman, $r=-0.66$, $p<0.001$), the latter increased (Spearman, $r=0.27$, $p<0.05$). We found a positive correlation between local population density and both mean group size (Pearson, $r=0.43$, $p<0.001$) and group number (Spearman, $r=0.27$, $p<0.05$). Population density accounted for 18.4% and 14.1%, respectively, of their variation (GLM, $p<0.001$).

We found a strong concordance in group frequency distribution across years (Kendall Concordance Coefficient, $W=0.91$).

Singleton class and 2-5 class were always the most frequent, but the former was the most frequent in 2008-2013, whereas the latter was most frequent in 1995-1996. Moreover, the class >40 had never been recorded for the last 6 years, when in fact the number of medium-large groups (i.e. >20 individuals) was found to decrease (Spearman, $r=-0.81$, $N=8$, $p<0.01$) and the number of small groups (1-5 individuals) increased (Spearman, $r=0.78$, $N=8$, $p<0.05$). These results do not change much if we take into account the possible bias due to the number of one-male groups that, for any reason, may have been sighted more frequently in one year than in another (one-male groups represent on average $54.5\pm 14.1\%$ of all singleton groups and their proportion showed a clear positive trend in 2008-2013: the reason of such a result still awaits an explanation). We also found that the number of groups >20 was positively correlated with population density (Spearman, $r=0.29$, $p<0.05$) and negatively correlated with female group number (Spearman, $r=-0.42$, $p<0.001$). On the other hand, female group number was negatively correlated with mean group size (Spearman $r=-0.40$, $p<0.001$) and explained the 22.8% of its variation (GLM, $p<0.001$).

These results outline the complex relationship between social structure and population density and are consistent with what generally reported in literature. Overall, our results support the hypothesis that population density decrease was related to an increase in small groups and a decrease in medium-large groups, in other words to a more scattered distribution of chamois in the area, concerning both female and one-male group dynamics.

However, Val di Rose does not seem to be representative of the whole PNALM, since the analysis of data collected in 2010-2013 in five areas, including Val di Rose, suggest that a certain spatial variability exists. These samples are too small to perform statistically reliable tests on trends, nevertheless each year the frequency distribution of group size showed quite a low concordance among herds (Kendall Concordance, $0.54\leq U\leq 0.70$). Thus, although probably occurring throughout the PNALM, density-dependent processes might differ from place to place and/or each herd might respond differently in relation to local conditions. To better assess species' population dynamics and conservation status it is important to continue monitoring social organization in this species.

IX Congresso Italiano di Teriologia

Tolerance for wolves in La Spezia province

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P077

The wolf's human dimension had never been considered in La Spezia's province, therefore, for the first time, a research has been developed in order to find information about the wolf's knowing and problem for the population.

The main goal of this study attempted to evaluate how many, socio-demographic factors, and cultural attributes, influenced the knowledge level about wolves.

We evaluated the attitudes toward wolves in La Spezia province, Italy, analysing 707 qualitative and quantitative surveys conducted with questionnaire. The questionnaire was designed to examine the awareness and knowledge level about several themes: wolf social role in our environment, ecology and biology of Italian wolf population, and the level relationship and direct experience with the wolf. The questionnaire has been sent to different categories of people such as students of primary and secondary school, and people belonging to several stakeholder associations (cultural, sportive, agriculture, breeding and hunting associations).

Analysis were conducted at two levels: using the whole sample of La Spezia province and splitting it in two sub-samples (questionnaires from people living where wolf is present (wolf-area)

and from people living where wolf is absent (no-wolf area).

Of 707 records 46.1% showed positive attitudes for wolves, and in contrast with others studies had a positive correlation with age (linear regression: $R^2=0.879$, $F=36.589$, $p=0.002$).

This study revealed that the knowledge about ecology and biology of Italian wolf population was higher in the hunter category than others (multiple regression: area: $\chi^2=15.76$, $p=0.203$; hunter/no hunter: $\chi^2=23.98$, $p=0.020$; farmer/no farmer: $\chi^2=12.90$, $p=0.376$; conservationist/no conservationist: $\chi^2=13.73$, $p=0.318$).

People with an highest educational standard showed more positive attitudes toward wolf, on the contrary, they had a poor knowledge about biology and behaviour of wolf. This aspect was strongly marked in primary and secondary students who got information principally by media sources (internet, TV). On the contrary, farmers and hunters got information by newspaper and direct cultural transmission.

Nevertheless, if we consider the whole sample of questionnaires, both ecology, biology knowledge and acceptance levels toward wolves weren't significantly different among people living in wolf and no-wolf area.

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Scavenging on ungulates carcasses in an Apennine mountains area

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P050

Although facultative scavenging is very common behavior, little is known about the factors that modulate the carcasses utilization. We investigated the utilization of wild boar, roe deer and fallow deer carcasses in an Apennine mountainous area in Arezzo province (Tuscany). Fieldwork was conducted from July 2010 to June 2013; a total of 27 carcasses were monitored during the study period through camera trapping technique. A total of 80 inspections were conducted and 7 species of scavengers were recorded at carcasses: 1 bird and 6 mammals. The three main

scavengers species were a mesopredator, the red fox, an apex predator, the wolf, and an omnivorous ungulate, the wild boar. Moreover, according to the classification tree (CART), we observed that temperature, elevation and distance from roads were the most important factors in describing the scavenging behavior of wolf. With this work, we suggest that the carcasses use is not a random process but it is modulate by abiotic factors, but further studies are needed to better understand the mechanisms at the basis of scavenging behavior in our study area.

Prime osservazioni italiane di attività predatoria da parte dello sciacallo dorato (*Canis aureus*) su ovini domestici nel Carso goriziano

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La presenza della specie sciacallo dorato *Canis aureus moreoticus* (I. Geoffrey, 1835) documentata per il Friuli Venezia-Giulia a partire dagli anni 80 è in continua espansione ed incremento con un particolare riferimento all'area carsica. Nel territorio preso in esame, una porzione di landa e boscaglia carsica in cui è ubicato un parco rurale di circa 100 ha con annesso allevamento ovino, la presenza di sciacallo dorato, documentata anche con l'uso di foto trappole, è passata da casi sporadici ad un numero certo di 7 esemplari che frequentano l'area. Congiuntamente all'aumento di presenza si sono avuti casi di predazione su ovini adulti mantenuti allo stato semibrado senza ricovero notturno. Sono state esaminate tre carcasse di ovini trovati morti in giornate successive. Le pecore appartenevano tutte alla classe adulta ed in particolare superavano gli 8 anni di età.

Le valutazioni anatomopatologiche delle carcasse, a diversi stadi di decomposizione, hanno messo in evidenza lesioni di carattere lacero contuso dei diversi piani tissutali nella regione del collo e nei garretti causate da morsi, con un consumo, costituito prevalentemente dai tessuti molli delle cavità toraciche ed addominali, variabile in base al tempo intercorso tra il ritrovamento ed il decesso. Dall'esame dei morsi ed in particolare dalla misurazione della distanza tra i canini, unite alle caratteristiche della predazione hanno permesso di riferirla a sciacallo dorato. Tale ipotesi è stata successivamente confermata con il fototrappolaggio. Dopo tali episodi, gli ovini sono stati ricoverati ogni notte in ovile chiuso e protetto. Tale metodologia gestionale è stata sufficiente a ridurre notevolmente l'impatto della predazione da sciacallo dorato sugli animali allevati.

Organochlorine residues in guano of long-fingered bats (*Myotis capaccinii*) from Lake Maggiore (NW Italy)R. BETTINETTI¹, S. QUADRONI¹, P. DEBERNARDI², L. GARZOLI², A. MARCHETTO³, E. PATRIARCA²¹ Dipartimento di Scienze Teoriche e Applicate, Università degli Studi dell'Insubria, Via Valleggio II, Como² S.Te.P., c/o Museo Civ. St. Naturale, via S. Francesco di Sales 188, 10022 Carmagnola (TO), e-mail teriologi@gmail.com³ CNR Istituto per lo Studio degli Ecosistemi, Largo Tonolli 50, 28922 Verbania Pallanza (VB)

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The long-fingered bat *Myotis capaccinii* is one of the most endangered Mediterranean bats. At present, only two maternity colonies of the species are known in Northern Italy, roosting at Lake Maggiore (at Isola Bella) and at Lake of Lecco. Even if it is possible that some further colonies occur, ignored due to the lack of surveying, the paucity of records reflects a condition of true rarity and highlights the conservation interest of the two colonies.

At Isola Bella, *M. capaccinii* occurs within a mixed-species colony (together with *M. myotis*, *M. blythii* and *M. daubentonii*), constituting approximately the 75-85% of the roosting bats. Colony size, monitored during the last 14 years by annual counts (total number of individuals, excluding juveniles) varied in the range of 477-859 individuals. Demographic trend over the same period resulted negative ($r_s = -0.78$; $p < 0.01$).

This trend cannot be related to direct disturbance, as the roost is inaccessible without permission and equipment. Some negative factors that could affect the colony (restoration works; artificial lighting illuminating the entrance of the roost) were avoided by caution measures (renovations were carried out while the bats were absent and without altering the characteristics of the roost; lighting system was removed). Nevertheless, other causes cannot be excluded: bats may suffer from disturbance during winter months (elsewhere, since only few individuals hibernate at Isola Bella), because of predation from wild or domestic animals (cats represent the most common potential predators in the area), diseases, and degradation and loss of their foraging habitat.

According to literature, calm water bodies are the preferred foraging habitats for *M. capaccinii*; prey, caught in flight and by trawling/gaffing, are mainly represented by adults, pupae and larvae of Diptera Chironomidae and other aquatic insects; the contribute of small fish to diet can also be important. Lake Maggiore represents a large foraging area for the individuals of the colony, which can be observed chasing close to the water

surface after their emergence from the roost. Thus, the water quality of the lake, through its effects on aquatic prey, may play a role in the local conservation of the species.

Lake Maggiore has a well-documented history of contamination by DDT and its relatives of around 50 years, due to the discharges of a production plant into the Toce river, one of the main inlets of the lake. Although the synthesis of DDT ended in 1996, the recovery of the lake has been delayed since DDTs are particularly persistent and therefore still present within the lake basin, in particular in biota and sediments.

Bats are particularly vulnerable to these and similar organochlorine (OC) compounds, which have been recognized as one of the severe causes of the dramatic declines in bat populations occurred in the 50s-70s.

We hypothesized that long-fingered bats of Isola Bella may accumulate OCs from their prey and partially excrete them in urine and feces. Previous works on other bat species have demonstrated a positive correlation between the levels of OCs in guano and those present in bat carcasses from the same colonies: chemical analysis of guano may therefore serve as an indirect and nondestructive technique to detect exposure and accumulated contaminant loads occurring in bats.

We analyzed three guano samples, collected beneath the colony of Isola Bella in March, May and June of 2011. Data revealed the presence of parental DDT compound (pp'DDT), confirming the presence of some hot spot DDT sources in the area. Among DDTs, *p,p'*-DDE was by far the most dominant metabolite, with concentrations ranging from 85.79 to 181.20 ng g⁻¹, followed by pp'DDD and pp-DDT, which ranged between 0.97-2.36 ng g⁻¹ d.w.

PCBs, of unknown and probably diffuse sources, were also present, reaching the concentration of 212.59 ng g⁻¹.

Since the recorded OC levels are not negligible, in order to go deeper into the possible causes of the colony decrease, a monitoring program concerning the contamination seems necessary.

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Differences between mistnetting and acoustic identification of batsS. BOLOGNA¹, M. SPADA^{1,2}, S. MAZZARACCA¹, M. PICCIOLI², F. BISI², D.G. PREATONI², A. MARTINOLI²¹ Istituto Oikos, Via Crescenzago 1, 20134 Milano, Italy² Unità di Analisi e Gestione delle Risorse Naturali - Guido Tosi Research Group, Dipartimento di Scienze Teoriche e Applicate, Università degli Studi dell'Insubria, Via J. H. Dunant 3, I-21100 Varese, Italy

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Among Mammals, bats represent the order with the largest number of data deficient species and the lack of data is one of the greatest issue in wildlife management. As all bat species in Italy are under threat, monitoring bat population is essential even if is particularly difficult due to their nocturnal and elusive characteristics.

The two basic methods for bats survey are mistnetting and acoustic identification. The use of mistnets allows to determine the species and the number of individuals captured, instead the use of bat detector methods does not always allow the identification of species because it is not possible to recognize all the emitted signals. Exact identification is possible only for some species (*Barbastella barbastellus*, *Hypsugo savii*, *Pipistrellus kuhlii*, *P. pipistrellus*, *Tadarida teniotis*) or species group (*Eptesicus-Nyctalus*, *Plecotus* spp., *Myotis* spp.), moreover bat detector do not allow to determine the number of animals registered.

To evaluate the differences between capture success of the two methods we compared data collected in 40 sites in Northern Italy using both techniques. We compared number of captures and

emissions across group of species or species level. In general number of registered emissions is higher than captured bats.

Concerning group of species, only *Plecotus* spp. has been contacted more with mistnetting than batdetector. The reason is probably that this group emits weak echolocation signals difficult to register with batdetector. All the other groups are usually detected easily with batdetector except for the *Eptesicus-Nyctalus* group that show similar pattern of captures across the two methods.

Five out of seven identified species have been registered with both methods depending to site, most of time only with bat detector but in few cases only with capture or with both. Two species (*Barbastella barbastellus* and *Tadarida teniotis*) have never been captured due to their hunting behaviour infact they usually fly at higher altitude compared to mistnet height.

Both methods are reliable: acoustic identification is far low cost compared to captures but has the weakness that does not always allow species identification, instead mistnetting is more efficient for species identification but it is more expensive.

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Seasonal food selection in small mammals: a cafeteria experimentA. BONACCHI¹, S. GASPERINI^{1,2}, P. BARTOLOMMEI¹, E. MANZO¹, A. MORTELLITI¹, R. COZZOLINO¹¹ Fondazione Ethoikos, Stazione Eto-Ecologica di Corbaiola, Radicondoli, Italy² U.R. Ecologia comportamentale, Etologia e Gestione della fauna, Dipartimento di Scienze della Vita, Università di Siena, Siena, Italy

P023

Several studies have examined the diet of the yellow-necked mouse *Apodemus flavicollis*, the wood mouse *A. sylvaticus* and the bank vole *Myodes glareolus*, however, little is known about the seasonal food selection of these sympatric species in thermophilous forest.

We investigated the food selection and possible trophic niche overlaps of micromammals during a year (from autumn 2012 to summer 2013) in a wooded area of central Italy, using a cafeteria-style feeding experiment. This study is part of a wide project on the role of food resources in micromammals population dynamics.

We live-trapped 33 *A. flavicollis* (16 males, 17 females), 7 *A. sylvaticus* (all males) and 13 *M. glareolus* (6 males, 7 females). The animals were transferred to experimental enclosures, where

they were given a sample of all seasonal fruits and/or flowers collected *in situ* from arboreal and arbustive species. The consumption of the food items was checked regularly in the following 24 hours.

The results revealed that some plant species (e.g. *Rosa* sp.) represent the preferred trophic resources both as fruits and flowers all year round, while others (i.e. *Juniperus* sp.) are eaten only in certain seasons. The order in which the fruits were consumed also revealed different foraging strategies in small mammals species. We found a distinct overlap of trophic niche among the three species where *M. glareolus* was the species with the widest spectrum of food items exploited. Our findings may help future studies to correctly evaluate the role that arboreal or arbustive species play seasonally as trophic resources for small mammals.

Records of bat roosts in western part of Balkan peninsula

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The bat fauna for Serbia and neighbouring countries has been specifically studied during the last few decades by few authors. However, data on distribution, biology and conservation problems for the known bat species are fragmentary and still under investigation, in particular on the relationship between species and roost characteristics.

Project related to identification of bat species and their roosts according to different bioclimatic belt and landscape composition at different parts of the western part of Balkan peninsula started in 2013. The data were gathered at 15 different localities in Serbia, Montenegro, Bosnia and Herzegovina and FYR of Macedonia during the period April – October 2013. We visited western, south-western and eastern parts of Serbia belonging to two different karst regions (Dinaric and Carpathian), western and south-eastern parts of Montenegro, eastern part of Bosnia and Herzegovina and western part of FYRM – sites belonging to National park Mavrovo. Bats were caught using mist net placed at cave entrances, or by hand nets inside the roosts. All bats caught were identified to species, sexed, weighted and released at the same site where caught.

In total, we caught 467 individuals belonging to 12 bat species: *Rhinolophus ferrumequinum*, *R. euryale*, *R. hipposideros*, *Myotis capaccinii*, *M. daubentonii*, *M. emarginatus*, *M. myotis*, *M. blythii*, *M. mystacinus*, *Nyctalus noctula*, *Pipistrellus pipistrellus* and *Miniopterus schreibersii*. In western Serbia, the

following number of species per locality was found: Petnička pećina cave (8), Degurička pećina cave (5) and Šalitrena pećina cave (5); in south-eastern Serbia: Hadži-Prodanova pećina cave (2); eastern Serbia: Ogorelička pećina cave (1) and Bogovinska pećina cave (3); western Montenegro: Vilina pećina cave (2); south-eastern Montenegro: Začirska pećina cave (5) and Jama Šutonjića cave (5); in eastern Bosnia: Orlovača cave (2), cave without name (by the road Han Pijesak-Vlasenica) (2) and Draganova pećina cave (1); in the NP Mavrovo in FYRM: Šarkova dupka cave (2), old orchard in the village Selce (3) and house attic in the village Tresonče (1). The most frequent species were *Rhinolophus ferrumequinum* (8 sites), *Miniopterus schreibersii* and *R. hipposideros* (7), *Myotis myotis/blythii* and *R. euryale* (6) and *Myotis capaccinii* (4).

The association among species is described and the most common community resulted constituted by Rhinolophids associated with *M. schreibersii* and *M. myotis/blythii*, typical of large caves, and in 2 caves we found also the presence in the mixed colonies of *M. daubentonii* and *M. capaccinii*.

Results of this research provide new records about distribution of bat species, community compositions and ecology related to their roost preference for the western part of Balkan peninsula, as well as it is the starting point for ecological studies related to the characteristic of roost and related landscape.

To feed or not to feed? The effectiveness of supplemental feeding sites for roe deer (*Capreolus capreolus*), with reference to box trapping success rate and winter space use

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Supplemental feeding is a diffused hunted ungulate management practice in several countries, especially where winter conditions are particularly harsh and diminish the probability of survival of animals. Thus, the management of supplemental feeding sites is primarily aimed to help ungulates' overwinter survival. Feeding sites are generally set in overwinter spots and continuously replenished throughout winter time with high energetic value food. Therefore supplemental feeding stations represent an important attractive resource that can bias animals' spatial use. This particularly applies to those species that need to continuously feed to satisfy their energetic requirements because they have limited ability to store fat reserves. These physiological traits are typical of the European roe deer (*Capreolus capreolus*), a small cervid distributed from Mediterranean to Scandinavia, across a variety of landscapes and climates. Roe deer are known to be "income breeder", i.e. they continuously use their energy during the reproductive period in summer, and do not store much fat in winter. Moreover, they are not particularly adapted to harsh winter conditions, especially deep snow cover and low temperatures (which increase the basal metabolic rate). Therefore, northern latitudes and alpine areas are considered suboptimal habitats, i.e. two extremes of roe deer distribution range. Not surprisingly, supplemental feeding practice has been

substantially used in these two areas, but not many studies assess the effectiveness of this practice, in terms of affecting animals' space use and resource selection.

Because of their attractive role for roe deer, supplemental feeding sites have been often chosen as locations to deploy box traps to capture and individually mark this ungulate for research purposes. The access to food in proper feeding sites is periodically limited, so that animals are pushed to get into box traps, that are instead refurnished with food.

In this work we focus on an alpine population of roe deer, in Trentino (North-Eastern Italian Alps; Val Rendena, Valli Giudicarie), where supplemental feeding practice has been carried out in the medium term (from 20 to few years). We performed roe deer captures with box trapping technique over two winter seasons (2012-2013 and 2013-2014), and then monitored the use of feeding sites by means of GPS collars fit to captured animals. We present the capture success rate, with hypothesis of variation linked to a variety of factors, such as weather conditions and topographic distribution of traps. Moreover, we show the importance of these punctual resources on roe deer space use, showing how it deviated from random according to distribution of supplemental feeding sites.

Bat community and conservation in and around the Montecatini Val di Cecina historical mine (Pisa, Toscana)

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Montecatini Val di Cecina, a small village in the province of Pisa, hosts an ancient copper mine; used since the Middle Ages, the mine reaches its maximum development at the beginning of 20th century, when it is considered one of the most important in Europe. The mine consists of an underground part, with many different tunnels going deep in the mountain, included a water drainage tunnel, and a certain number of ancient buildings, recently restructured.

In order to assess the local bat population due to a windfarm repowering, from 2011 a series of studies were carried out to detect bat species, numbers and phenology of the community present in the mine and around the site. Series of visits were organized to visually verify the presence in the mine tunnels, as well as the use of infrared cameras and thermal cameras to count animals at the exits.

First information on the presence of a large wintering colony derive from survey conducted by Firenze Museum team.

The visual inspection of the mine give different information from the overground buildings, the "touristic" tunnels and the drainage tunnel.

In the overground buildings a group of breeding females (from 12 to 16) of *Rhinolophus euryale* were found in July, as well as the refuges of a small colony of *Pipistrellus kuhlii*. In the summer 2011 and 2012, 10-15 *R. ferrumequinum* were also recorded and a small colony of *Myotis emarginatus* (12-15 individuals) were found in summer 2011.

In the tunnels used by tourists only few individuals of *R. euryale* and *R. hipposideros* were found all year round.

In the drainage tunnel there is the presence of a large wintering

colony of *R. euryale* that can vary between 157 to 215 specimens. At the same time few individuals of *Myotis blythii*, *R. hipposideros*, *R. ferrumequinum* are founded in the tunnel and a large group, up to 450, of *Miniopterus schreibersii* is also present.

These numbers become more impressive in breeding time, when the colony of both *M. schreibersii* and *R. euryale* double the presences and up to around 100 mixed *M. myotis* and *M. blythii* can be present.

The count with cameras during summer nights show 1250-1350 (August-September 2012) up to 1850 (late July 2013) bats flying out the tunnel, when also the young of the year area going out to forage.

To provide information on other species and to check any sort of impact, acoustic surveys (6 listening point, 30' each, and 7.5 km driven transects) were carried out in 24 nights around the hill of the mine in order to sample all the possible environments present.

The most common species recorded is *Pipistrellus kuhlii* followed by, in descending order of presence, *Pipistrellus pipistrellus*, *Miniopterus schreibersii*, *Hypsugo savii*, *Eptesicus serotinus*, *Tadarida teniotis*, *Nyctalus noctula*, *Nyctalus leisleri*, *M. myotis/blythii*, *Myotis* sp., *Plecotus* sp.

The research at the moment provide information on the presence of at least 14 taxa and on the reproduction of 3 of them (*M. schreibersii*, *R. euryale*, *P. kuhlii*). This monitoring effort should continue to provide a control on the potential effect of the windfarm but mainly is providing more information on the autoecology of the species in this Tuscany hills landscape.

Captive or wild? Investigation on the source of genetic introgression in two Italian wild boar populations

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Heritable traits owned by animals raised in captivity may severely affect wild populations, in case of hybridization subsequent to accidental escapes or intentional releases of captive-bred individuals. A strong genetic divergence between wild (WP) and captive populations (CP) can be the effect of breeding practices aimed at modifying some species' traits (like tameness, reproductive performances, meat quality). In some cases, such changes are obtained through crossbreeding with the domestic counterpart. Domestic genes introgressed in this way into captive animals can thus be transferred to the wild population leading to unpredictable consequences on fitness, possibly causing outbreeding depression or an increase of species invasiveness. Hybridization between wild boar (*Sus scrofa*) and domestic pig occurred in the past and still occurs today, having strong evolutionary and management implications. In fact, genetic introgression from the pig may alter traits like behaviour, reproduction rate and immunology in wild boar, with likely demographic impacts. Thus, it is crucial to understand under what conditions hybridization occurs in *Sus scrofa*.

Captive crosses with domestic pigs (released or escaped) have been suggested to constitute the major source of the spread of domestic genes into wild boar populations. However, to date, few studies have assessed the degree of admixture in farmed animals in comparison to the surrounding wild populations. With this purpose, we analyzed microsatellite loci in wild boar sampled in breeding stations and in the local wild population in two Italian regions (Sardinia, SAR, and Piedmont, PIE. SAR-WP, n=353, SAR-CP, n=28; PIE-WP, n=631, PIE-CP, n=9).

Allele frequencies and standard genetic diversity indices were calculated for each group. Additionally, for the two datasets separately, the Bayesian clustering algorithm implemented in STRUCTURE was used to infer individual genetic ancestry and the average rate of self assignment (Q) of each population.

In order to test for different rates of genetic introgression in CP and WP, accounting for the unequal sample size, 1000 subsets of individuals, randomly chosen from the WP and having the same size of the corresponding CP were created. Then, the percentage of cases in which the subset had a mean Q equal to or lower than the captive sample was obtained.

Both captive populations had lower allelic richness than the corresponding wild population, but a similar expected heterozygosity. In Piedmont, introgression from the domestic form into the wild population seems to be extremely low (PIE-WP, Q=0.993), while there are significant signs of admixture in the sampled breeding stations (PIE-CP, Q=0.928). In none of the 1000 subsets of 9 individuals randomly selected within the PIE-WP, the mean Q resulted lower than or equal to the PIE-CP (thus, there is significant difference between the Piedmont wild and captive population, at $p < 0.001$). In Sardinia, instead, both the wild and captive populations showed moderate signs of introgression (SAR-WP, Q=0.973; SAR-CP, Q=0.966). In 222 out of the 1000 subsets of 28 individuals randomly selected within the SAR-WP, the mean Q resulted lower than or equal to the SAR-CP (i.e., the captive sample did not differ significantly from the wild population, $p=0.22$).

We conclude that hybridization in nature seems to play the key role in Sardinia, while intentional hybridization in captivity is the major source of introgression in Piedmont. Accordingly, in several areas of Sardinia an illegal husbandry system occur, with pigs being allowed to wander freely all year round, in absence of fences, human control and a regular food supplementation. Our findings emphasize the need for a routine genetic monitoring of wild boar captive populations, coupled with reference data on the neighbouring wild populations, to prevent the spread of domestic genes in wild populations.

New monitoring techniques in the study of red deer (*Cervus elaphus*)

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About 200 years ago the red deer (*Cervus elaphus* L., 1758) was extinct in the Sibillini National Park (SNP), but since 2005 a total of 79 individuals have been reintroduced, the last of them in 2012.

In 2011 and 2012, three techniques were adopted to monitor the red deer population: camera trapping, roaring stags census, and playback. The first two techniques were employed on a research-intensive area in the district of Castelsantangelo sul Nera (MC/Macerata), where the presence of red deer has been constant. The third technique was applied in some areas of the SNP, where small groups of red deer had been sighted.

The camera trapping technique was applied from June 2011 to November 2012 in the same area where the roaring stags census had taken place. It was employed for individual identification of male deer and evaluation of the population structure. The data collected between August and November turned out to be helpful for the individual identification of male red deer (adults and sub-adults) according to shape and characteristics of their antlers, whereas the data collected during the summer time have allowed to extrapolate the structure of the population.

In 2011, 38 stations were monitored over a 14.8 km² area. The camera traps have been operating for 1264 camera-trapping days. The monitoring allowed the identification of 25 males (17 of them were adults while 8 sub-adults). The percentage of males (adults + sub-adults) in the red deer population was estimated 16% of the pre-mating population, which was calculated excluding the calves of the year.

In 2012, 47 stations were monitored over a 18.8 km² area. During 2110 camera-trapping days, 28 male red deer (19 adults and 9 sub-adults) were identified: male percentage was overall 16.67%.

The roaring stags census was carried out within two evenings (from 8.00 pm to 11.00 pm) each year, during the peak of the rutting season (from the third decade of September and the beginning of October). For each census between 11 and 16 listening stations have been monitored on a 17 km² area.

The total number of roaring stags censused was respectively of 20 in 2011 and 22-23 in 2012 with a density of 1.18 and 1.32 per km².

The estimation of the red deer population size in the research-intensive area was carried out relating the number of male adults and sub-adults, both those identified through camera traps and those identified through the roaring stags census, together with the percentage of male adults and sub-adults recorded in summer time through camera traps. In this way, it was possible to estimate the sizes of the pre-mating population, which fluctuated between 125 and 156 individuals in 2011 and between 135 and 168 in 2012.

Playback technique was tested in 2012 to estimate red deer population in the remaining area of the SNP where small groups of deer may be present at low density. According to previous observations and bibliographical data it emerged that male red deer tend to reduce considerably their roaring activity in low-density areas. As a result, it was difficult to identify them through the traditional roaring stags census. The playback technique consists in the simulation of red deer roaring through amplified recordings. Those acoustic emissions aim at stimulating the response of male adults and sub-adults during the rutting season. 14 quadrants of 25 km² each were examined using 42 emission stations during 11 evenings of adequate weather conditions. Between 17th September and 10th October 2012 one to three sessions of playback have been carried out in each station.

The application of this technique allowed the reception of 5 responses of roaring red deer, attributed to at least 4 male red deer outside the research-intensive area. These results prove the benefit of the playback technique for studying red deer in low density-areas. However, it is important to remark that they have to be considered as minimum estimation of the red deer's presence and further investigations are necessary to elaborate a method of standard application for this new monitoring technique for small populations or in low-density areas.

Bats in the LIFE+ ManFor CBD Project: assessing the effects of alternative forest management on bat communities

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Many bat species use forests for roosting or foraging so such mammals constitute an important component of forest biodiversity. Bats are long-lived and selective for habitat type and prey, so they are likely to be influenced by forestry. As a part of an ongoing broader project (LIFE + ManFor C.BD.) we are investigating the responses of bats to different forest management strategies, comparing the effect of traditional logging vs. those of innovative exploitation strategies within seven areas across Italy, from Calabria to the Eastern Alps are under investigation. At all sites, both the situation recorded before and after logging as well as the differences among treatments have been assessed. We have surveyed bats through manually operated and automatic real-time bat detectors and mistnetting with acoustic lures (AUTOBAT; Sussex University). Captures have been used to provide a better picture of the local bat species assemblage whereas bat detectors are used to measure and compare bat activity across plots assigned to different treatments. Bat calls have been identified by multivariate discriminant functions.

A first outcome of the project was a better understanding of bat distribution in Italy. We recorded high species richness at the “Vallombrosa” Reserve (Reggello, Florence) with 13 bat species detected, including Habitat Directive Annex II species such as barbastelle (*Barbastella barbastellus*), Geoffroy’s bat (*Myotis emarginatus*) and greater horseshoe bat (*Rhinolophus*

ferrumequinum); at the “Marchesale” Reserve (Mongiana, Vibo Valentia) with 12 forest bat species detected, including Annex II *B. barbastellus* and Bechstein’s bat (*Myotis bechsteinii*); and at the “Cansiglio” Forest Reserve (Fregona, Treviso) with 11 bat species detected, including Annex II *B. barbastellus* and *R. hipposideros*.

At “Bosco Pennataro” (Vastogirardi, Isernia), 10 bat species were detected; at both “Chiarano Sparvera” (Scanno and Barrea, L’Aquila) and “Tarvisio” (Tarvisio, UD) Forest Reserves, 8 bat species were detected. Lower species richness was found at “Lorenzago” (Lorenzago di Cadore, BL) site, totaling 7 bat species.

Our work considerably increased the knowledge of the occurrence of rare species, including barbastelles, in the country. As for the main aim of the project, preliminary analysis showed that species richness may not be a suitable indicator of the effect of alternative management options at the extent of ManFor sites (ca. 30 ha surface, treatment plots ca. 3 ha) as bats are highly mobile and this factor may mask species-specific association with different treatments applied to adjoining plots. The first results show that at least under certain treatment schemes total bat activity is influenced by logging and differs across logging protocols, but such observation await confirmation from the ongoing data collection.

Il ritorno del cervo (*Cervus elaphus*) in provincia di PerugiaL. CONVITO¹, M. CROCE¹, G. SORBAIOLI², F. ZUCCACCIA²¹ Servizio Gestione Faunistica e Protezione Ambientale, Provincia di Perugia, e-mail luca.convito@provincia.perugia.it² URCA Umbria, e-mail giuliano.sorbaioli@hotmail.it

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Le originali popolazioni di cervo e capriolo scompaiono in Umbria fra il XVIII e XIX secolo per la pressione antropica e le sempre maggiori trasformazioni ambientali.

A seguito del primo Piano Faunistico Regionale (1983) che aveva fra gli obiettivi la “ricostituzione del patrimonio faunistico regionale” si realizzano una serie di Centri di Ambientamento e Diffusione (CAD) dedicati al capriolo ed uno per il cervo, gestito dalla Comunità Montana Alto Tevere e situato nell’Oasi di protezione di Rogni (Comune di Città di Castello) all’interno del vasto complesso forestale demaniale dell’Alto Tevere Umbro. A distanza di circa trent’anni, esistono oggi solo piccoli nuclei in libertà legati alla fuga degli individui dal CAD di Rogni o da altri recinti di allevamento (Val di Chiascio nel Comune di Gubbio e Armenzano nel Comune di Assisi) e non vi sono distretti in cui ne è autorizzato il prelievo. Di prossima colonizzazione sembra il territorio della Valnerina (porzione meridionale del territorio provinciale), considerato che il Parco Nazionale dei Monti Sibillini ha provveduto negli ultimi anni ad un’operazione di reintroduzione del cervo e che alcuni di questi individui hanno già cominciano ad essere segnalati all’esterno del Parco.

Il fototrappolamento, condotto dai tecnici del Servizio Gestione Faunistica e Protezione Ambientale della Provincia di Perugia per le indagini d’istituto fin dal 2009 in varie zone del territorio di competenza, ha permesso di documentare la diffusione spontanea dei cervi, anche a più di dieci chilometri dai recinti di provenienza e, negli ultimi anni, la loro riproduzione con successo in territorio a caccia programmata, anche dove in passato non sono mancati episodi di bracconaggio.

Una serie di filmati di una femmina accompagnata da un piccolo sono stati realizzati infatti nelle estati 2011 e 2012 a circa 13 km in linea d’aria dal CAD di Rogni.

Nonostante la casualità ed il ridotto numero degli scatti di cervo, è stato comunque possibile aggiungere nuovi quadrati pentachilometrici di presenza accertata ai dati dell’Atlante dei Mammiferi dell’Umbria.

Il CAD di Rogni, dal 2004, è stato affidato in gestione ad URCA Umbria che nel 2013 ha stipulato una convenzione con la Provincia di Perugia per la gestione anche della circostante Oasi di protezione.

Nel giugno 2011 visto il forte interesse suscitato dai sempre più frequenti avvistamenti soprattutto da parte degli operatori della caccia di selezione, l’URCA Umbria ha organizzato il Convegno “Il cervo... che verrà” coinvolgendo le due Province umbre e tecnici che si occupano in ambito nazionale della gestione del cervo.

Dal 2008 ad oggi, l’URCA Umbria ha condotto annualmente sessioni di ascolto del bramito durante la stagione degli amori nell’Umbria settentrionale, coinvolgendo come volontari i cacciatori di selezione.

Da molti anni inoltre, i cacciatori di selezione iscritti all’URCA contribuiscono alla raccolta di informazioni sugli avvistamenti di cervo condotti durante i censimenti primaverili del capriolo e anche di quelli al di fuori dei distretti di gestione di appartenenza, in un clima di maggiore consapevolezza del proprio ruolo di “gestori” e non solo di “prelevatori” delle risorse naturali.

La toponomastica e la presenza del lupo (*Canis lupus*) in UmbriaL. CONVITO¹, M. CROCE¹, F. VELATTA¹, C. ROMANO²¹ Servizio Gestione Faunistica e Protezione Ambientale, Provincia di Perugia, e-mail luca.convito@provincia.perugia.it² Associazione A. Valli da Todi, e-mail croman97@libero.it

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Spesso, nella redazione delle carte geografiche, i toponimi sono tratti da denominazioni relative alle biocenosi vegetali o alle specie animali: nel presente lavoro sono stati presi in considerazione quelli originati dalla presenza del lupo nel territorio della Provincia di Perugia.

Presenza che ha raggiunto il minimo storico (in Umbria, come nel resto d’Italia) sia per numero dei capi che per ampiezza dell’areale intorno la fine degli anni ’70, quando pochi individui sopravvivevano nei territori della Valnerina, a confine con Marche e Lazio, in particolare nei Monti Sibillini.

Negli anni seguenti, il regime di protezione accordato (specie protetta dal 1971) e la ripresa delle popolazioni di Ungulati selvatici (prima il cinghiale e quindi capriolo e daino) hanno permesso una fase di progressiva espansione in ambito regionale. Attualmente, infatti, sulla base delle segnalazioni di individui osservati o rinvenuti morti e quelle relative ad eventi di danno alla zootecnia, si può stimarne la presenza (anche se non sempre come colonizzazione stabile) in quasi tutti i comparti regionali. I toponimi presenti sul territorio regionale sono stati estratti dallo *shapefile* dei toponimi delle tavolette IGM.

Quelli che avevano una derivazione plausibile dalla presenza del lupo (evidentemente passata, visto che il rilevamento delle tavolette IGM in provincia di Perugia è stato condotto fra il 1892 e il 1955) fanno riferimento a 61 località distribuite in 26 comuni (sui 59 dell’intero territorio provinciale).

Fanno riferimento a varie tipologie di presenza (es. Selva Lupara, Colle del lupo), attività e uso del territorio (es. Cantalupo, Cacalupo, Passo del lupo) da parte di questo mammifero un tempo fortemente perseguitato dall’uomo, ed oggi tornato ad occupare di nuova buona parte dell’areale originario.

Confrontando tale distribuzione con quella della presenza accertata (cumulando i dati dell’Atlante dei Mammiferi dell’Umbria con quelli del fototrappolamento e dei rilievi di campagna condotti dal Servizio e delle segnalazioni più recenti ed attendibili pervenute allo stesso) e quella dei danni alla zootecnia (per gli anni dal 2003 al 2013) risultano alcune discrepanze. In particolare nei settori centro-meridionale e centro-occidentale del territorio provinciale non risultano al momento segnalazioni di presenza del lupo, anche se contermini a territori già abitualmente o solo occasionalmente frequentati.

Prevenzione degli incidenti stradali con ungulati selvatici: il progetto LIFE Strade in Umbria, dati preliminari

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Negli ultimi anni, è notevolmente aumentato nel territorio regionale il numero di incidenti stradali con la fauna selvatica, in particolare con il cinghiale e il capriolo (entrambe specie con popolazioni in crescita, sia numericamente che come distribuzione), tanto da rappresentare un grosso problema sia sul piano della sicurezza per la circolazione che dal punto di vista economico ed ecologico.

Al fine di migliorare la conoscenza del fenomeno nel proprio territorio e dotarsi di adeguati strumenti di intervento, nel luglio 2011 la Provincia di Perugia, ha firmato l'adesione ad una proposta di progetto LIFE, successivamente approvato e finanziato dalla Comunità Europea con il nome di LIFE STRADE - LIFE11BIO/IT/072 "Dimostrazione di un sistema per la gestione e riduzione delle collisioni veicolari con la fauna selvatica". Per la stesura del progetto sono stati raccolti ed esaminati una serie di dati georeferenziati relativi agli incidenti stradali e alle successive pratiche di liquidazione (il database dell'Osservatorio Faunistico Regionale va dal dicembre 1986 ad oggi, anche se la raccolta dati si fa sempre più organica soprattutto dopo la metà degli anni 2000 man mano che il fenomeno acquista maggiore rilevanza economica).

Beneficiario e capofila del progetto è la Regione Umbria con partner la Regione Toscana, la Regione Marche, la Provincia di Perugia, la Provincia di Terni, la Provincia di Siena, la Provincia di Grosseto e la Provincia di Pesaro-Urbino (<http://www.lifestrade.it>).

Il progetto è ufficialmente iniziato il 1° gennaio 2013 e si concluderà il 31 marzo 2017 con un budget totale di € 1978917 (percentuale di cofinanziamento da parte della Comunità Europea

del 49.06%, pari ad un contributo massimo di €970856).

Il progetto prevede la sperimentazione e messa in posa, in ogni Provincia partecipante, in più tratte stradali (da individuare in base alla casistica pregressa ed attuale degli incidenti), di una serie di sistemi con il seguente funzionamento: un sensore radar doppler registra il passaggio di un animale e trasmette l'informazione a una centralina elettronica. Questa provoca l'attivazione di un segnale di allerta, con luce intermittente, per i guidatori, invitandoli a ridurre la velocità fino a un livello ottimale. Un sensore radar registra se l'automobile in questione rallenta fino a una velocità desiderata. Se l'automobile rallenta, il sistema si ferma a questo punto. In caso opposto il radar trasmette un segnale alla centralina, che provoca l'attivazione di un sistema di dissuasione ottica e/o acustica per l'animale, mettendolo in fuga.

Il sistema è dotato di una serie di sensori di funzionamento collegati a una piattaforma informatica, che permettono il controllo e monitoraggio a distanza dell'intero sistema, consentendo un immediato intervento in caso di errato funzionamento, sarà inoltre accompagnato dall'installazione sulla strada di specifici cartelloni (forniti di immagini e testi) utili a rendere maggiormente attenti e consapevoli del rischio gli automobilisti in transito.

Al momento sono in corso tutte le azioni preliminari riguardanti il monitoraggio delle strade individuate per l'installazione dei dispositivi di prevenzione con il rilevamento sia delle presenze faunistiche che del volume di traffico veicolare e l'individuazione dei punti particolarmente critici per l'attraversamento della fauna selvatica.

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The intravenous saphena lateralis access for the collection of haemoserum samples from hares *Lepus* sp.

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From the mid-90s health issues are indicated as an integral part of the management system of game populations of hares *Lepus* sp. in Italy. Since then it has gone from a system of health verification based essentially on a sporadic passive surveillance (surveys on the causes of death in individuals found deceased) to monitoring systems, including those based on active surveillance, that is programmed on both national free-range subjects and in those imported and farmed too. In particular, monitoring live hares do allow to perform programs based also on serological programs predetermined as a function of the expected prevalence of infections, for the detection of antibodies against specific various diseases such as EBHS, tularemia, toxoplasmosis, brucellosis, leptospirosis and borreliosis. The need of haemosera for multiple investigations do require joining with the programmed manipulations of animals during check in/out for transport and relocation, in order to obtain sufficient amount of blood and minimal effects from manipulations, as often sera collection result affecting the hares with an additional long time of contention. For such purposes further monitoring campaigns in Italy from the 90s on live hares were carried out with blood samples from venules of the outer side of the ear, with methods in order to improve the visibility of the venule and facilitate the aspiration. While the amount of haemoserum obtained have always been considered as minimum sufficient for serological programs, it is also well known that these sampling procedure have often not well accepted by stakeholders because considered

a substantial time dilation of restraint of animals and wasting of time for the operators helping the veterinarians. The recent use of blood dried on blotting paper presents interesting aspects especially useful for investigations based on bagged hares but obviously not for collections of fresh serum.

In January 2014, to meet some proposals for new monitoring required by local hunting communities (ATC MO1 and MO2), the Veterinary Service of the Local Health Agency of Modena decided to commit especially for the captures campaign of 2014-2015, starting by checking the feasibility of a protocol with less impact on the logistics of the catches and the restraint of the animals. For this purpose withdrawals has been programmed during three sessions of catches, comparing intravenous access from venules of the outer side of the ear with lateral saphenous vein access, proposed in 2006 for leporids; actually the results from this second method were very interesting for the amount of time for each restraint (only 2-3 minutes versus 6-10) and a greater amount of haemoserum obtained (1-1.5 ml versus ca. 0.5 ml). The intravenous access from the lateral saphenous vein is based on the tonsure of the distal part of the thigh, compression of the proximal part, easy puncture and moderate negative pressure, possible reactivation of compression for a supplementary intake and a short squeeze to obtain a complete hemostasis. This method compared to the most cited and practiced, seems to improve considerably at the same time the efficiency of collection and the conditions for the animal welfare.

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Adequacy of the Italian network of protected areas in conserving populations of terrestrial mammals

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Preserving habitat connectivity is fundamental for conserving species over large temporal and spatial scales. Protected area networks may allow species to persist in fragmented landscape by preserving natural population spatial dynamics. The Italian network of protected areas has been assessed for coverage, representation and irreplaceability, but it has never been assessed for connectivity. We analysed the connectivity of the Italian network of protected area for terrestrial mammals in order to detect species, sites and areas that require conservation attention. We calculated the cost distance between all protected areas within the extent of occurrence of each species by weighting species suitable habitat. We estimated dispersal distance for each species through allometric relationships and we applied a

probabilistic index of connectivity (PC) to calculate the reachable habitat for each species within the network, and the relative importance of each site and dispersion areas for connectivity. We then aggregated species results to identify protected areas and connection areas that are especially relevant for preserving the connectivity of Italian terrestrial mammals.

Here we discuss the adequacy of the current network of protected areas, dispersing areas and stepping stones that require conservation attention, and a further implementation of the network for species of conservation concern. The present work is intended to inform and support the planning and management of the Italian network of protected areas.

Wolf and large mammals in camera-trapping monitoring at Parco del Corno alle Scale (Bologna)

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Camera trapping is a technique largely used in monitoring large mammals across the world as it can be useful to detect cryptic species as well as to investigate density and distribution of many different species. Here we present results of the use of the technique in the Corno alle Scale Regional Park.

The Park is located on the main ridge of the Apennines between the Bologna and Firenze provinces with an extension of around 5000 hectares. Covered mainly by broadleaf forest, above all beech forests, reach in creeks, is characterized on the ridge by snowing peaks, high altitude glacial cirques, and mountain grasslands. Small villages are scattered present in the valleys.

8 camera traps (Scout Guard and Boly Guard) were positioned after an accurate check in points with sure wolf signs of presence and leave in the field for 18 months. 47 days and 595 km on feet were used to check the traps. In a total of 1742 night traps were collected 6675 pictures and video. Discharged the empty frames, 999 pictures were used. This frames have at least one reckonable element that was possible to correlate to trap position, environment, use of a bait. Activity and behavioral categories were also put in the database.

12 taxa were caught in images. Among carnivores *Canis lupus*, *Vulpes vulpes*, *Meles meles*, *Martes foina* and *Mustela putorius* to which one have to be added domestics *Felis catus* and *Canis familiaris*. Among ungulates *Sus scrofa*, *Dama dama*, *Cervus elaphus*, *Capreolus capreolus*, *Ovis musimon* and also *Lepus europaeus* and *Buteo buteo*. All the known species of large

mammals of the park were detected.

Camera were positioned keeping as main target the wolf and this allow to collect 258 pictures and movies of the species that also permit to assess, based on recognition of specimens, contemporary shooting and sequences of movements, the presence in the Park area of at least 10 individuals for the winter 2012-2013. Also 2 reproductions, 2 young with sarcoptic mange and the presence of a non reproductive couple with non-conventional dark fur female on the border of the main herd were also documented.

Considering the number of photo shoots, the most numerous species was *S. scrofa* with 416 pictures, followed by *V. vulpes* (360), *C. lupus* (258), *C. capreolus* (196), *O. musimon* (57), *M. meles* (31), *M. foina* (15), *B. buteo* (14), *L. europaeus* (12), dog (4), *C. elaphus* (4), cat (2), *M. putorius* (2) and *D. dama* (1).

About the behaviours, mainly thanks to movie detection, the main recorded category is obviously the passage in front of the camera but also social interactions, conflicts, markings and search for food were also collected as demonstration of the validity of the methods in the field, as widely accepted.

The method give to the park managers a strong model, based on number of presence for relative number of night/trap, correlated to distribution and landscape types around the trap point, that can be apply to monitoring all large vertebrate in the park and in particular can be used to follow the groups of wolves in their local evolution.

Elaborazione delle misure di conservazione dei mammiferi di interesse comunitario nei siti della Rete Natura 2000 della provincia di Bologna

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In provincia di Bologna sono presenti 30 siti della Rete Natura 2000 (SIC - ZPS) distribuiti dalla pianura alla montagna, di cui 5 ricadenti completamente o parzialmente all'interno di altrettanti Parchi Regionali.

La Provincia di Bologna, competente per la gestione di 25 siti, e l'Ente per la gestione dei Parchi competente per la gestione dei 5 siti ricadenti all'interno delle aree protette, in applicazione della L.R. 7/2004, hanno da poco concluso il processo di elaborazione e adozione delle misure specifiche di conservazione degli habitat

e delle specie di interesse comunitario, ciascuno per i siti di propria competenza.

Nell'ambito di tale processo, sono state elaborate strategie e specifiche misure per la conservazione dei mammiferi di interesse comunitario, che costituiscono gli obiettivi di gestione della rete dei siti Natura 2000.

Nel poster si descrivono i problemi affrontati per le diverse specie e le risposte che sono state individuate, anche attraverso la consultazione degli *stakeholders* interessati.

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Preliminary data from wolf monitoring in an area of Aspromonte National Park

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From September 2008 to March 2011 we monitored carnivore populations in a mountainous area (about 1500 hectares) of Aspromonte National Park (Calabria, Southern Italy) to define their presence and distribution. The study was included in more extended Environmental Impact Assessment concerning the construction of a dam on the river Menta (So.Ri.Cal. RC). We used several methods such as observing natural signs (footprints, scats, burrows) along established trails, camera trapping (used in Calabria for the first time) and, exclusively for wolf, snow-tracking and wolf-howling. The aim of this study was to confirm presence of wolf (*Canis lupus*) in the study area, to estimate minimum number of packs members and number of wolf packs with pups during breeding period.

Seasonally we went along 31.3 km on 9 established trails (min 0.56 km - max 8.3 km) uniformly distributed on study area, covering a total of 313 km.

We gridded area into blocks of 1 km on a side and placed a camera trap within each block in two trapping lines adjacent (n=8) to each other that were run in two consecutive data collection

periods. All together camera traps worked for 659 trap-days during summer and autumn.

We identified 3 sub-areas in which we conducted regular snow-tracking surveys in winter (in total approximately 146 km) on 3 paths (one for each sub-area) located opportunistically, walking along them 36-48 h after snowfall in order to locate wolf tracks and scats.

We carried out wolf-howling technique during summers, according to saturation census that requires the total coverage of study area. We gridded area into blocks 3 km on a side and identified 9 sample sites. Trial series (n=3) was repeated for 3 successive nights once a month from June to September.

The study confirmed presence of wolf in Aspromonte National Park and provided that the study area is part of a pack's territory. By snow-tracking resulted a pack of at least 7 wolves. Pups responded to simulated howling during summer 2009 so we identified some pups inside the pack. Camera trapping provided the very first picture of a pack of wolves in the Aspromonte National Park.

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Dati sulla presenza del lupo (*Canis lupus*) nel Parco Regionale delle Alpi Apuane

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La presenza del lupo (*Canis lupus*) nel Parco Regionale delle Alpi Apuane è stata documentata nell'anno 2008 tramite l'analisi genetica di campioni fecali, dopo circa un secolo dall'estinzione locale della specie; gli individui rilevati probabilmente provengono dal vicino Parco Nazionale dell'Appennino tosco-emiliano. Nel 2010-2011, sono stati genotipizzati 2 esemplari, un maschio nelle Apuane meridionali ed una femmina nella parte centro-settentrionale della catena montuosa. Il ricorso al foto-video trappolaggio come metodologia utilizzata durante i rilievi legati alla redazione del Piano di Gestione degli ungulati, ha fatto registrare 22 eventi di "cattura" di lupo con una consistenza minima accertata di riguardanti 2 esemplari maschi nell'area delle Apuane centrali. In seguito la prosecuzione delle campagne di rilievo da parte dell'U.O.S. "Vigilanza e Gestione faunistica" ha portato i reperti oggettivi (foto e video catture) ad un numero considerevole, superiore ai 50 eventi. La presenza del lupo nel Parco va contestualizzata all'interno del *trend* di

ricolonizzazione mostrato dalla specie, in Italia, a partire dagli anni '90 del secolo scorso; con i risultati conseguiti non è possibile far ancora emergere ipotesi circa gli aspetti quantitativi del fenomeno sulle Alpi Apuane, ma si ottengono comunque importanti elementi esclusivi e nuovi, che contribuiscono a consolidare l'idea, già emersa dai dati genetici, che il territorio del Parco possa rappresentare un altro ambito nel quale la specie stia andando a recuperare porzioni del suo originario areale peninsulare. Nello specifico dei dati mostrati, si può ipotizzare che siano presenti due gruppi differenti e che sia in corso un processo di stabilizzazione della specie in diversi settori del Parco. Alla luce di ciò, indagini scientifiche successive ed intensive si rendono necessarie per verificare avvenuti eventi riproduttivi. Questi risultati sembrano indicare una crescente complessità delle zoonosi e delle catene trofiche presenti nel Parco Regionale delle Alpi Apuane a quasi trent'anni dalla sua istituzione.

First assessment of classical swine fever marker vaccine for oral immunization of wild boar under field conditions

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Classical swine fever (CSF) is a devastating disease of domestic and wild suids. In the recent past, large epidemics were registered in several European Countries and currently the disease is still reported in the territories of Russian Federation and other neighboring countries. Moreover, the occurrence of CSF in wild populations is particularly worrying because the eradication of the disease is difficult and necessitates long time. In this contest, oral vaccination against for CSF was experimented as effective tool to control the disease outbreaks in wildlife; vaccination campaigns have been carried out based on C-strain vaccine that do not allow serological differentiation of infected from vaccinated animals (DIVA). Understandably, the use of marker vaccines could improve the knowledge of vaccination dynamics. Recently, the CSF marker vaccine candidate *CP7_E2alf* was proposed for oral immunization and it was experimented under laboratory conditions. These promising results suggested to study the vaccine candidate in bait formulation under field conditions. Two oral vaccination campaigns were carried out with *CP7_E2alf* bait vaccines in two areas called “faunistic-hunting farms” in the region of Umbria, Italy. The first cam-

paign was conducted using a single vaccination, the second one employing a double vaccination strategy. The campaigns were carried out in cooperation with the faunistic service of Perugia Province and the support of hunters equipments led by the owners of the farms; the baiting activities were carried out under the control of camera traps. After each hunting activity biological samples were collected from shot animals in order to evaluate the efficacy of vaccination by serological and virological laboratory investigations.

The overall rate of baits uptake at feeding places was determined to be between 63.7% and 98.7%. The antibody prevalence reached 33.3-35.1% after immunisation. These results were within the limits of our expectation and are comparable with findings previously obtained during similar oral vaccination campaigns by application of the C-strain vaccine. The seroprevalence rates observed in this field trials show that the oral immunisation of wild boar using a bait vaccine based on a chimeric live attenuated marker virus can represent an additional tool for CSF control by increasing of herd immunity.

Wolves *Canis lupus* adapted to exploit a dairy farm in a highly populated area in the foothills of Apennines in Modena province

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A stall of dairy cattle in the vicinity of a large conurbation in the foothills of Apennines in the Modena province, from the beginning of 2012 is regularly visited by canids that feed on the sporadic carcasses of dead cattle made to stand in a corner of the yard waiting for the transport to the establishment of disposal. The carcasses do stand in the yard briefly, typically for 1-3 days and are regularly used by canids nighttime even in the case of deposit of one day only. In 2012-2013 the time interval elapsed between a carcass and the next was on average approx. 40 days (minimum 2 days, max. 120 days), the consumption has typically been a few kg (5-7), but were also documented consumption of about 30-50 kg achieved in just one night. The farmer attributed the consumption to a big dog in the neighborhood that often joined his German shepherd but the site of storage of the carcasses actually showed an animal path consistently beaten by large canids that came from a grove about 200 meters away from the farm. The use of camera traps in January 2014 to monitor both the storage area and the path has repeatedly documented two wolves *Canis lupus* who walked

the trail in pair and visited the site in the absence of carcasses. In other hand since 4-5 years in the area the wolves seemed to be interested to the manure of cattle in other dairy farms, as it maybe happened with foxes *Vulpes vulpes*, probably because of the frequent availability in fetal adnexa or occasional fetuses thrown by farmers in the manure heap. For example, in the considered dairy farm of 90 lactating cows (with approx. 30-40 calves and heifers) in the two last years the cows calved all the year long and with an average interval of 3-4 days, although of course with a high variability of the minimum and maximum values. Perhaps this frequent availability of fetal adnexa could be an element of stable interest for the wolves, encouraging them in frequenting place as dairy farms and make them take advantage also of even more rare events, such as the storage of carcasses and habituating them to situations even of particular disorder. In fact, the considered far is located next to a main road, with about forty families in the radius of 1 km and is located 1 km as the crow flies from the neighborhood of one of the largest industrial and urban areas of the province of Modena.

Three sika deer *Cervus nippon* recently hunted in the Emilia-Romagna's area of <A.C.A.T.E.R. West> question the management of italian *Cervus elaphus* population

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The European Red deer (*Cervus elaphus*) population of ACATER West management unit (northern Appennines, Emilia-Romagna) is the target of censuses since 2009, and under hunting plan since 2012. In February 2011, a deer was tentatively identified as <Sika deer> (*Cervus nippon*) and after several attempts of trapping it was finally shot by the Provincial officers in March 2012, in the same locality where it was observed one year before. The details of the event, involving an adult male of 72 kg weight, have been reported in a poster presented at the VIII National Congress of Teriology (ATI, Piacenza, 9-11 May 2012), where the case was described as the first in Italy. Only after the meeting a previous case was brought to our knowledge, having occurred in October 2010 in the province of Bolzano also concerning an adult male of 73 kg. A second Sika deer was hunted in Modena, in October 2012, at the same site of the previous killing; also this time it was an adult male weighting 113 kg. After these cases an investigation has started in order to identify farms or detention sites of Sika deer from which the specimens could have escaped. The survey, particularly challenging and often frustrating, has excluded recent escapes from Sika farms of the Emilia-Romagna, Marche, Lombardia and Liguria regions. However 3-4 specimens escaped in 1999 from a farm in the mountains of southern Emilia-Romagna region. A variable degree of hybridization between Scottish Red deer (*Cervus elaphus*) and Sika deer has been reported in several European areas, therefore, additional concern for the <ACATER West> Red deer population derives from the existence of potential hybrids of *Cervus elaphus* × *Cervus nippon* purchased in Scotland and bred since 40 years in central Italy and Emilia Romagna, some of which have escaped from captivity and settled near the site

of the Sika deer shot. Morphological variability due to potential hybridization and degree of introgression may make difficult to distinguish between Sika and Red deer. Consequently, it was proposed to the Emilia-Romagna Region and Modena's Province the implementation of an information sheet (made with the coordination of ISPRA) concerning the morphological characters of *Cervus nippon* and its similarities and differences with *Cervus elaphus* and *Dama dama* (Fallow deer), with the aim of raising awareness in the volunteer staff in charge of biometric monitoring at the checking stations. The circulation of information has in fact contributed to alert several hunters and volunteers of <ACATER West>, with interesting feedbacks and rising questions regarding cases deemed suspect or doubtful. Among these, could be the case of a Sika deer hunted in January 2014 in the province of Parma, about 30 miles far from Modena's site, but still included in the same <ACATER West> management unit. As in the past, the animal was an adult male, weighing 123 kg. The collaborative attitude of the hunters allowed to start collecting samples for genetic tests aimed at determining if the three Sika deer so far shot were pure species or hybrids. Additional tests will determine whether some apparently pure European deer shot may in fact derive from introgression from Sika or not. The genetic surveys based on microsatellites analysis, in cooperation between Czech and Italian laboratories, are in progress.

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A case of death by starvation of a group of wild boar *Sus scrofa* in the high Apennines of Modena during a long snow period, in February 2012

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In February 2013 near a village of the municipality of Frassinoro, in the high Apennines of Modena province, have been reported some wild boar *Sus scrofa* in trouble in the high snow that lingered the local mountains since several weeks; after some attempts to rescue them only some carcasses were found scattered in the thick blanket of snow. Over a period of a week were recovered the carcasses of three sub-adult and finally were found also an adult. Other carcasses less precisely reported in the same area were not found. The wildboars were as crouched in the snow without fresh paths around them; after recovery were transported to the Zoo-prophylactic Institute of Modena where they were subjected to autopsy. For all the four subjects were found: absence of signs of infectious diseases, absence of wounds and poisoning, extreme weight loss, absence of

subcutaneous fat, absence of visceral fat, empty stomach and intestines. The stomach of the adult actually showed a small amount of a dark mush that apparently looked like a mixture of potting soil and rotted wood. Also it was registered a strong pediculosis. In addition to the effects of long snow, animals may have also been badly affected by a scarce availability of beechnuts, acorns and chestnuts caused by a severe drought in summer and autumn. Few other episodes were reported in the woodlands of nearby municipalities but without available information to retrieve the carcasses.

Acknowledgements: we thank the villagers for noticing the presence of wildboars in trouble and the volunteers of the "CRAS il Pettiroso" to search the three subadults for rescuing and finally transporting the carcasses to the Institute for autopsy.

Long distance dispersal of a male apennine bear (*Ursus arctos marsicanus*) emphasizes the importance of non invasive monitoring in the peripheral range

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Due to the recent availability of non-invasive detection methods, and the renewed attention for the conservation of the Apennine brown bear, more structured and coordinated initiatives to record bear presence have been recently activated in the peripheral portions of the Apennine bear range, in particular in the Sibillini National Park (SNP; 700 km²) and in the Duchessa Nature Reserve (DNR; 35 km²). In the Sibillini National Park, bear presence was detected since 2006 using hair traps and remote IR cameras, opportunistically placed in areas of most recent bear presence. From September 2006 through May 2010, we collected in the SNP 70 hair samples, and obtained photos or video clips in 17 bear visits, in addition to a number of other bear signs including damages to cultivations, beehives and sheep. Genetic analyses of hair and faecal (DNR only) samples were conducted in the Conservation Genetics lab of ISPRA. Individual multilocus genotypes were obtained using a panel of 11 autosomal microsatellite loci and one sex-specific marker (the amelogenin gene) following a multiple-tubes protocol and stringent quality-controls of the data set. Forty percent of collected hair samples in the SNP were used for genetic analyses, 20 of which were successively scored, and all were assigned to a single bear genotype (G70) which was never sampled before. As we never had evidence of more than one bear frequenting the SNP by all survey methods, we conservatively assumed all other bear signs belonged to bear

G70. From 2006 to 2010, this bear moved across an area of 243 km² in SNP, excluding a portion of Valnerina, 18-27 km southwest from its closest locations in the SNP. After 2 May 2010, we never collected further evidence of bear presence in the SNP. However, one hair and one faecal sample matching bear G70's genotype were collected in the DNR on 28 September and 25 October 2010, respectively, at 76 km from the closest sampling location in SNP. On 16 January 2012, an adult male bear was captured in the Sirente-Velino Regional Park (SVRP) as it showed clinical symptoms of Aujeszki, but it died overnight. Although Aujeszki was not confirmed by subsequent virological tests, ultimate causes of mortality remained unclear. This bear's multilocus genotype successively revealed to match that of bear G70.

The case we hereby report coincides with the northernmost location recently reported for Apennine bears in their peripheral range and underlines the availability of suitable habitat outside the core range and the stepping-stone role that protected areas might have for bears dispersing across the Apennines. Monitoring dispersal by Apennine bears outside the core range is of crucial importance to obtain empirical evidence of functional landscape connectivity and, most importantly, to assess survival of dispersing bears in the light of diffuse ecological traps.

IX Congresso Italiano di Teriologia

Effects of the environment micro-variability on a community of cave bats in western-Sicily

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The analysis of the hypogean microclimate represents a crucial point to better understand the dynamics of cave bats communities. In our survey we hypothesized the latitudinal difference between Sicily and Peninsular Italy as a factor directly influencing both the phenology of a cave bat community and a diversified use of various cave micro-environments.

The cave, located in Western Sicily, hosts 3 bat species: *Myotis myotis*, *Myotis capaccinii* and *Miniopterus schreibersii*. From June to November 2012 we monitored the hypogean microclimate by means of dataloggers; at same time we conducted a census of the bat community to evaluate its structure and phenology across time.

Generalized Linear Models confirmed, the presence of a “buffer effect” in the cave and consequently the importance of microclimate for placing the roosts. Furthermore, hypogean displacement of *M. myotis* nursery has proved to be significantly connected with variations in temperature and humidity.

The different latitude of Sicily and the consequent climate variation leads to a shift of all phenology events and shows a picture which does not agree with peninsular data. Although the above is just a preliminary survey, it represents the first research on a bat colony in Sicily. Maintenance of suitable environmental conditions for the presence of bats, are crucial for conservation of Chiroptera.

IX Congresso Italiano di Teriologia

Medical aspects in hand rearing roe deer

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Each year fawns of wild deer are removed from natural environment by people who mistake them as orphans. This fact is a major problem that arises from a cultural gap and becomes an event of interest is ethical veterinarian wildlife. Cervids in fact are, in many areas in Italy, as also in Tuscany, present in excess and Included in control culling planes. Anyway in wild life rescue all newborn and juvenile animals are submitted to rescue centers or to experienced people in charge for hand rearing and weaning and this aid includes deer. These animals are the expression of the healthy status of their environment. In this work three year of experience in hand rearing and weaning roe deer (*Capreolus capreolus*) is described. Despite the strong and healthy appearance of this graceful ruminants roe deer fawns are delicate and demanding to breed. From 2011 to 2013 about fifty newborn and juvenile roe deer were submitted to authors for medical care, hand rearing and weaning.

In 2011 despite milk replacer was goat milk and protocol suggested in literature a severe diarrhea killed many of the fawns submitted (8). Necropsy and laboratory investigations were

performed at the Istituto Zooprofilattico Sperimentale delle Tre Venezie to investigate bacteria, viruses and parasites probably cause of death: an antibiogram was performed for intestinal bacteria found.

In 2012 a new protocol in hand rearing the roe deer submitted (15) has been set. The fawns survived but several of them died the next winter despite the care taken in feeding them in captive conditions. The animals, twelve roe deer, were weaned and kept in one hectare of forest with integration support of hay and dry food for domestic ruminants. A new pathological research was performed and despite poor literature present regarding captive management of the roe deer several specialist in other species of deer were asked for experience.

In 2013 the animals (24) were hand reared with goat milk supplemented with goat commercial colostrum, fresh grass, and hay have been made available until the first day. In addition twigs and branches of *Quercus pubescens*, *Robinia pseudoacacia*, *Alnus* sp., *Rubus ulmifolius*, were daily offered. They survived in the same forest of the animals studied the years before.

Lice (*Phthiraptera: Trichodectidae*) infestation on roe deer (*Capreolus capreolus*) from northern Italy

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The study was carried out on 70 roe deer (*Capreolus capreolus*) carcasses sent to our laboratory for diagnostic purposes between November 2012 and November 2013. The animals were mostly collected after car accident or found dead (n=33) in the province of Sondrio or died at a local rescue center (n=37). During routine necropsy facial and inguinal areas were examined for lice detection.

An "infestation score" was calculated (mild–medium–severe) according to the number of lice collected.

Some (1350) lice collected from the rostral part of the face area (nose and chin) were stored in 70% ethanol for species, sex and age characterization through dichotomical keys.

22 out of 70 (31%) roe deer were found visually infested by lice. *Damalinea (Cervicola) meyeri*, the typical louse of roe deer, is the only species of louse identified and, despite the severe dermatitis and massive infestation observed, we couldn't find any exotic and more pathogenic species as reported for cervids in North America.

The nymphs/adult females ratio of *Damalinea (Cervicola) meyeri* varied from 0.13 to 4.92. Only 3 male lice were collected, from 3 different roe deer, supporting the hypothesis of parthenogenesis, as already observed in other *Trichodectidae* species.

According to the data analysis, a seasonal pattern both of age ratio and lice prevalence can be described. In particular a statistically significant increase of nymphs/adult female ratio can be

described in spring and autumn (1.92 and 0.82 respectively) compared to summer and winter (0.38 and 0.31 respectively) (ANOVA $p < 0.05$) while an opposite prevalence trend can be seen in spring (25%) compared to autumn (60%), winter (50%) and summer (56%).

The severity of dermatitis was positively correlated (ANOVA $p < 0.01$) with the nymphs/adult females ratio.

Roe deer infested also by other arthropods (*Lipoptena* spp., *Cephenemyia* spp., *Ixodes* spp.) demonstrated a younger population of lice (ANOVA $p < 0.05$).

The positive correlation between infestation score and age and gender (massive infestation in females more than ten years old, Fisher's exact test $p < 0.05$) suggest a hidden biotic factor that drive parasite population to rise. Furthermore, peculiar pathological state are able to interfere with the normal time budget of ungulates (i.e. resting and self grooming) and also on their home range and their intraspecific interaction, giving lice more chance to grow. However we couldn't find any statistically significant correlation between pathological findings and infestation indices.

Based on these results we can assume that abiotic factors can influence the prevalence of lice in roe deer but more studies such as analysis on immune response or hematological parameters could help understanding the interaction between non blood sucking ectoparasites and host welfare status.

Wild boar annual trend in a small natural reserve in sub-Appenine area of central Italy

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The coexistence of wild boar (*Sus scrofa* L., 1758) and anthropic activities in protected areas is an important local cause of social and political conflicts. According to several authors, the relative abundance of wild boars, is related to different kinds of potential impacts. Among the most cited by experts and media in Italy are crops losses and roads safety.

The consequence is a general aversion against wild boars and the protected areas from both local communities and political decision makers. This led often to request removing some protected areas by conflict grounds generated from wild boar over-abundance. The negative perception of this species risk to play an indirect role also in other environmental issues, such as the management and conservation of large European predators where the wild boar may be a significant source of food for large carnivores. Moreover the health and environmental aspects of

the presence of the wild boar in high densities generally are not considered. These issues suggested us to study the dynamic of the presence of wild boars in a small protected area (3500 ha). We evaluated the monthly presence of species during a yearly study by naturalistic method in the Navegna Cervia Natural Reserve (Rieti, Latium).

The higher number of animals were contacted during the evening observations (< 0.01). The maximum number of young wild boars was observed in April ($juv/Ad=1.69$). The lowest frequency of wild boar contacts (f) was observed in the month of July ($f=1$); the higher frequency was observed in the month of October ($f=4.94$). The high number of the wild boar observations in October was not justified by young-adults ratio of the same period ($juv/Ad = 0.65$). Effects and consequences of the hunting disturbance are briefly discussed.

Un racconto dalla città: la presenza della martora a Perugia (Italia centrale)

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La martora (*Martes martes*) è carnivoro incluso nell'allegato V della Direttiva Habitat. Presenta una distribuzione rara e frammentata lungo la penisola ed è spesso confusa con la congenerica e più diffusa faina (*Martes foina*). I depositi fecali della martora sono identici a quelli della faina e sono sovrapponibili con quelli della puzzola (*Mustela putorius*) e della volpe (*Vulpes vulpes*). Anche il fototrappolamento è spesso inadeguato a distinguere le due *Martes*, infine il rilevamento diretto di questo animale è difficile sia per le sue abitudini notturne che, soprattutto, per la presenza in zone isolate e "selvagge". Ma è davvero così?

Per quanto riguarda l'Italia centrale, l'area di presenza storica della martora è rappresentata dall'alto Lazio (province di Rieti e Viterbo), dal sud della Toscana (province di Grosseto e Siena) e dal sud dell'Umbria (provincia di Terni) da cui la specie sembra essere in lenta ma costante espansione. Infatti il gruppo di ricerca dell'Università degli Studi di Perugia, che studia e monitora la specie dal 2000, ha osservato un trend positivo a partire dal 2006, anno in cui viene registrato il primo dato di presenza oggettivo nella provincia di Perugia. Oggi la martora non è più relegata solamente all'area ternana, ma in otto anni ha conquistato terreno e si è spostata verso nord fino ad arrivare alle porte della città di Perugia. Nel marzo del 2011 viene rinvenuto un esemplare *in carne*, una giovane martora di sesso maschile, lungo la strada che collega il paese di San Martino in Colle al capoluogo umbro, in un punto di transizione tra l'ambiente rurale e quello cittadino. A gennaio 2012 viene fotocatturata un'altra martora all'interno del SIC Monte Malbe. Dopo un anno e mezzo circa, sempre nello stesso SIC, viene rinvenuto un'ulteriore esemplare *in carne*, anche questa volta un giovane maschio.

Tale sito si estende per 945 ettari in posizione nord-occidentale rispetto al capoluogo umbro e rappresenta la zona naturale più prossima a Perugia. Gli insediamenti antropici si spingono

fino all'interno del SIC, creando uno scenario altamente mosaicizzato in cui le unità abitative private occupano una porzione significativa dello spazio.

La presenza della martora nel Sito Natura 2000 IT5210021 assume un aspetto ancora più interessante in quanto nella stessa area è presente l'alloctono scoiattolo grigio (*Sciurus carolinensis*), specie invasiva in grado di instaurare una forte interazione competitiva nei confronti dell'autoctono *Sciurus vulgaris*. Tale contemporanea presenza stimola la curiosità scientifica e nasce, così, ad agosto 2013 un progetto di ricerca annuale volto a stabilire se il nuovo sciuride sia considerato una preda dai mesocarnivori che vivono a Monte Malbe: martora, faina, volpe e *Felis silvestris* (gatto domestico e/o selvatico).

Dopo aver disegnato una rete di cinque transetti, a settembre è iniziata la fase di campo che prevede due sessioni al mese per la raccolta dei depositi fecali appartenenti ai 4 carnivori e la raccolta degli indici di presenza dei due sciuridi.

La martora rilevata su tutti i transetti percorsi, per un totale di 20 indici di presenza, risulta comunque concentrata nella porzione meridionale dell'area di studio ed in particolare su un unico transetto dal quale provengono 11 depositi fecali ad essa attribuiti. La congenerica faina è stata rilevata solo quattro volte in due transetti ed è localizzata nell'estremo sud-occidentale del SIC. Il dato relativo alla martora assume ancor più valore essendo il mesocarnivoro con il maggior numero di reperti attribuiti dopo la volpe, 5 infatti sono risultati appartenere a *Felis silvestris* e 131 sono quelli di volpe. Dai 63 depositi fecali esaminati per il comportamento alimentare non si è ancora rinvenuto lo scoiattolo grigio. La distribuzione di *Martes martes* appare, infine, non influenzata dalla presenza antropica e non strettamente legata alle aree più interne e meglio conservate del SIC.

Survey of Flaviviruses on long- and short-distance migratory birds in Trentino-Alto Adige (North-eastern Italy) with oral and cloacal swabs

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Background West Nile virus (WNV) and Usutu virus (USUV) (genus *Flavivirus*, Flaviviridae family), are emerging as important pathogens. They are maintained in nature by a cycle involving ornithophilic mosquitoes, principally *Culex* spp., and birds. Migratory birds are involved in the spread of *Flaviviruses* over long distances, particularly from Africa to Europe. There is still a knowledge gap on the role played by the different bird species in the ecology and transmission mechanisms of these viruses. Trentino-Alto Adige (North-eastern Italy) is located on the migratory route of many of the short- and long-distance migratory birds that cross the Alps. Until now, only a silent circulation of WNV and USUV within this territory has been confirmed by serological screenings. Continuous spillover events of both viruses, however, have been reported in the neighbouring regions. The aim of this study was to detect if active virus shedding occurs in migratory birds captured during their seasonal movements.

Methods Oral and fecal swabs' collection was carried out in Trentino-Alto Adige region during the 2011 and 2012 autumnal ringing campaigns and during the 2012 spring ringing campaign. Samples belonging to 18 transaharian and 21 intrap-

aleartic species were tested during spring (n=176) and autumn (n=146) using a generic nested-PCR for Flaviviruses.

Results All samples tested negative. Discussion Flaviviruses transmission dynamics is based on a complex relationship between virus, host, vector species, environmental and climatic factors. In previous studies, the oro-faecal shedding has been found only in some of the bird species. Our results further corroborate the results of a previous study carried out in Italy, which found there was no evident oro-faecal shedding of USUV and WNV in the families Fringillidae, Lanidae, Paridae, Muscicapidae, Silvidae, Turdidae, Hirundinidae and Picidae. Our results also seem to suggest that families Motacillidae, Prunellidae, Emberizidae, Cuculidae, Egialidae, Strigidae may not be important shedders. The lack of detection of active virus shedding does not exclude the circulation of these viruses within this region. Their circulation is anyway apparently very limited. Many factors can be involved: the length of the shedding with regard to the length of the migratory movements, the low density of mosquitoes, the lack of suitable habitat for *Culex* spp., the mountainous orography of the territory and the high avian biodiversity.

Flaviviruses identified in mosquitoes collected in Veneto and Trentino-Alto Adige regions (north-east Italy)

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The genus *Flavivirus* (family Flaviviridae) comprises more than 70 viruses, divided according to their ecological and epidemiological characteristics, and disease associations in three groups: 1) those infecting a range of vertebrate hosts through mosquito or tick bites, called "arthropod-borne viruses", 2) those spread by an unknown vector, presumed to be limited to infect vertebrates only, and 3) apparently limited to insects alone, called "insect-specific flaviviruses" ("ISFs"). In the first group are present some important or emerging human pathogens, as West Nile virus (WNV) and Usutu virus (USUV). ISFs replicate only in mosquito-derived cells and the first of them to be discovered was Cell Fusing Agent virus, isolated in 1975 from a *Aedes aegypti* cell line. During the last decades, many others have been isolated and identified, in different geographic regions, from field collected mosquitoes belonging to different species. Other ISFs have been only detected through molecular methods but not isolated. Despite their non-pathogenicity to humans and animals, ISFs have recently gained attention with respect to their ecological and evolutionary relationships with other important flaviviruses. A particular focus of interest is the possible interaction of these viruses within the same vector that can lead to different results as "superinfection exclusion" or enhanced transmission or replication. In Trentino the only evidence of WNV and USUV have been seroconversion in sentinel chickens in 2005, but ISFs have been detected since 2007. A completely different ecoepidemiological situation is present in Veneto since WNV and USUV have been detected in several studies during the last decades, but there is only one report regarding the detection of ISFs in this region.

To gain a better understanding regarding the presence of flaviviruses in these two regions characterized by strong differences in environmental, meteorological and ecoepidemiological conditions, we carried out a mosquito screening to detect flaviviruses. Mosquitoes were collected from May to October 2012, using 20 and 10 traps BG-Sentinel (Veneto and Trentino, respectively), located half in a rural and half in an urban environment, with BG-lure attractant and dry ice, checked weekly. Mosquitoes

captured were killed at -80° C, identified to species level and pooled according to date, location, species and gender and stored at -80° C until molecular analysis. After RNA extraction, we used a generic RT-nested-PCR targeted on a region of the NS5 gene for the screening of flaviviruses. The phylogenetic analysis were realized on a fragment of 1000 bp. For samples positive at the generic NS5 RT-nested-PCR, virus isolation was attempted in C6/36 cell lines (from *Aedes albopictus* mosquito). Fresh supernatants and cells from cell cultures with evident cytopathic effect, were used for electron microscopy studies.

In Veneto we collected a total of 52096 female and 1190 male mosquitoes, belonging to *Oc. geniculatus*, *Oc. caspius*, *Cx. pipiens*, *Cx. territans*, *Cx. modestus*, *Cs. annulata*, *An. plumbeus*, *An. maculipennis*, *Ae. cinereus/geminus*, *Ae. albopictus*, *Ae. vexans* and *Ae. koreicus* species. We detected USUV in *Cx. pipiens*, and AeFV in *Cx. pipiens* and in *Ae. albopictus*. In another pool of *Cx. pipiens* we also found sequences of an ISF never reported before in literature that could be considered as a new insect-specific flavivirus. We successfully isolated in cell culture AeFV from one pool of *Ae. albopictus*, with evident cytopathic effect (CPE) (cell aggregation). Transmission electron microscopy performed on C6/36 cells infected by AeFV confirmed the presence of flaviviruses.

In Trentino we collected a total of 1622 female and 464 male mosquitoes, belonging to *Oc. geniculatus*, *Cx. pipiens*, *Cx. hortensis*, *An. plumbeus*, *An. maculipennis* and *Ae. albopictus*. We detected only AeFV in pools of *Ae. albopictus*, that was also successfully isolated in cell culture. In 1 pool we obtained evident CPE and by electronic microscopy we detected viral particles with the typical morphological characteristics of *Rhabdovirus*. Our results confirm the different eco-epidemiological situation present in North-east Italy underlined by previous studies. They strongly support the importance of the influence of the climatic conditions on the transmission viral cycle. Moreover they suggest that a high prevalence of ISFs could dampen replication and transmission of other more pathogenic viruses.

Monitoring brown bears' activity at rub trees in Trentino using camera trapping: preliminary results

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P036

With the reintroduction of brown bears (*Ursus arctos*) in Trentino and the progressive increase of the population over the last 12 years, the development of systematic monitoring of this unique bear population by the Provincia Autonoma di Trento (PAT) is critical. An efficient programme used since 2002 is the collection of hair samples left by animals (done both opportunistically and systematically at hair traps and rub trees) for subsequent genetic identification. This has led to over 130 rub trees to be identified in the core area of bears' activity and monitored systematically every year. Rub trees are known to be used by bears for marking and communication, however very little is still known on their use and function. Hence, a programme of monitoring bear activity at rub trees using camera trapping has started in 2012 by PAT supported by Museo delle Scienze di Trento (MUSE) and Parco Naturale Adamello Brenta (PNAB) following preliminary trials (2010, 2011), which indicated the high potential of camera traps to provide complementary information on bears' activity and behaviour at rub trees, along with information on occurrence of a range of other species. Here, we report on the preliminary results of this camera trapping programme as implemented in 2012 and 2013. Twenty actively used rub trees and distributed across the core activity area were monitored each year with the aim of covering the entire activity phase, from April to November. Digital camera traps, set on video mode, were set on trees facing the rub trees and checked every three weeks by the staff of the PAT and PNAB for maintenance and data download. Overall, a sampling effort

of 3022 and 3631 camera trap days was cumulated in 2012 and 2013, respectively, generating nearly 10000 videos, which were related to 323 "bear individual events", i.e. concatenated video sequences of events of bears passing in front of the camera and separated by at least 1 hour. Preliminary analysis has shown that bear activity at rub trees, as expressed by naïve occupancy, peaks in May-July, decreases in the summer and increases again in the early fall before the lethargic pause. Daily activity as based on the time of capture events is mainly crepuscular and nocturnal, with peaks in the crepuscular hours and lowest values between 10:00 and 18:00. Rub trees are actively used by adult males by rubbing against the tree (82% of all events of rubbing) or by only checking the tree (27% of all events of animals checking). Adult females occasionally use the rub trees and so applies to young individuals and cubs. Especially for adult males, the use of rub trees peaks in May-July and decreases in the following months, corroborating the hypothesis that this behaviour is associated to reproduction. The monitoring also provided interesting data on the timing of the breeding season and of the rearing of cubs. Data were also obtained for 14 other species of mammals; in <10% of capture events, ungulates and smaller carnivores check the rub trees, with small carnivores occasionally marking them with urine. These results show that camera trapping can provide a range of important information on bear activity in general, and in particular it can reveal novel information on the use of rub trees by age and sex classes of the population.

Global trend of extinction risk in Carnivores and Ungulates

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In order to develop more successful and efficient conservation strategies it is important to assess species' response to past changes in extinction risk drivers and conservation actions. However long-term assessments of species conservation status, that allow to associate extinction risk trends to observed trends in its drivers, are currently missing. This study aims at evaluating changes in extinction risk for carnivores and ungulates in the past 40 years. The choice of these two study groups depended on their ecological roles (such as top-down ecosystem regulation by apex consumers) and their high current extinction risk (relative to other mammalian groups). We collected extinction risk information for 498 species (91% of all extant species in the study groups) and classified it using criteria and categor-

ies of currently adopted by the IUCN Red List. The results obtained have provided a broad picture on the temporal trend of endangered species of the mammals considered. Our results show a decline in the conservation status for both carnivores and ungulates, in particular, the decline of the latter appears to be more pronounced. We observed a relationship between the trend of extinction risk, species' body mass and their biogeography. The present work set a basis to understand factors influencing changes in species conservation status over time. This in turn can inform the designation of more effective conservation strategies, directly targeted at reducing the risk of conservation status deterioration.

Spatially structured populations of small mammals in fragmented landscape of central Italy

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P024

Habitat loss and fragmentation are among the main causes of worldwide biodiversity loss. As a consequence of these processes portions of suitable habitat for a species are surrounded by a usually unsuitable matrix. The resulting spatial heterogeneity leads to formation of spatially structured populations, composed of interacting subpopulations located in different patches. The kind of dynamic among these subpopulations is determined by biological (e.g. dispersal ability and vital rates) and landscape (e.g. matrix permeability, isolation and patch size) features.

Earlier research has highlighted theoretical and empirical support to the existence of different kinds of spatially structured populations (e.g. metapopulation, source-sink, patchy population) which differ according to the level of connection between subpopulations and extinction probability of a given subpopulation. In particular, much emphasis has been given to the concept of classical metapopulations (*sensu* Levins, 1969) to describe the dynamics of animals populations in fragmented landscapes, although to date there is poor support for the actual existence of this kind of dynamic among mammals.

Our aim was to test Levins' assumptions for classical metapopulations in a system of populations of small mammals (*Mus-*

cardinus avellanarius, *Myodes glareolus*, *Apodemus flavicollis*, *Apodemus sylvaticus*) in a fragmented landscape of central Italy. Furthermore, when the assumptions were not verified, we hypothesized the most likely kind of dynamic for these species in the study area.

The suite of selected species are phylogenetically related but differ in their degree of habitat specialization and dispersal capabilities, ranging from the strictly forest dependent and dispersal limited *Muscardinus avellanarius* to the habitat generalist and long distance disperser *Apodemus sylvaticus*. We used extensive demographic data available from a 3 year study in a fragmented landscape in central Italy encompassing more than 36000 trap nights and 6300 captures.

For each species we analyzed colonization/extinction dynamics, synchrony in populations dynamics, and population structure.

Our results clearly show that, in the study area, none of the species followed a classical metapopulation structure. For *Muscardinus avellanarius* and *Myodes glareolus* we hypothesized source-sink dynamics, whereas *Apodemus* species are more likely to follow a patchy population dynamics.

Non-invasive genetics insight into an eurasian otter (*Lutra lutra*) population in central Italy

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The Eurasian otter (*Lutra lutra*) is still one of the most endangered carnivores in Italy. Only during the last decades the species is recovering after going extinct from the north and the centre of the Italian peninsula during '80s. Elusiveness, nocturnal habits and low population densities make the specie difficult to directly observe and study. Nevertheless, the characteristic marking behaviour used for intra-specific communication permits to apply non-invasive genetics and explore in depth some aspects of wild otter populations. The study area concerns the Sangro basin, in Abruzzo and Molise regions, only recently re-colonized by the species and representing the northernmost metapopulation, except for the recently reported few records from Friuli and Bolzano province. During 2010 we performed a pilot study to find frequent otter marking sites on 600 m linear

transects along the Sangro river. During 2011 we collected 191 non-invasive samples along the river and its main tributaries. We performed genetic analyses using a panel of 13 microsatellite loci and we obtained a total genotyping success of 35.1% with a mean amplification success rate of 79.0%. The critical values of theoretical probability of identity among unrelated individuals and siblings were respectively $PID=0.001$ (6 loci) and $PID_{sibs}=0.002$ (13 loci). Microsatellite allowed to recognise 11 individual otters (5 males and 6 females) and to estimate a population density of 0.17 individual/km in the study area. During the 2012 field season we recaptured two known individuals and we also sampled three new genotypes. Parentage analysis and capture recapture data allowed to hypothesize some aspects of the species socio-biology in the study area.

Application of an habitat suitability model as a tool for the study of batsA.G. LOCATELLI¹, R. TOFFOLI²¹ University of Turin, e-mail andreag.locatelli@gmail.com² CHIROSPHERA Association for the study and protection of bats and their environment, e-mail rtoffoli@iol.it

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The proper drawing up of environmental management plans is fundamental in order to ensure an adequate conservation of species within a protected area. In this context it is necessary to find the most relevant information both in distribution and ecological needs for protected species by developing methods aimed at maximizing the accuracy of the obtained data while minimizing time and cost of application. These issues take on an even more crucial value when investigating the conservational status and distribution of species with sampling difficulties. This project was developed by studying the presence and distribution of bats in the Site of Community Interest IT1160056 “*Alpi Marittime*”. Bats are an extremely important systematic order from a conservational point of view and are strongly protected by various laws and conventions both on national and international level. Sampling methods currently available for the study of bats suffer from a limited operational efficiency because of their susceptibility to the elusive and extremely vagile nature of these animals, in addition to the difficulties arising from night sampling operations. For this purpose we tested the application of the ENFA (Ecological Niche Factor Analysis) habitat suitability model which allows to generate maps related to the potential distribution of a species within an investigated area by correlating data acquired from sampling activity with the ecological niche in which they were obtained. Preliminary stage of this work was the implementation of previously available data by collecting new records (by mist-netting, bat-detector monitoring) within the study area resulting in a dataset composed of more than 1000 georeferenced information from 21 bat species. The habitat suitability model ENFA was developed with presence data, through the use of BIOMAPPER 4.0 software. In detail, it was possible to apply this model for 13 out of the 21 species present inside SIC boundaries for which it was available a significant number of data about their distribution. In detail, analysis were carried out successfully for the following species: *Rhinolophus ferrumequinum*, *Rhinolophus hipposideros*, *Barbastella barbastellus*, *Eptesicus serotinus*, *Hypsugo savii*, *Myotis daubentonii*, *Myotis mystacinus*, *Myotis nattereri*, *Nyctalus leisleri*, *Pipistrellus kuhlii*, *Pipistrellus pipistrellus*,

Plecotus auritus and *Tadarida teniotis*. The software allowed us to generate maps of habitat suitability through preliminarily establishing correlation matrices between single environmental variables and presence data and providing a detailed indication of the existing relationship between available habitats and the ecological requirements for a species. The environmental variables considered were: altitude, exposure, slope and the habitat categories at level III of the CORINE Charter of Use of the Soil (CUS). In detail, we considered the percentage of the following environmental categories inside a 10000 m² square (100 × 100 m): urban areas, agricultural arable lands, open areas with sparse or absent vegetation, water bodies, mining areas, orchards, meadows, deciduous forests, coniferous forests, mixed forests, natural pasture areas and high altitude grasslands, heath and scrub and lastly beaches, gravels. The variables and environmental categories were selected on the basis of their representativeness in the study area. Obtained maps were consistent with the environmental characteristics of the area and corresponding with the currently knowledge on bat species ecology. Validation of the model was made using the Jack-Knife cross validation run by the software. Based on the quality of the results the model habitat suitability ENFA proved to be an extremely versatile tool capable of providing truthful information compatible with the notions that we have today about the ecological needs of bats. The habitat suitability maps generated by the program proved to be immediate and easily interpretable showing a high potential for application in both management plans of the territory and a diagnostic tool in the hands of specialists. In general the ENFA model is useful for investigating potential distribution and ecological needs of species under condition similar to those found in the present project or in the study of vagile and elusive animals in a broad and varied area. The application of this method of investigation is therefore a tool of great utility in the study of bats, in particular for management plans inside protected areas, being able to provide information on the distribution and ecology of the different species with a standardized, faster and cheap methodology.

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Il gatto selvatico (*Felis silvestris silvestris*) nell'Appennino centro-settentrionale: il caso di studio delle Riserve Naturali Casentinesi

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P030

La ricerca condotta nelle Riserve naturali biogenetiche casentinesi sul gatto selvatico europeo (*Felis silvestris silvestris* Schreber, 1777) a partire dal 2009, ha permesso di definire distribuzione e consistenza minima del felide in questo territorio, importante dal punto di vista zoogeografico in quanto prima “testa di ponte” accertata nel processo di espansione di areale della specie verso nord. L’indagine condotta ha altresì accertato il consolidamento di tale popolazione arrivando a rilevare un avvenuto evento riproduttivo, occorso nell’area della R.N.I. di Sasso Fratino, sulla base di video trappolamento di giovani gatti selvatici, da soli ed al seguito della madre. L’attività di raccolta dati sul campo è stata svolta su un arco temporale pari a 4 anni e 4 mesi, dall’attivazione della prima stazione di trappolamento in data 11 luglio 2009, alla rimozione dell’ultimo sito di cattura avvenuta il 16 novembre 2013. L’area di studio complessiva è risultata estendersi su un territorio pari a 6567 ettari. Dal 2009 al 2013, le sessioni di foto-video trappolamento si sono svolte attraverso 11 step temporali esercitati su altrettante aree campione, alcune delle quali sottoposte a più di una fase di rilevamento; su tali aree sono stati individuati 43 Siti di rilevamento sui quali sono state

distribuite 56 Stazioni di trappolamento usando complessivamente 18 diversi dispositivi di foto-video cattura. Relativamente alla specie-obiettivo *Felis silvestris* sono stati ottenuti 57 eventi a fronte di un totale di oltre 5200 catture. Entrando maggiormente nel dettaglio sono stati raccolti 58 reperti oggettivi relativi a *Felis silvestris*: 57 foto-video catture ed un’osservazione diretta. I dati raccolti con le operazioni di foto/video trappolamento hanno definito una consistenza minima stimata della specie nel corso del periodo di studio 2009-2013: sono stati identificati 15 individui diversi (8 maschi e 7 femmine), di cui 13 (12 gatti selvatici e 1 gatto domestico) nell’area compresa tra la Riserva naturale integrale di Sasso Fratino e la Riserva biogenetica di Camaldoli (3592 ettari). L’indagine condotta dall’UTB di Pratovecchio rappresenta la prima ricerca strutturata sulla specie nell’Appennino settentrionale e sarà integrata, nell’immediato futuro, con rilievi di campionamento genetico non invasivo tesi a definire la qualità della popolazione presente, il grado di ibridazione con il gatto domestico (*F. s. catus*) ed elaborare protocolli di gestione da applicare sull’area ampia di espansione di *F. s. silvestris*.

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Habitat selection by eurasian pine marten: a long term radiotelemetry study in central Italy

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P019

Although the Eurasian pine marten *Martes martes* seems widespread in most regions of Italy, little is known about its habitat use in our country. The species is considered a habitat specialist, associated primarily with mature mesic mixed forest habitats, avoiding areas without overhead cover. Using radiotelemetry locations, we examined the habitat selection of fourteen pine martens (7 males and 7 females) monitored for 1-12 months each (more than 2300 locations) in the managed Forest *La Selva*, in central Italy. Compositional analysis was used to determine whether habitat types were used more or less than what would

be expected by their availability, and ranked accordingly. Both males and females used more open field at both Johnson’s (1980) second and third order selection of habitat. Even though pine martens exhibit preference of certain types of habitats, our results show that martens prefer to stay close to forest cover but the activity is not restricted to the oak woods and they use open field and anthropic areas not far from the trees. Our results agree with those found in NW of Italy and France and were obtained in the first long term study of pine marten in Italy using radiotelemetry technics.

Monitoraggio e aggiornamento della presenza della lontra eurasiatica *Lutra lutra* in PugliaM. MARRESE^{1,2}, M. CALDARELLA¹, M. GIOIOSA¹, F. SILVESTRI², L. MARTINO², G. COSTANTINO³, N. UNGARO³, R. PETRUZZELLI²¹ Centro Studi Naturalistici ONLUS, via Vittime Civili 64, 71121 Foggia, e-mail marrese@centrostudinataura.it² ARPA Puglia, DAP Foggia, via Rosati G. 139, 71121 Foggia

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La ricerca ha considerato tutti i siti idonei alla Lontra eurasiatica (*Lutra lutra*) presenti in Puglia, gli interi bacini idrografici inter-regionali dei corsi d'acqua che attraversano la regione (Ofanto, Fortore, Cervaro, Celone e Carapelle) compresi i torrenti minori localizzati prevalentemente a sud e le maggiori zone umide pugliesi (lagune, paludi, invasi artificiali). I corsi d'acqua principali, il Fiume Ofanto, il F. Fortore, il Torrente Cervaro, il T. Candelaro, il T. Carapelle e il T. Celone hanno origine o entrano nel territorio regionale per lo più nella zona nord-occidentale ai confini con il Molise, la Basilicata e la Campania, laddove l'orografia risulta essere più accentuata (Monti Dauni, Appennino centrale) e si sviluppano prevalentemente nel Tavoliere, sfociando poi nel mare Adriatico. Importanti sono le lagune pugliesi di Lesina e Varano (provincia di Foggia). Accanto a queste lagune naturali sono da menzionare i Laghi Alimini (provincia di Lecce) e quelli artificiali, rappresentati dagli invasi di Occhito sul fiume Fortore (provincia di Foggia), di Capaccio sul T. Celone, la diga di Capaciotti sul F. Ofanto e quella del Locone sull'omonimo torrente. Per quanto concerne le zone umide, le più importanti sono quelle costiere come il complesso delle paludi sipontine (Foggia), le Saline di Margherita di Savoia (Foggia), Torre Guaceto (provincia di Brindisi), e Le Cesine (Lecce). Le zone umide minori non sono state considerate perché non idonee.

L'indagine si è svolta dal 2008 al 2014 in continuità gli studi precedenti (Cripezzi et al. 2001, Marrese et al. 2005, Gioiosa et al. 2008). La prima fase si è articolata, per un approccio conoscitivo delle aree con in ispezioni sul campo, interviste alla popolazione locale, ricerche bibliografiche. La seconda fase ha riguardato rilevamenti in campo effettuati in base alle linee

guida sul metodo standard del IUCN/SSC OSG. La scelta dei siti è stata basata essenzialmente sulla posizione topografica, sulla accessibilità e sulla verifica dei siti "storici" di marcamento e sulle esigenze di copertura complessiva delle aree. Ogni sito di monitoraggio è stato studiato misurando le pressioni, l'uso del suolo nelle aree circostanti ed applicando gli elementi di qualità biologica ai sensi delle normative nazionali ed europee (fonte ARPA Puglia). I dati sono stati inseriti in apposito geodatabase, schede e software GIS open source (LibreOffice e Quantum GIS).

Rispetto al *survey* del 2005 (Marrese et al. 2005) e alle attività svolte fino al 2008 (Gioiosa et al. 2008) si conferma la presenza della Lontra nel bacino del Fiume Ofanto (fino alla foce) e nel F. Fortore. Inoltre si segnalano i nuovi ritrovamenti, dal 2007 in poi, nel T. Carapelle. Interessanti sono stati i ritrovamenti di impronte nel T. Gravina in provincia di Bari (Cillo N. *in verbis*, 2012) e di segni di presenza in alcuni torrenti minori della provincia di Taranto (Lato, Lenne e Tara) confermati anche dai ritrovamenti recenti di esemplari investiti (2011) probabilmente appartenenti alla popolazione lucana in espansione.

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Potential breeding and birth distribution of wild boar (*Sus scrofa*) in Varese provinceA. MOLINARI¹, A. GAGLIARDI¹, E. CARLINI¹, B. CHIARENZI¹, D.G. PREATONI², A. MARTINOLI²¹ Istituto Oikos srl, via Crescenzago 1, 20134 Milano, Italy² Unità di Analisi e Gestione delle Risorse Naturali – Guido Tosi Research Group, Dipartimento di Scienze Teoriche e Applicate, Università degli Studi dell'Insubria, Via J. H. Dunant 3, I-21100 Varese, Italy

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Wild boar (*Sus scrofa*), introduced in Varese province in the late 70s, is a species characterized by a high reproductive rate, dependent on climate and environmental conditions and on genetic contamination with domestic pig.

Breeding parameters of wild boar population have been investigated in game seasons from 2007/2008 to 2012/2013 in the northern part of Varese province (CAC Nord Verbano), and from 2009/2010 to 2012/2013 in a hilly area at lower elevation (ATC 1).

In each hunting period, all shot animals were aged (6 age-classes based on teeth eruption), sexed and in case of females we determined whether the animals were pregnant. From pregnant females, the uterus was removed and embryos were counted and sexed. To investigate productivity of wild boar, ratio of pregnant

females on total number of females, average number of embryos per female and age of pregnant females were calculated for all years and all areas.

Data concerning season T have been correlated with number of culled wild boars in season $T + 1$ and $T + 2$, to test productivity effects on availability of game animals in successive hunting seasons. We also compared data on the population structure from game season 1994/1995 with our recent data for the northern part of the province to investigate differences respectively 15 and 30 years after first introductions. Correlation between population size and food availability (especially related to chestnut production) as well as damages caused by wild boars to agricultural lands will be presented.

Wolf population estimate in Italy and monitoring perspectivesL. MATTIOLI¹, P. FORCONI², D. BERZI³, F. PERCO⁴¹ Provincia di Arezzo² Studio Faunistico Chiros³ *Canis lupus* Italia⁴ Parco Nazionale Monti Sibillini

In Italy several estimates of the wolf population (*Canis lupus*) were produced from 1970s to 1990s. According to these contributions, the wolf population increased from 100–110 to 400–500 individuals (extrapolated densities), and the total range increased from 8500 to 25000 km². At the beginning of the '70s a density of 1.70 wolf/100 km² was calculated in a sample protected area, and in 1998 the mean density adopted was 2 wolf/100 km². In the last 15 years, only guessed estimates (expert opinions) were produced, varying from 600 to 1000 individuals. The National Action Plan for wolf conservation in Italy highlighted the priority of a national monitoring program, but until now it was not achieved. Nevertheless, in the last decade genetic studies and photo/video trapping technique made a significant contribution in improving estimates, and many protected areas as well as regional and provincial administrations carried out wolf monitoring programs at a local scale. The aims of this study are: 1) to produce an up-to-date estimate of the minimum number of wolves present in the best studied areas of Italy, 2) to draw the permanent wolf range and, accordingly to this informations, 3) to infer an estimate of the total population size species in Italy.

We reviewed data about number, localization and size of wolf packs, in 20 study areas, available from articles, reports or conference proceedings of the last ten years. For each study site, to calculate a comparable pack density, we drew the most likely area occupied by packs, on the basis of available data (summer home-sites, snow tracks, actual home range from telemetry and non invasive genetic). We followed a conservative approach, taking into account the mean inter pack distance and the amount of usable space by packs.

181 wolf packs corresponding to at least 773 individuals (winter estimate, excluding extra pack individuals) were confirmed to be present, although non simultaneously, in the 20 study areas (32620 km²). The mean pack density was 0.36 pack and 1.89 wolves/100 km² in the Alpine region of Piemonte-Liguria and 0.63 (0.54-0.72 95% CI; n=17 areas) pack and 2.69 wolves/100 km² in the rest of Italy. Pack density was higher in large protected areas (0.70 packs and 2.99 wolves/100 km², n=9) respect to other areas (0.53 packs and 2.35 wolves/100 km², n=8). Winter mean pack size was 3.9 in the Alps (n=16 packs) and 4.24 in the Apennines (n=54 packs).

To draw the permanent wolf range, we reviewed published material. Furthermore, 16 contributors provided data on wolf

presence across Italy (Molinari Luigi, Canestrini Mia, Varuzza Paolo, Ricci Luigi, Marini Giorgio, D'Alessio Silvio, Cerquitelli Riccardo, Carpino Filomena, Ianiro Alfonso, Sorino Rocco, Frassanito Anna Grazia, Gaudiano Lorenzo, Priore Giuseppe, Gervasio Giacomo, Crispino Francesca and Urso Salvatore).

The permanent range of the species (i.e. pack presence over several years) has reached about 74000 km², 6000 of which in the Alps (Piemonte-Liguria-Val d'Aosta).

To estimate the total population, two approaches were used: first we added to 773 wolves assessed in the 20 study areas, those estimated in the remaining area of 42000 km² adopting a conservative density of 2.0 wolves/100 km². In the second one, different mean densities for the Alps (1.4 wolves/100 km²) and for Apennines (2.99 wolf/100 km² in protected areas, 2.35 wolves/100 km² in non protected) were applied. Protected areas are intended as national and regional parks with a 5 km buffer. All values are winter minimum density. The estimated population for whole Italy is comprised between 1600 and 1900 wolves. Wolf numbers fluctuate every year at a local level due to natural and human factors. In some regions, conflicts with livestock farmers is growing, accompanied by acts of poaching, which generate some changes in population size between and across years. Nevertheless the wolf population seem still expanding and new areas have been recently occupied (not considered in this estimate), such as Lessinia, Dolomiti Bellunesi, Natisone Valley, Conero, Mt. Aurunci. Finally, hybridization with dogs appear to be growing, probably also due to improving in genetic techniques, and the present estimate is accordingly referred to the admixed population of wolves and hybrids.

Better estimate can be obtained in the future by planning a national monitoring strategy, increasing the number of sample areas, and including new settlements. Monitoring techniques can be grouped in 2 levels: a preliminary one with snow tracking and wolf howling with spectrographic analysis of recorded howls, and an advanced one with non-invasive genetic studies and videotraps. Non-invasive genetic can be very useful to distinguish different packs and to identify hybrids, while videotraps are useful in estimating group size, producing better estimates than other techniques. We emphasize the need of a wide network and an open national data bank to improve the knowledge of the species and to provide an essential support for planning a conservation strategy.

Integrative taxonomy at work: genetic and biometrical characterization of alien *Callosciurus* species

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The introduction of alien species is a growing problem in conservation biology and it is considered as one of the primary causes of biodiversity loss. The consequent invasions have caused the alteration of biotic communities on a global scale, changing the role of the native species in the ecosystems, upsetting the evolutionary processes and causing radical changes in the relative abundances among species, including extinction. These changes represent a threat to global biodiversity and to human exploitation of biological resources, that is second in impact only to the direct destruction of habitats. The effects of the introduction and subsequent range expansion of invasive alien species can become a threat for the long-term survival of native species and occur through the ecological processes of competition, predation, parasitism and hybridization. Rodents, and in particular tree squirrels, commonly traded as pet species, can often establish viable colonies starting from few founders. This phenomenon can lead to severe ecological and economic threats when these species become invasive.. The prevention of new introductions, and the adoption of early management actions are undoubtedly the most effective and economical ways to reduce the overall risks associated with the spread of invasive species. For these reasons, it is necessary to obtain permits and decrees to manage the invasive species in a short time (e.g. blocking importation and giving permits for the eradication and control of the species). Thus, it is essential that a new invasive taxon can be identified exactly to the species level.

In the last decades a new alien squirrel species of the genus *Callosciurus*, native of South-East Asia, has established a wild population in the province of Varese, Northern Italy, in co-occurrence with the native *Sciurus vulgaris* that may be affected by potential competitive interactions. Fifteen different species belong to the genus *Callosciurus*, some of which are extremely morphologically similar. Therefore, to verify the taxonomic status of the new Italian alien squirrel, a combined morphometric and genetic approach was used: concerning the morphometric approach, 147 skulls of the 10 *Callosciurus* species (i.e. *C. caniceps*, *C. erythraeus*, *C. finlaysonii*, *C. melanogaster*, *C. nigrovittatus*, *C. notatus*, *C. phayrei*, *C. prevosti*, *C. pygeryth-*

rus, *C. quinquestriatus*) conserved at the Natural History Museum of Genova "Andrea Doria" were compared with skulls of 14 invasive tree squirrels from Varese, 15 of *Callosciurus erythraeus* introduced in France and 25 from the population of *Callosciurus* cfr. *erythraeus* introduced in Belgium. The PCA performed on skull measurements (PC1 explained 78.6% of the variance) indicates that *Callosciurus* from Varese and from Belgium are overlapping and both of them overlap with *C. notatus*, *C. melanogaster* and *C. erythraeus* reference samples. However, *C. notatus* and *C. melanogaster* are very different in their body morphology (i.e. size, colour) from Belgian and Italian *Callosciurus* so the most reliable hypothesis is to classify our specimens as *C. erythraeus*. On the contrary, *Callosciurus* skulls from France seem to be different from the other European and museum specimens.

In order to support these results with another approach, we investigated some individuals from the naturalized populations of Italy, Belgium and France with molecular analyses. DNA sequences of the mitochondrial *coxI* and d-loop regions were produced to examine the relationships among European *Callosciurus* samples. For both markers, additional sequences of *Callosciurus* were retrieved from GenBank to be used as a comparison. *CoxI* data were analysed under a standard DNA barcoding approach to clarify the taxonomic status of introduced populations. D-loop haplotypes were used both to support the taxonomic assignation and in an attempt to trace the origin of these European populations through a phylogeographical network reconstruction. Both approaches mirrored the results of the morphological screening and confirmed the almost complete similarity between Belgian and Italian populations as well as the marked divergence of French samples. Interestingly, the phylogeographical analysis grouped this last group of samples together with some haplotypes of *C. erythraeus* from Taiwan, while the taxonomy of samples from Italy and Belgium remains still unclear. Additional data from the whole area of distribution of *C. cfr. erythraeus* are required to univocally assess the taxonomic status of these populations. The study has been partially financed by LIFE project NAT/IT/00095.

IX Congresso Italiano di Teriologia

Are female bats choosy during lactation? Prey selection by Geoffroy's bats during and after lactation

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The aim of this study is to improve the knowledge of Geoffroy's bat (*Myotis emarginatus*) trophic niche, especially during and after lactation. We collected guano weekly from the middle of June to the beginning of August 2007, under the roosting site of a *Myotis emarginatus* nursery. The colony is located in a building in Laveno Mombello, a city near lake Maggiore, in the North of Italy; it consists of about 30 females of Geoffroy's bat. During the first half of August, the nursery was abandoned because the young were weaned and able to hunt independently. We carried out a morphological identification of prey remains in order to have a qualitative and quantitative estimate of prey. Seven orders of Arthropoda were preyed; Araneae is the most frequently hunted (F, frequency of occurrence = 0.93), followed by Lepidoptera (F=0.25) and Diptera (F=0.12); the other orders were present with a frequency less than 12% of the total. Frequencies of food items varied in function of the week in which the guano was collected. Aranea had a very high frequency for the first four weeks, from June 11 to July 31, corresponding to the end of pregnancy and the whole lactation period, and then

decreased drastically in the last week, when the young were weaned. Conversely, Lepidoptera had a very low frequency throughout the period of investigation, except the last week, from August 1 to 8. In the fifth week the frequency of Araneae and Lepidoptera differed significantly from the previous weeks; frequency of Araneae decreased from 82-94% to 9% and, vice-versa, Lepidoptera increased from 1-3% to 71%. The frequency of other Insects preyed did not have large variations, remaining under 12% for entire period. Hence, in the last week, which corresponds to the end of lactation period, the diet of females Geoffroy's bats changed and, through surveys of radio-tracking, we also recorded also a change in the foraging areas. We believe that the observed variation in prey selection may be due to a change in the nutritive and energetic demand of females, especially during late pregnancy and lactation. The production of milk involves a high nutritional and energetic demand, and this results in females selecting foraging areas and prey types to optimize their energy budget.

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Raccoons to conquer Italy: may isolated observations help the invasion process?

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P021

The raccoon *Procyon lotor* (Linnaeus, 1758) is a species native to North and Central America, but alien populations have established in Europe and Japan, being introduced for fur farms, hunting, or as pets/attraction in animal parks. As for European countries, raccoons were first released in Germany and in Russia in the 1930s, then this carnivore spread also in the neighboring countries. In Poland, where first raccoons were released in 1945, it is considered a game species since 2004. Recently the species has been introduced in Spain in 2004. The only known reproductive population in Northern Italy (Adda river), observed since 2004, may be the result of new introduction events or probably derive by individuals in dispersal from Switzerland even if the latest option is unlikely.

So far, little is known about their impacts on native European fauna. However raccoons may heavily threaten autochthonous species as well as human economy (e.g. poultries). Moreover raccoons can be host to several pathogens transmissible to humans, domestic stocks and wildlife. In the native range, this opportunistic omnivorous carnivore may reach high density especially in the surroundings of human settlements, thus resulting in human-raccoon conflicts.

Growing evidence of possible range expansion in Italy has been anecdotally reported in the last year, especially in Northern Italy,

where the possible unique population is thought to occur. Here, we collected published and unpublished data (coordinates of occurrence points and dates) to reconstruct the current distribution range of raccoons in Italy. To complete as much as possible our screening, we have proceeded as it follows: (i) reading papers, articles in newspapers and book dealing with raccoon distribution; (ii) gathering information from experts and from a mailing list dealing with Italian vertebrates.

Since 2008, records from Northern Adda Valley in Lombardy have increased, and sporadic observations have been reported from Piedmont (1), Emilia Romagna (3) and Tuscany (3). Accidental observations of individuals possibly escaped from captivity are often ignored, and no attempt was made to capture and remove them from the wild. This is particularly true for species gaining emotional affiliation from the general public as raccoons: this limits management actions as control/eradication. Populations of feral raccoons may be funded also by a small number of funder individuals, as it happened in Spain. If sporadic releases of raccoons by pet owners or zoo parks (e.g. those in Emilia Romagna, Piedmont and Tuscany) occur and come in contact with reproductive populations, the genetic variability and adaptive potential may increase, determining great difficulties to control this invasive species.

Sviluppo dell'Osservatorio Nazionale ibridi lupo × cane

L. MOLINARI, M. CANESTRINI, F. MORETTI, W. REGGIONI

Servizio conservazione della natura e delle risorse agro-zootecniche, Parco nazionale dell'Appennino tosco-emiliano



P072

In seguito alle attività di monitoraggio svolte nell'ambito di alcuni progetti LIFE (LIFE96NAT/IT/003115 - Preservation and conservation of *Canis lupus* populations through biological surveys and non-poaching; LIFE00NAT/IT/7214 - Azioni di conservazione del lupo in 10 siti SIC di 3 Parchi Regionali dell'Emilia-Romagna; LIFE07/NAT/000502 - Improving the conditions for large carnivore conservation – a transfer of best practices – EXTRA) nel territorio del Parco nazionale dell'Appennino tosco-emiliano è stata accertata fin dall'anno 2002, tramite genetica molecolare non invasiva su campioni fecalianalizzati presso il laboratorio di Genetica molecolare dell'ISPRA di Ozzano Emilia (BO), la presenza di ibridi lupocane. Poiché l'ibridazione antropogenica costituisce una gravissima minaccia per l'integrità genomica e quindi conservazionistica della specie ed in considerazione del ruolo fondamentale che i parchi nazionali devono svolgere per individuare e sperimentare soluzioni funzionali di conservazione, rappresentando un modello per il resto del territorio, il Parco nazionale dell'Appennino tosco-emiliano ha messo a punto e proposto a MATTM e all'ISPRA misure gestionali finalizzate a contenere i rischi associati alla presenza di esemplari ibridi. Contestualmente è stato stilato il documento "Caratteristiche fenotipiche nel lupo in Italia (*Canis lupus italicus* Altobello, 1921), e variabilità potenzialmente riconducibile all'ibridazione con il cane (*Canis lupus familiaris*)", con l'obiettivo di descrivere – anche con esempi concreti – quale variabilità fenotipica potenzialmente riconducibile all'ibridazione con il cane attualmente sia riscontrabile più comunemente in natura a livello nazionale e a livello locale.

Allo stesso tempo sono stati avviati i lavori per la costruzione di un sito web in grado di raccogliere segnalazioni georeferenziate e documentate fotograficamente di esemplari di lupo con fenotipo anomalo, con l'intento di sviluppare una banca dati di portata nazionale liberamente accessibile e consultabile. In una prospettiva di ampio respiro istituzionale, il Parco Nazionale dell'Appennino tosco-emiliano recentemente ha istituito il Wolf Appennine Center, centro di riferimento per la gestione del lupo a scala interregionale, che grazie all'attuale rete di contatti e collaborazioni attualmente in essere ha già permesso di collezionare decine di osservazioni e dati inerenti il fenomeno dell'ibridazione.

Attualmente le analisi genetiche hanno un potere diagnostico ancora limitato ad alcune generazioni, e ancora poco conosciute sono le diverse espressioni fenotipiche che più di altre sembrano essere anomale nel Lupo (*Canis lupus*) e di possibile derivazione canina. A livello nazionale ogni gruppo di lavoro che si occupa di lupo possiede informazioni e osservazioni utili inerenti la presenza di ibridi o esemplari fenotipicamente anomali in natura, ma manca una regia centrale che congiunga queste osservazioni. L'osservatorio ibridi permetterà una descrizione metodica più minuziosa ed aggiornata del fenomeno. Questo strumento offrirà supporto ad un network di "esperti" di Lupo che, indipendentemente dalla validazione o meno su basi genetiche, potranno fornire il loro parere relativamente a quanto un determinato esemplare possa apparire fenotipicamente ibrido o sospetto tale e su quali basi. L'osservatorio ibridi, in attesa di eventuali approfondimenti genetici, permetterà di evidenziare aree critiche ("hot spot") per il fenomeno dell'ibridazione.

A wolf crosses Po Plain (Lombardy, north Italy) after two centuriesC. MORELLI¹, D.G. PREATONI¹, A. ORIANI², R. CASTIGLIONI³, A. MARTINOLI¹¹ Unità di Analisi e Gestione delle Risorse Naturali – Guido Tosi Research Group, Dipartimento di Scienze Teoriche e Applicate, Università degli Studi dell'Insubria, Via J. H. Dunant 3, I-21100 Varese, Italy² Società Italiana di Scienze Naturali - Centro Studi Storico Naturalistici³ Società Italiana di Scienze Naturali - Centro Studi Faunistica dei Vertebrati

P222

On the night between 12 and 13 November 2012, the wildlife task force's police officers of the Province of Varese were charged with the recovery of the dead body of a "wolf-like" animal, run over by car, on a road in Somma Lombardo, not far away from Milano Malpensa Airport. The physical traits of the animal led the officers and the wildlife advisors of the University of Insubria (Varese) to believe that it could be a wolf and therefore some tissue samples were collected for further analysis. The genetic analysis, conducted by ISPRA (Italian Institute for Environmental Protection and Research), confirmed that the specimen was indeed a wolf (*Canis lupus* Linnaeus, 1758) and belonged to the Italian population of the species. The wolf was a young male, approximately 2 years old, weighed

36 kg, and was identified with the code W1435M. Detailed subsequent analysis by Institute for Environmental Protection and Research (ISPRA), Large Carnivore Conservation and Management Centre and Wildlife Biology Program, Department of Ecosystem and Conservation Sciences, University of Montana (USA) revealed that the wolf's genotype had never been sampled before and that it is close to some populations of the Western Alps. This suggests that the animal could have reached the Po Plain from the North, following the Ticino river valley, which confirms its important role as North-South ecological corridor. It was the first wolf record in the province of Varese since 1892 and in the Po Plain area, near Somma Lombardo, since the beginning of XIX Century.

Theriofauna of SCI “Poggi di Prata” (Grosseto, Italy): a checklist created through a combination of different methods

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P022

To know which species live in a certain area is a prerequisite for the establishment of Natura 2000 sites, such as SCI and SPA. The SCI “Poggi di Prata” has been analyzed from both the ornithological and herpetological point of view, while the information about species richness of mammals is still scarce. With this work, we provide a list of the mammal species of this protected areas. We performed a three years survey with camera traps and direct observations through spotlight. Road kills were also collected and considered within the survey. Small mammals were surveyed also from pellets of long-eared owl *Asio otus*. Bats were searched through the help of bat detector, as well as excursions in a cave (“Buca del Gallo”) and other occasional observations (i.e. roosting sites in human settlements, domestic cats predations). Our results showed a total of 38 mammal species, with 33 native species belonging to seven orders: Erinaceomorpha (N=1), Soricomorpha (N=3), Rodentia (N=7), Lagomorpha (N=2), Chiroptera (N=10), Carnivora (N=8), Artiodactyla (N=2). Five exotic species (coyote *Myocastor coypus*, black rat *Rattus rattus*, brown rat *Rattus norvegicus* and domestic mouse *Mus musculus*) are also present: the Eastern cottontail rabbit *Sylvilagus floridanus* has been recorded for a

few months during the 1990s, but never established. Recent genetic and paleontological analysis consider also the crested porcupine *Hystrix cristata*, as allochthonus. One species, the lesser horseshoe bat *Rhinolophus hipposideros*, is classified as Endangered in Italy. Four taxa (Mediterranean horseshoe bat *Rhinolophus euryale*, greater horseshoe bat *Rhinolophus ferrumequinum*, wolf *Canis lupus* and Italic roe deer *Capreolus capreolus italicus*) are Vulnerable and two Near Threatened (serotine bat *Eptesicus serotinus* and brown long-eared bat *Plecotus auritus*). Bern Convention lists in its annexes 12 mammal species recorded within our study areas; 15 species are also protected by the Habitat Directive. The presence of two Italian endemic taxa, *Capreolus capreolus italicus* – genetically determined – and *Lepus corsicanus*, is also noteworthy. Although this survey is not exhaustive and further research (especially on Chiroptera) are needed, all the terrestrial native mammals recorded in the Province of Grosseto – with the exception of four small mammals (*Glis glis*, *Elyomys quercinus*, *Talpa caeca* and *Sorex samniticus*) – have been detected at least once within “Poggi di Prata”, thus confirming the naturalistic value of the area covered by this survey.

Moonlight avoidance in the crested porcupine

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P020

Predation avoidance is one of the main factors determining nocturnal activity of mammals, which has been shaped by evolution in relation to local environmental variables. The nocturnal activity of 16 females and 11 males of radio-tagged adult crested porcupines *Hystrix cristata* was studied in four study sites of Southern Tuscany (Central Italy), with different environmental features. The activity patterns of porcupines, monitored for 16-23 hours/week/individual, were correlated to lunar phases, in open/closed habitat types, throughout the year. The median duration of nocturnal activity was 7h 38', with no significant

seasonal variation. Moonlight avoidance was shown in all our study sites, throughout the year, especially in open habitats. Full moon, irrespectively from its visibility, always inhibited activity of this large rodent. Old World porcupines originated 5 million years ago in the forests of Asia and Africa, where a number of large Carnivores must have preyed – and still prey – on them. Most likely, moonlight avoidance evolved as an antipredatory behaviour. In areas with no or little predation risk e.g. our study sites, moonlight avoidance could have been kept in the repertoire of porcupines because of its non-maladaptive nature.

Understanding genetic patterns and historical connections between the Western Mediterranean peninsulas in the trawling bat *Myotis daubentonii*

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P071

Myotis daubentonii (Vespertilionidae, Kuhl, 1817) is a bat widespread in Europe and closely linked to aquatic habitats. It largely occurs in southern Europe, including Italy, Spain and Portugal. Preliminary molecular studies suggest that during the Last Glacial Maximum *M. daubentonii* populations were confined to the peninsulas of Southern Europe, an event which may have had large influence on their genetic structure. In this study we assess and examine genetic variation of *M. daubentonii* from the Italian and Iberian peninsulas. We non-invasively sampled 63 specimens of *M. daubentonii* and analyzed the hypervariable non-coding regions I and II (HVI and HVII), from the control region (D-loop) of the mtDNA. Sampling covered central and southern Italy, north of Portugal and most of the Spanish territory. DNA was extracted from biopsy samples (wing membrane tissue), amplified and sequenced in both directions using an automated sequencer (DNA ABI 3100, PE Biosystems, Warrington, UK). Sequences were trimmed to a length of 411 bp (HVI) and 318 bp (HVII) respectively to avoid the regions of repeats in both fragments as their genetic interpretation is doubtful. The alignments of the two final fragments were analyzed separately and finally joined to sum up their phylogenetic information. Maximum likelihood (ML), Maximum Parsimony (MP), Minimum Evolution (ME) and Bayesian (BPP) criteria were used to build up evolutionary hypotheses. Evolutionary relationships were also evaluated by MP-based networks using median-joining algorithm. Finally, genetic diversity was estimated for the main

lineages found.

The data show quite a remarkable differentiation with more than forty different haplotypes. All phylogenetic reconstructions point to the distinction of three main lineages very differentiated and highly structured:

1. a small lineage seems to be at the base (ancestral?) in most of the topologies and is made by samples from the northern half of Iberia, from Braganza (Portugal) to the Basque Country;
2. a second, large, lineage highly structured and covering the whole Iberian Peninsula and again subdivided in local lineages (one in Galicia, two in Andalusia, one in Catalonia, etc.);
3. a third Northern Iberian lineage from Galicia to the Pyrenees and Balearic Islands (Menorca) which is the only one that connects with the Italian samples, which show also internal structure.

Our markers – probably due to their high mutation rates – are very good at showing the different lineages but not very good at explaining the deep connections between them. Therefore, we are expanding the analysis to the much slower evolving cytochrome b gene. Nevertheless, they show clearly that *Myotis daubentonii* populations are highly structured in the Iberian and Italian Peninsulas with a possible pattern of “refugia within refugia” as a consequence of the climatic cycles from the Pleistocene.

IX Congresso Italiano di Teriologia

Reliability of roe deer (*Capreolus capreolus*) age determination by morphological analysis: comparison with molar wear rate and cementum layers

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P149

Age estimation is an important step in collecting and processing wildlife population data. These information are required in order to set up and implement a proper wildlife management and, especially in areas where hunting is practiced, to plan the hunting rate and to verify its accuracy.

There are several methodologies to measure the age of roe deer, each of which has different applicability and requires different time, tools, costs and technical skills.

The present study was carried out on 99 roe deer found dead in the Abruzzo, Molise and Marche regions and brought to the Institute Zooprofilattico "G. Caporale" of Teramo, from the 1st of January of 2012 to the 31st of August of 2013 for routine health monitoring activities.

In order to verify the accuracy of each age determination method, a comparison was made between three different methods: observation of the morphological characteristics of both sexes and of the males' antler, the evaluation of molar wear rates and the cementum layers analysis.

The age class or the age recorded on a specific wildlife sample form by operators involved in the collection of dead wild animals in the field, have been taken into consideration in the observation of the morphological characteristics.

Molar wear rates were estimated using photographic and illustrated plates, while the count of the cementum layers was per-

formed on 10 μ m sections of decalcified first incisor, observed under the microscope.

For each of the different methodologies both the age in years and the estimated age class for each individual were considered.

The age estimation recorded on the sample form, was confirmed only in 35.6% of animals and in 45.8% of cases if reference is made to the class age by tooth wear analysis performed on 59 roe deer.

The estimated age was confirmed only for 36% of roe deer and the in 64% of cases if reference is made to age class by cementum analysis, performed on 25 individuals.

Finally, by matching the results obtained with tooth wear rate and cementum analysis we established the correct age class of 95 roe deer.

For 60 animals, was made a comparison with information reported in the sample form of each individual and in our study we confirmed that the morphological evaluation of the age class was correct only in 45% of deer.

The results obtained seem to show how the age estimation of roe deer from morphology and antler isn't a reliable methodology for this species; instead, the tooth wear rate estimation has provided correct results in most cases, despite the exact evaluation of the age in the all individuals was not always feasible.

IX Congresso Italiano di Teriologia

Wildcat survey through camera trapping in the Abruzzo, Lazio and Molise National Park

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P052

The wildcat (*Felis silvestris silvestris*) is listed as Near Threatened in the Italian IUCN Red List. The main causes of species decline are deforestation, habitat fragmentation, illegal hunting, road mortality, and hybridization with the domestic cat. *Felis silvestris* lives in forest habitats, in particular broad-leaf woods where it finds protection and preys. Direct observations of the wildcat are rare because of its nocturnal habits and elusive nature. Trapping and radiotracking are invasive techniques that provide important data but also imply animal anesthetization and handling, which are not always suitable for rare and protected animals. As many other felids, the wildcat is characterized by distinct individual traits in their color pattern that potentially allow to recognize individuals using non-invasive techniques such as camera trapping. We investigated for the first time the population of wildcat inhabiting the Abruzzo, Lazio and Molise National Park through camera trapping. We selected 25 trapping sites by using a random sampling design. In order to guarantee the independence of data, we discarded sites nearer than two

km from each other, with the exception of seven cameras that were placed close each other in an attempt to distinguish among different individuals living in a restricted area. Each sampling station was monitored during seven consecutive weeks. At the end of this period the camera traps was moved to a new site and monitored for other seven weeks. We also tested the use of *Valeriana officinalis* as scent, but it was unsuccessful, maybe due to the frequent rain during the sampling season. Two camera traps were stolen during the study with a resulting loss of data. *Felis* spp. were recorded at eight over 25 sites (32%), in 14 recording events. Wildcats or potential hybrids were captured in 8 video/pictures while domestic phenotypes were recorded 6 times. Our results confirmed the presence of the wildcat in the study area. The presence of potential hybrids and domestic phenotypes in far away build-up areas, pose a serious concern on the future conservation of the wildcat population of the park, and strongly recommend the adoption of a strict regulation for the control of feral cats.

Comparison of camera-trapping method with pellet group counting method to estimate the fallow deer (*Dama dama*) and the roe deer (*Capreolus capreolus*) population densities in Monte Rufeno nature reserve

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P141

The assessment of the animal population density is an essential aim to ensure suitable wildlife management in a protected area, but often to reach this outcome, expensive and difficult techniques are required.

This work focused on density assessment of fallow deer and roe deer populations in Monte Rufeno Nature Reserve through two different methods: camera trapping activity which is cheaper and requires less sampling effort, and a naturalistic method as pellet count. The aim of this study is to verify if camera trapping can replace the traditional and more onerous techniques, therefore it could be possible for the protected area operators to gather the same result with less effort.

Sampling design was based on a grid of 2 km squares, extended to 36 km², most of Monte Rufeno Reserve territory. Every square included 5 circular sampling areas with a diameter of

20 m placed along a transect of 1 km. Pellets were collected in the five considered areas, and only in 3 of the 5 sampling areas videos were collected. Data was gathered throughout two seasons (autumn and winter) since September 2013 to January 2014, once a week. Calculating densities, following results were obtained: 0.43-7.12 fallow deer/km² with camera trapping and 0.62-1.91 fallow deer/km² with pellet count; 0.96-38.25 roe deer/km² with camera trapping and 0.83-18.83 roe deer/km² with pellet count. Statistical analysis of results suggested that the camera trapping can replace the pellet count to assess the fallow deer density, because of the low number and the high concentration only in some areas of the species, but it should be employed together with naturalistic methods in the case of the roe deer.

Bat monitoring in Marche region: from barbastelle to human dimension

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The aims of this study are: to acquire more information about bats in Marche region, particularly about a rare species such as the barbastelle (*Barbastella barbastellus*), and to study the Human Dimension in order to assess human attitudes towards bats, essential for an effective communication.

The barbastelle is one of the rarest species of bats and it is listed as Endangered in the Italian Red List. Until 2007, about 20 sites for this species have been reported in Italy and in a recent atlas of Umbria region (2013) only 4 observations are indicated.

This species roosts in forest behind loose bark and in tree cracks, but also in buildings, rock crevices, caves, mines and bat boxes (flat). Forests, edges and gardens represent foraging habitat.

Echolocation calls are very typical and easy in identification, as generally characterized by two call types (31-33 and 41-42 kHz FMAX) emitted alternately.

Bat monitoring was performed in Marche region (Central Italy) from 2007 to 2013 in several stations distributed in different habitats, mainly along the Apennines and to a lesser extent in the hilly and coastal areas. In each station, we recorded every bat passage within 10 minutes using a bat detector Pettersson D1000X in direct sampling mode (3 seconds). Over 6500 bat recordings were analysed with Bat Sound software.

15 species have been identified by spectrograms: *Rhinolophus ferrumequinum*, *Rhinolophus hipposideros*, *Rhinolophus euryale*, *Myotis daubentonii*, *Myotis emarginatus*, *Myotis nattereri*, *Nyctalus noctula*, *Nyctalus leisleri*, *Eptesicus serotinus*, *Pipistrellus pipistrellus*, *Pipistrellus kuhlii*, *Hypsugo savii*, *Barbastella barbastellus*, *Miniopterus schreibersii*, *Tadarida teniotis*. Among them barbastelle is one of the rarest species detected although we have 110 recordings regarding 15 areas identified in the following municipality: PU = Serra S. Abbondio; MC = Matelica, San Severino Marche, Serrapetrona, Camerino, Sefro, Serravalle di Chienti, Pievetorina, Montecavallo, Visso, Castelsantangelo sul Nera, Fiastra, Belforte del Chienti; FM = Fermo; AP = Rotella.

Distribution reflects sampling effort, mainly concentrated along the Apennines. More effort needs to be deployed in the Northern and Eastern part of the region.

Habitats used by barbastelle are: riparian vegetation (9), forest edge (8), old forest (4), rocks and caves (5), pastures (1), fields (1) and buildings (1), with an elevation comprised between 150 and 1,500 m above sea level.

As a whisperer, barbastelle produces very low intensity calls,

detectable up to only 4-5 m of distance, so abundance can be underestimated in comparison to other louder bats species. However, Marche region appears to be a very important area for this species, despite the low quality of forest habitat.

The human dimension study was carried out through a questionnaire of 30 questions organized in 5 fields of interest: personal data, feelings and experiences, bat biology, prejudice, conservation. It was proposed in person to a sample of 67 potential visitors of 3 sites of survey (inhabitants of Esanatoglia (MC), speleologists and local hikers).

People were chosen in order to have a representative sample of each age, gender and educational qualification.

60% of the interviewed declare not to feel comfortable while thinking of bats but the percentage is far different if analysed separately in the three sites: 21% of the speleologists compared with 74% of the inhabitants of Esanatoglia and 76% of the hikers. The most used adjectives to define bats are: ugly, pleasant, black, disgusting.

On the basis of the score frequency distribution obtained in the "biology" section, the sample was divided in two groups: satisfactory and not satisfactory. Comparing the biology scores with the educational qualifications, among the not satisfactory scores there is a higher percentage of people with Primary and Secondary school certificates while holders of a degree are evident only in the satisfactory scores section. Similarly, in the comparison between biology knowledge and the age, not satisfactory scores are mostly distributed in the under-20 category and in the 40-60 one. In addition, the number of people feeling uncomfortable is higher in the not satisfactory group.

While bats are widely believed to be connected with prejudice, the ideas that they suck blood or bring bad luck are not very common (4%) while thinking that they stick on people's hair is more widespread (36%).

Most of the people state that bats are useful (87%) especially for pest control and more than half would put a bat-box near their house (63%). Only few interviewed know bats are protected by law (24%).

Finally, when asked what they would do if a bat entered their house, 74% say they would try to make it go away (although using fatal methods) and 5% would try to kill it.

Some of the adjectives associated with positive feelings (pleasant, fascinating and useful) could be used while making an effective communication.

Influence of forest management practices on the probability of occurrence of *Muscardinus avellanarius* in a Central Apennines woodland

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The common dormouse (*Muscardinus avellanarius* L.) is a protected rodent species with highly selective arboreal feeding behaviour. Therefore it is among the target species of the LIFE project ENV IT 078_ManForCBD aimed at evaluating the effects of forest practices on biodiversity. We designed an occupancy model to estimate the probability of occurrence of the dormice in response to different forest practices in a woodland area in South Central Italy (Feudozzo-Monte di Mezzo-Monte Miglio-Bosco Pennataro, elevation 650–1300 m a.s.l.) characterized by extensive high growth and coppice Turkey oak and beech stands. An equal number of sampling sites (n=70) were randomly set in coppice and high stands at a distance of at least 200 m, for a total of 140 sites. One nest-box and one hair tube were set up at each site and checked about every 15 days (late August - early October 2013, 4 sampling sessions). A set of 17 dendroauxometric and structural characteristics were measured in forest plots to characterize the dormice microhabitat and entered as covariates in the occupancy models. Indirect signs of species occurrence (hairs, hazelnuts and droppings) were collected and photographed for further identification in the laboratory. Nests were ascribed to dormice only when the animals were found in the nest at least

once. Bitten hazelnuts were identified with the aid of field guides. Hairs collected at hair tubes were first impressed in celluloid stamps and further examined with a binocular optical microscope 40× for species diagnosis based on the shape of the medulla, cuticle and scale patterns. Presence/absence data on dormouse occurrence during the four sessions were entered as binary data for each site and each kind of occurrence (nest, hair and hazelnut). All occurrence data were then pooled and the probability of occurrence of the species was computed through the software PRESENCE using single-season models, and including data on forest type, dendroauxometric and structural characteristics as covariates effects. In a first model, the proportion of occupied sites was modelled as a function of the different forest management practices. Estimated occupancy of dormice was much higher in coppice ($\psi=0.3134$, SE 0.0576) than in high forest ($\psi=0.1524$, SE 0.0447). Detection probability increased from the first to the last session, ($p_1=0.2838$, SE 0.085; $p_2=0.3638$, SE 0.0889; $p_3=0.6417$, SE 0.0897; $p_4=0.7704$, SE 0.0811), likely as a consequence of the increased need of hibernation site as the cold season was approaching.

Sometimes they come back: evidence on natural red squirrel re-colonisation after alien squirrel removal

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P048

Local extinction of red squirrel (*Sciurus vulgaris*) by competition with other alien tree squirrels (e.g. *Sciurus carolinensis*), has been documented in Great Britain and northern Italy. When alien squirrel populations increase in size and density, the fitness of sympatric red squirrels is reduced, mainly by food competition reducing reproductive success in females and juvenile recruitment. Competition for space among juvenile and subadult red and alien squirrels seems to force young individuals of the native species to settle in sub-optimal or even marginal habitats. In 2010 the EU funded a LIFE project NAT/IT/00095 to develop and to apply methods for removing alien squirrels inhabiting northern Italy. The removal activities were carried out in some areas of Lombardy by several trapping sessions. The use of ground-placed live traps was successful and led to the removal of grey squirrel, and *Callosciurus* sp. Moreover, during the same sessions, 130 Eurasian red squirrels were also marked and released. Removal trapping is still in progress and covers 4 macro-areas where wild populations of both alien and native squirrels are present. This systematic control is expected to cause a marked reduction in abundance of alien squirrels,

provided that the rate of individuals removed exceeds squirrels immigrating or being born there. As a consequence, the immigration of red squirrels from the populations inhabiting the surrounding fragmented habitats should occur. Our results show that after a substantial reduction of population size of alien squirrels, red squirrel re-colonized several areas, where this species had no longer been observed for at least two years. Furthermore, after alien species removal, we observed an increasing rate of red squirrel captures also in sympatric areas. Although being preliminary, these results confirm that the control activity of alien squirrel has reduced the threat to red squirrels. Therefore, we argue that interruption of control could invalidate the results achieved so far, due to alien squirrel population resurgence and re-colonization. Indeed continuation and intensification of trapping effort is still strongly required especially in those surrounding areas close to the sites which red squirrels recolonized. Further studies using radiotracking are required to understand over which distances dispersers from a recovering red squirrel population can move becoming potential colonizers of areas where alien squirrels have been removed.

A possible introduction pathway of the Eastern Grey Squirrel in Umbria (central Italy)

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The increasing worldwide introduction rate of invasive species represents one of the most serious threats to global biodiversity. The introduction into Europe of the Eastern grey squirrel (*Sciurus carolinensis*) constitutes one of the most successful mammal invasions. This species is known to compete with the native red squirrels (*S. vulgaris*) in the British Isles and Northern Italy and it is responsible for its replacement through a competitive exclusion mechanism. In Italy, grey squirrels were first introduced in 1948 in Turin from Washington (District of Columbia, USA). This population is now spreading steadily and leading to red squirrel local extinctions. In 1966, five animals were released into the Villa Gropallo park in Genoa and, more recently, several nuclei appeared in Lombardy and around the city of Padova (Veneto).

With the exception of a failed introduction in Rome, no mention of grey squirrels in the peninsular part of Italy has been reported except for the population in Perugia. Seven grey squirrels were purchased in 1999 from a pet retailer in Varese (northern Italy) by a private wildlife park near the city of Perugia, as confirmed by an invoice. The squirrels were kept on display in wire cages outdoors, but the animals were reported to have escaped at the beginning of the 2000s. The grey squirrel population range in Perugia currently occupies an area of at least 50 km² and seems to have its expansion core right inside the private wildlife park. The population is expanding at a rate of 0.29 km/yr, slower than most grey squirrel invasions elsewhere in Europe. A Management Plan, in action since 2011, has led to the capture of 77 grey squirrels, versus only 11 red squirrels caught in the suburb of Perugia. Tissue samples collected from the captured specimens were used for genetic analysis. Nuclear DNA analysed at 12

different microsatellite loci revealed that the grey squirrels in Perugia have extremely low genetic diversity, consistent with a small founder size. In particular, genetic assignment tests indicate that the Perugia population was founded by translocations from an established population in Piedmont, Italy.

It can therefore be inferred that the introduction of the grey squirrel in Umbria is derived from illegal catches carried out in Piedmont.

This new propagule represents a conservation threat to the red squirrel subspecies of the Perugia area, *S. vulgaris italicus*, endemic in central Italy. In the mid-long term period the grey squirrel might represent a threat for the biodiversity of the Apennines ecosystems. Given the high degree of ecological connectivity in the area, the range occupied by grey squirrels might soon be very extensive if no control measures are adopted. New releases that increase genetic diversity will also increase spread rate: introgression of new genotypes, even of just a few individuals, could generate novel phenotypes, reduce the genetic load and have an effect on the evolutionary responses of invading populations.

The inclusion in 2012 of the Eastern grey squirrel in Annex B of European Community Regulation 338/97 and the inter-ministerial decree that bans the breeding and commerce of squirrels, and regulates the detention of the species, are a step in the right direction. Grey squirrel owners must now report the animals to the competent authority (CITES office). To date, however, no pet grey squirrels have been reported in Umbria.

We suggest that the eradication of the grey squirrel population in Umbria and stricter controls for compliance with the current regulations are the key stone to the conservation of forest biodiversity in central Italy.

A checklist of bats (Mammalia: chiroptera) of Aosta Valley (NW Italy)

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During recent surveys funded by the Autonomous Region of Aosta Valley (*Ass.to Agricoltura e Risorse Naturali, Servizio Aree protette*), Gran Paradiso National Park and Mont Avic Regional Park, we ascertained the occurrence of three bat species formerly unrecorded in Aosta Valley (NW Italy): *Rhinolophus hipposideros*, *Vespertilio murinus* and *Eptesicus nilssonii*.

An echolocation call sequence of *R. hipposideros*, identified from the typical structure of Rhinolophids calls (FM/CF/FM) and from the frequency of the CF component between 108 and 111 kHz, was recorded inside Lolair Nature Reserve (Valgrisenche), on 04/08/09. The recording site is located 1195 m asl and is characterized by a large natural pond surrounded by a heterogeneous environment, consisting of patches of cane field, marsh, meadows, xerophile vegetation (*Pinus sylvestris*, *Quercus pubescens*, *Juniperus sabina*), rock debris and cliffs. Since *R. hipposideros* is easily detectable at its roost sites, the absence of previous records, despite a large number of underground sites and cultural heritage buildings of the region were surveyed, proves it is a very rare species in Aosta Valley.

A male *Vespertilio murinus* was mistnetted above an artificial pond near the village of Carrè (Rhêmes Valley), on 23/09/13. Capture site is located at an altitude of 1644 m, among grassland and larch woods. In Italy *V. murinus* is considered a species of irregular presence, probably due to migratory movements, but information on the topic is scanty.

During summer surveys carried out from 2007 to 2013, nine echolocation sequences attributable to *Eptesicus nilssonii* were recorded at five different sites, located in the lateral valleys of Champorcher, Champdepraz, Cogne, Savararenche and Ferret, at altitudes ranging from 1345 to 2460 m asl. The identification of the acoustic sequences, at least partially characterized by QCF calls with a bandwidth <5 kHz and a frequency of maximum energy of 27-29 kHz, was verified using iBatsID tool and Zingg's discriminant functions. Both methods provide a very high classification accuracy for *E. nilssonii* and, in addition, iBatsID gives an estimate of classification error, which resulted <5% for the analyzed calls. A mosaic of pastures, hay meadows, coniferous woods (mainly dominated by *Larix decidua*, marginally by *Picea abies* or *Pinus sylvestris*) and small villages characterizes the recording sites, with the exception of the one at the highest elevation, situated in an open alpine environment covered by marsh land, prairie and rock debris. The scattered distribution of the records suggests *E. nilssonii* as widespread in the Aosta Valley; it is nevertheless uncommon: no other calls could be attributed to this species in a set of about 3900 sequences obtained from

bat detector surveys carried out across the region.

The inventory of bats recorded in Aosta Valley, updated with the new records, comprises the following 19 species: *Rhinolophus ferrumequinum*, *Rhinolophus hipposideros*, *Myotis bechsteinii*, *Myotis daubentonii*, *Myotis myotis*, *Myotis mystacinus*, *Myotis nattereri* (complex), *Pipistrellus kuhlii*, *Pipistrellus pipistrellus*, *Pipistrellus pygmaeus*, *Hypsugo savii*, *Eptesicus nilssonii*, *Eptesicus serotinus*, *Vespertilio murinus*, *Nyctalus leisleri*, *Plecotus auritus*, *Plecotus macrobullaris*, *Barbastella barbastellus* and *Tadarida teniotis*. The presence of a 20th species, *Nyctalus noctula*, already suggested as probable on the basis of some echolocation calls, needs confirmation.

The occurrence in the region of 2 additional species – *Myotis emarginatus* and *Pipistrellus nathusii* – can be considered highly probable: in 2008 a male *M. emarginatus* was found in Piedmont at only 10 km from the administrative boundary of Aosta Valley, which features large favorable areas for this species along its bottom; we recorded echolocation calls probably emitted by *P. nathusii* (QCF calls with a bandwidth of 1.3-6 kHz and a frequency of maximum energy of 38.4-40.2 kHz) in Ferret and Rhêmes Valleys, in September 2012 and in the late August 2013 respectively.

On the contrary, we could not find any evidence of the presence of *Plecotus austriacus*, whose occurrence in Aosta Valley is reported in the CKmap 5.3.8 database on the basis of a specimen collected in 1978, i.e. before the description of *P. macrobullaris* as a good species. We cannot exclude the presence of *P. austriacus* in Aosta Valley, neither consider it certain. Anyhow, it is noteworthy that in 2013, near Issogne, we captured a male long-eared bat with a penis thickened and rounded towards the end, traits typically associated with *P. austriacus* in literature. Body measures and other external traits led to a field classification of the individual as *Plecotus austriacus vel macrobullaris*; afterwards, genetic analysis performed on a skin sample allowed us to identify it as a *P. macrobullaris*.

Concerning taxonomic classification, we finally discuss some remarks about *M. mystacinus* (we captured some individuals showing dental characteristics reported for the taxon *aurascens*) and the genus *Pipistrellus* (we recorded a large number of echolocation calls featuring characteristics, among which frequency of maximum energy in the range 48-54 kHz, which arouse classification problems basing on literature criteria and using classification software).

Further survey is needed to complete the inventory.

Il cinghiale: problema o risorsa per il nostro territorio? Ipotesi di filiera per le carni cacciate in Umbria

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PIII

Le trasformazioni del territorio appenninico hanno creato in questi ultimi anni le condizioni idonee per la crescita e la diffusione di diverse specie di Ungulati selvatici tra cui in particolare il Cinghiale. I numeri insistenti sul territorio (14143 sono i capi abbattuti nella Regione Umbria nella stagione venatoria 2011/2012 e € 828250000 i danni accertati alle colture nel 2011) rendono necessario un approccio gestionale che non solo tenga conto degli elementi utili a conseguire una razionale gestione delle conflittualità innescate dalla presenza di questi animali, ma anche dei considerevoli interessi di natura economica connessi con l'attività di caccia al cinghiale. Da questa consapevolezza nasce l'esigenza di affrontare, in particolare, le implicazioni derivanti dal crescente consumo della carne della fauna selvatica cacciata: non si può infatti ignorare come, vista la dimensione raggiunta dall'attività venatoria e dall'attività di controllo (per quanto riguarda il cinghiale), la carne degli Ungulati selvatici non possa più essere considerata semplicemente come risorsa da destinare all'autoconsumo. Considerando le indicazioni contenute nella legislazione vigente quale conditio sine qua non per promuovere qualsiasi iniziativa, il presente studio ha tentato di rispondere a due importanti interrogativi:

- è possibile realizzare una filiera di carne di Ungulati selvatici cacciati in Umbria, con particolare riferimento al cinghiale?
- quali sono le problematiche principali che impediscono a questa risorsa "ambientale" di essere utilizzata come tale?

Lo studio ha rilevato le strutture disponibili sul territorio quali mattatoi (pubblici e privati), centri di lavorazione, ristoranti ed agriturismi con menù di cacciagione, salumifici e trasformatori. È stato indagato il numero di "persone formate" ai sensi del reg. 853/2004 e la loro distribuzione. Si è avviata un'indagine conoscitiva presso ristoratori per conoscere la provenienza dei cinghiali acquistati; inoltre è stato svolto uno studio delle dinamiche del flusso dei capi conferiti ai mattatoi autorizzati ed ai centri di lavorazione e delle attuali modalità di gestione dei capi cacciati presso le Aziende Faunistiche Venatorie al fine di individuare le criticità connesse a tale gestione. Parallelamente, si è avviata la caratterizzazione nutrizionale delle carni indagando le caratteristiche chimico-fisiche di animali provenienti da abbattimenti condotti sia con il metodo della braccata che dell'aspetto.

Behavioural adaptations of *Canis lupus italicus* depending on the trophic availability resulting from human activities

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2013 in Italy has been undoubtedly the year of the wolf. A year characterised by several sightings of wolves reported by hunters and hikers, predations on livestock and also the year of the ostentation of poaching.

The territory of the province of Modena under the management of ATC MO2-Centrale has not been exempt from this phenomenon and in Autumn 2013 an action of intensive control started in this area, especially in the perimetral areas of some breeding farm that have already been subjected to the consumption of carcasses left outdoors by the farmers while they were waiting for their removal.

The study started on the 19th November 2013 and ended on the 24th December 2013: 6 hunting cameras were placed within a breeding farm of fresian cows, located in the Municipality of Pavullo nel Frignano (MO) at 750 m.a.s.l. The hunting cameras were placed in correspondence to those spots where the transit of wolves was considered more probable.

The farm has been chosen after the chaos unleashed by the testimony of the farmer about the consumption of the carcass of a bovine (dead of natural death) perpetrated by wolves during the night between the 8th and the 9th of November. The following night, between the 9th and the 10th of November, the owner of the farm placed a hunting camera nearby the carcass and filmed the repeated consumption carried out by the pack of wolves, that amounted to 5 specimens at least.

The carcass has been removed for its disposal on the 11th of November. The footage, broadcasted on Youtube, caused an uproar about this case and caught the attention of media and politics.

The hunting cameras filmed wolves for 14 days, producing in the aggregate 33 video clips that prove the presence of wolves, filmed both individually and in group. Two footages show a pack composed by 5 specimens at least, but there's the suspicion that there could be a sixth element.

After an analysis on the video clips realized in the proximity of the barn and the house of the farmer, located at about 50 meters away, an interesting fact regarding the transition time of the wolves came to light: above 57% of the passages took place between 17:00 and 21:00, and the remaining 47% of them between 1:00 and 8:00 am.

Particularly noteworthy is the transit of a specimen filmed by the camera situated at about 5 meters from the barn: this video clip has been shot at 18:35, exactly 8 minutes after the transit of a tractor and 7 minutes before the arrival of four big-size dogs that belong to the farmer.

The whole area, well frequented by people, dogs and agricultural machinery is characterized by an high level of anthropic disturbance, that was accentuated during the period of our study for the several photographic posts at dawn, the recurring operations of replacement of the SD cards for the hunting cameras and also for the appearance of television crews on site.

The study area and its proximity reaches an high density of foxes, porcupines, badgers, hares, stone martens, roe deers and boars: these last two animals in particular are the favourite prey of wolves.

Despite this combination of discouraging factors, wolves do not have any hesitation in searching for carcasses, fetal membranes and residues of animal feed at the interior of the dunghill.

Felis silvestris nel Parco Nazionale della MajellaE. PETRUZZI¹, C. SPILINGA¹, E. CHIODINI¹, A. ANTONUCCI², B. RAGNI³¹ Studio Naturalistico Hyla s.n.c., Via Aganoor Pompili 4, Tuoro sul Trasimeno PG, e-mail info@studionaturalisticohyla.it² Parco Nazionale della Majella³ Università degli Studi di Perugia

Nel 2013 è stato intrapreso uno studio tramite fototrappolamento (*Cuddeback Attack Flash*) su *Felis silvestris* (*F. s. silvestris* gatto selvatico europeo; *F. s. catus* gatto domestico) nel PNM, propedeutico alla redazione del Piano di Gestione dei Siti Natura 2000 del Parco. Una prima fase è consistita nell'elaborare i dati già raccolti con lo stesso metodo nel settore NW del Parco. Sulla base della prima, nella seconda fase si è campionato nelle due aree di saggio Corpi Santi e Val di Terra nei settori NE e S del Parco. I risultati complessivi sono (IC:Indice di Cattura=Catture/GG-TRAPPOLA): AREA SAGGIO NW: MCP KMQ=142; STAZIONI=17; GG-TRAPPOLA=3000; FS=75; FSS=74; FSC=1; IC FS=0.025; IC FSS=0.0247; IC FSC=0.0003; AREA SAGGIO Corpi Santi: MCP KMQ=5.5; STAZIONI=15; GG-TRAPPOLA=547; FS=8; FSS=3; FSC=5; IC FS=0.0146; IC FSS=0.005; IC FSC=0.009; AREA SAGGIO Val di Terra: MCP KMQ=1.8; STAZIONI=15; GG-TRAPPOLA=885; FS=8; FSS=8; FSC=0; IC FS=0.009; IC FSS=0.009; IC FSC=0. Nella seconda fase, la popolazione minima di *F. s.* gravitante sullo spazio e nel tempo saggiati risulta, Corpi Santi: 2 gatti selvatici europei adulti e 4 gatti domestici maschi; Val di Terra: 4 gatti selvatici europei, tre maschi – un giovane-adulto (1-2 anni), un adulto-giovane (2-3 anni) e un adulto-maturo (almeno 5 anni) – ed una femmina adulta (intorno 3 anni). A Val di Terra è stata saggiata l'ipotesi d'impatto determinato dalla frequentazione dello stesso spazio da parte delle categorie: Persone, Fungaroli, Auto, Domestici (bovini, equini, cani). È stata evidenziata la possibilità di impatto antropico altamente significativa ($\chi^2=376$; g.d.l.=3; $p<0.001$) con progressione crescente delle categorie Auto, Fungaroli e Persone a differenza dell'impatto esercitato dai Domestici che mostra un peso nettamente inferiore. Lo studio sperimentale ha evidenziato almeno due fonti di criticità per la conservazione di *F.s.s.*: la presenza, l'attività e l'abbondanza del gatto domestico in condizione temporanea o permanente di "naturale libertà"; la presenza, l'attività e l'abbondanza degli umani, sia a piedi che su veicoli. Inoltre entrambi i fattori avversi sono in condizioni di sinpatia e di sintopia con la popolazione di gatto selvatico presa in considerazione; entrambe le sorgenti di criticità si ricongiungono al grado di antropizzazione del luogo considerato, sia diretta che indiretta, sia permanente che temporanea. Quanto alla prima "situazioni di criticità", rappresentata dal gatto domestico, nel tentativo di definire parametri ambientali che suggeriscano un rapporto di causa-effetto con tipologie di antropizzazione, si prende in considerazione la situazione comparativa tra le due Aree indagate: H_0 = la distanza tra i siti-trappola ed i centri abitati permanenti e le strade asfaltate di collegamento non influenza la presenza differenziale di gatto selvatico europeo e di gatto domestico liberamente vagante nelle stesse unità di spazio e di tempo. L'elaborazione di tali parametri consente di affermare che: la differenza delle distanze di fotocattura dai fattori antropici considerati tra i due taxa oggetto di studio, è altamente significativa ($\chi^2=203.28$; g.d.l.=1; $p<0.005$). La

Ipotesi Nulla formulata deve, quindi, essere rigettata e sostituita dalla seguente H_1 = la presenza di *F. s. catus* in un'area extraurbana può dipendere dalla ridotta distanza dei luoghi caratterizzati da manufatti antropici attivi e permanenti, quali vie di comunicazione e insediamenti. Tale rapporto di causa-effetto è attivamente corroborato dalle osservazioni relative all'altra Area Campione, Val di Terra, per i seguenti motivi: detto comparto territoriale non è risultato abitato o frequentato dal gatto domestico; le caratteristiche ambientali presentano, comparativamente, elevate condizioni di naturalità strutturale (vegetazione, uso del suolo, modellamento antropico storico e recente, altitudine); il campione di gatto selvatico fotocatturato suggerisce l'esistenza di una popolazione locale stabile e ben strutturata di *F. s. silvestris*; la distanza dal centro abitato più prossimo è quasi 2.5 volte superiore a quella misurata nell'area con presenza di gatto domestico; le distanze dalla strada di collegamento più prossima praticamente uguali tra le due Aree Campione, "nascondono" una profonda diversità funzionale: quella relativa a "Corpi Santi" è una via di comunicazione pedemontana ad alta intensità di traffico veicolare continuo, interposta a centri abitati densamente distribuiti lungo tale asse; quella prossima a "Val di Terra" è una strada altomontana a bassa intensità di traffico veicolare fortemente discontinuo nell'anno e caratterizzata da una bassa densità di insediamenti da essa collegati. Dal punto di vista della *habitat selection* il campione fotocatturato risulta complessivamente effettuare una scelta attiva delle 7 categorie ambientali "offerte" dall'area in modo altamente significativo ($\chi^2=17$; g.d.l.=6; $p<0.01$): Brughiere e cespuglieti e Aree a ricolonizzazione naturale risultano variamente sotto-utilizzate, congruentemente con l'*habitat selection* nota del gatto selvatico nella penisola italiana; al contrario, il dato di accentuato sopra-utilizzo dei Boschi di conifere si discosta notevolmente dalle attese eto-ecologiche relative all'habitat del felide nell'anzidetta regione geografica, in quanto tali formazioni vegetazionali risultano normalmente sotto-utilizzate o evitate; la situazione esposta è in qualche modo confermata e corroborata dal "sopra-utilizzo", ancorché "basso", trovato per i Boschi misti di conifere e latifoglie; il dato statistico di "equo-utilizzo" dei Cedui matricinati non deve trarre in inganno: al di là del calcolo matematico, infatti, una categoria ambientale che copre il 40% dell'estensione totale delle 7 categorie offerte, deve essere considerata *de facto* eto-ecologicamente altamente significativa per la specie in studio; anche se in misura meno accentuata, la situazione esposta è paragonabile a quella relativa alla categoria Aree a pascolo naturale e praterie d'alta quota, rispetto alle quali si osserva un altro "equo-utilizzo", rispetto ad una tipologia ambientale che si presenta seconda nella "graduatoria" delle superfici coperte, tra le 7 considerate, nettamente distanziata dalle altre; la propensione del felide alla frequentazione di aree aperte, per motivi trofici, evidenziata al punto precedente, viene confermata e sostenuta dal "sopra-utilizzo", anche se "moderato", dell'altra categoria erbacea, i Prati stabili.

Environmental education as a tool to promote correct knowledge, and positive attitudes and behaviour in children towards wildlife conservation and aliens species management

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The success of wildlife conservation strategy does not depend only on ecological and biological knowledge about species and habitat. To implement successful policies for wildlife conservation, the role of the social sciences has become increasingly important. Examples from different countries demonstrate the pivotal role of the public in affecting the success or failure of conservation efforts. Public influence is especially prevalent in controversial conservation issues such as the reintroduction of large carnivore and eradication or control of invasive species.

The study of the interactions between humans and animals, which is increasingly emphasized in planning of conservation and management strategies, has given rise to a research discipline called "Human Dimension" (HD).

The HD recognizes that perceptions, opinions, attitudes, and behaviours towards the wild species are an integral component for an optimal management of natural resources.

In this theoretical approach, education programs and environmental education activities provide an important contribution to the conservation of wildlife. Since most environmental attitudes are formed during childhood, conservation education programs should target children.

We have involved 250 children (8-10 years old) from 5 schools of the Municipality of Magenta (province of Milan, Italy) in a three-year environmental project centred on biodiversity, territory and environmental sustainability. The activities included 10-hour multimedia class lessons, field excursions in the Ticino valley Natural Park, and direct involvement of children and their parents. The first year project was centred on biodiversity;

particularly the aims was to sensitize the younger generation on the themes of biodiversity and its conservation, focusing the attention on aliens species, since in Magenta lives a grey squirrel populations. Children were involved in: placing hair tubes in school courtyards to monitor the presence of squirrels; a grey squirrel visual census to estimate the range of species presence in the surroundings of the city, distinguishing it from the native red squirrel, still present in wooded areas. We have also organized a night excursion with children and their parents preceded by a short lecture on the topics of the project. At the end of the first year project, children have prepared drawings and texts for an exhibition to disseminate the contents of the project. Before and after the first year project, a longitudinal study was also carried out. We administered a questionnaire mainly focused on knowledge, attitudes, emotions toward biodiversity, aliens species and Grey squirrel. Initial results showed that there is a significant increase in the knowledge concerning biodiversity. Additionally, knowledge reduces indifference and negative emotions, such as disgust and anxiety toward animals, and increases expression of positive emotions such as happiness. Most importantly, higher levels of biodiversity knowledge are correlated with the support of aliens species management activities (grey squirrel), greater concern for nature and pro-environmental behaviours. In a contest of environmental education, the Human Dimension techniques serve as a verification of the effectiveness of interventions, giving the ability to identify important predictors of attitudes and behaviours.

Inductive models to monitor the conservation status of union interest species: first results

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The EU Habitats Directive (92/43/EEC) protects several habitat types and species defined as of "Union concern". All Member States are required to establish surveillance systems to periodically evaluate the conservation status of such habitat types and species, and to forward the results of the surveillance to the Commission every six years. Reporting guidelines define the parameters to be used to assess the conservation status of habitat types and species, and indicate that monitoring shall be performed at biogeographical scale across the entire territory of each Member State. The results of such surveillance activities are expected to allow the evaluation of the efficacy of conservation measures adopted according to the Directive and to influence European policies for biodiversity conservation. In Italy, regional administrations are charged with collecting the information necessary to conduct such surveillance. European-level guidelines identify four parameters that, combined in a general evaluation matrix, allow for the assessment of the conservation status according to four classes: favourable, unfavourable-Inadequate, unfavourable-bad, unknown. The four parameters identified for the species are: range; population; habitat for the

species; future prospects. We are testing the feasibility of using inductive distribution models as useful tools to measure two of these parameters at the regional scale, and in particular to assess the extent of the "range" and "habitat for the species". Inductive distribution models use presence, presence/absence or density data to define the potential distribution of species, assuming that this can be estimated based on the distribution of a series of environmental variables. Tools for producing inductive models have been largely improved over the last 20 years, and several software packages are now available. We are in particular testing the use of Maxent and Biomapper software for a set of selected mammal species of unional interest or conservation concern. We are using a geodatabase of approximately 18000 occurrence records of 73 species of mammals, and 50 layers representing the distribution of a series of environmental variables describing land use, woodland structure and coverage, altimetry, slope, aspect and phytoclimatic classes. Here we present the first results we obtained for a sample of the species considered and pinpoint a few relative critical issues.

Distribution and abundance of roe deer (*Capreolus capreolus*) in the National Park of Gran Sasso and Laga mountains

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As in large part of the Central Apennines, in the National Park of Gran Sasso and Laga Mountains (PNGSL), roe deer (*Capreolus capreolus*) reached the lower abundance and distribution in the period 1950-1960. In the following decades the gradual abandonment of mountain areas and the reduced agricultural activities favored different ungulates, including roe deer, to expand and gradually repopulate the suitable areas. This natural trend was also enforced by the positive effects associated with reintroductions and repopulations carried out in Central Italy. In PNGSL, between 2001 and 2002, a reintroduction of the species was made, with the aim of increasing and stabilizing the species more quickly than with the spontaneous recolonization. This reintroduction was carried out within the Life Project "Conservation of wolves and bears in the new parks of central Apennine" as an action aimed at environmental enhancements, for the increase of food availability of large carnivores.

As part of the research activities carried out by the Community Project LIFE07/NAT/IT/000502 "Improving the conditions for large carnivore conservation - a transfer of best practices" – EX-TRA, a study was carried out in order to acquire knowledge on the abundance and distribution of roe deer. The study was carried out with the methodology of the fecal pellet group count (FPGC), the most widely used technique to monitor the abundance of ungulates.

The following criteria have been met for detection:

- sample units represented by strip transect width 2 m and 500 m long (0.1 ha);
- sample units randomly distributed within each grid cell of a grid of 500 m;
- the sampling area between 0.1 and 0.4% of the entire study area;
- sample units identified at random;
- sampling carried out after a fixed accumulation time (as by melting snow);
- pellet group registered consisting of a minimum of 6 pellets identical in shape, size and color, spread over an area no larger than 1 m radius;
- registration of all signs attributable to the presence of the

species (scrapes, footprints, beddings).

The study area was divided in two sample areas (A and B) about 2600 ha each. The sampling area A has a forest cover of 82%, the area B a forest cover of 63%. In the two areas were carried out a total of 145 transects, for an average length of 561 m each, for a total of about 81.3 km, and a total surface area of 1626674 m² inspected. This area represents 0.3% of the study area considered.

The distribution of the species is defined by overlapping to the sample area a grid of 1 km side where the presence of the species was recorded. Considering all the signs attributable to the presence of roe deer, it was possible to detect the species in 49 cells on a total of 83 (60%).

The estimation of the abundance and density was obtained by considering only the number of fecal pellets registered. The pellet group count gave density values ranging from 1.09 heads/km² (area A) and 1.38 heads/km² (area B).

The estimated density in the present investigation appear to be lower if compared to densities observed in similar habitats of the Apennines, and it shows even lower than the findings of a study conducted in adjacent areas by the same authors (2.4 deer/km²). Even considering all the signs of presence and by calculating the kilometric index of abundance (IKA), the data obtained are confirmed on average lower than those of other studies. These values are probably low because the area sampled is characterized by the presence of some disturbing factors such as pressure of grazing sheep and cattle, presence of small towns; presence of herding dogs, and stray dogs and uncontrolled dogs. Although with low densities, the species is uniformly distributed within the sample areas as specified above.

The study results enforce the data collected annually with the long-term monitoring program conducted on the species by means of the technique of counting in open areas in springtime, and show that roe deer in the park has a wide distribution, but with low density.

The further studies will be aimed at identifying the factors that influence the density of roe deer in the protected area.

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Monitoring Ungulate presence in a protected area with Occupancy ModellingD.G. PREATONI¹, F. BISI¹, M. TRIZZINO², I. CATALDO³, A. MARTINOLI¹¹ Unità di Analisi e Gestione delle Risorse Naturali – *Guido Tosi Research Group*, Dipartimento di Scienze Teoriche e Applicate, Università degli Studi dell'Insubria, Via J. H. Dunant 3, I-21100 Varese, Italy² Istituto Oikos, Via Crescenzago 1, I-20134 Milano, Italy³ Parco Regionale della Pineta di Appiano Gentile e Tradate, via Manzoni II, I-22070 Castelnuovo Bozzente (CO), Italy

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In the last three years, the first red deer (*Cervus elaphus*) sightings occurred in the area of Parco Regionale della Pineta di Appiano Gentile e Tradate (Lombardy, N Italy). The protected area already hosted a roe deer (*Capreolus capreolus*) population, as well as a nucleus of fallow deer (*Dama dama*, a paleo-introduced species). As the Park was interested in setting up a long-term, low-cost monitoring scheme to assess ungulate presence, a basic monitoring program has been started on the whole Park area, engaging the volunteer Park wardens.

Here we present the results gained so far, in terms of distribution maps for red deer, roe deer and fallow deer in the Park area,

as well as some considerations on the application of occupancy modelling based on the collection of signs of presence by non-specialized personnel.

Estimated species occupancies are low, indicating low densities for both roe and fallow deer, whereas the presence of red deer seems to be confined in the southern portion of the Park area. The effort requested for the systematic presence sign census has proven to be sustainable by the Park in terms of costs and benefits, and the Park volunteers already adopted it routinely, therefore granting the continuity in time that is needed for such monitoring schemes.

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Influence of artificially added limonene on eurasian red squirrel's food choiceD. RIBOLINI¹, D. SIMONELLI¹, A. MARTINOLI¹, M.V. MAZZAMUTO¹, S. BANFI², L. CHIODAROLI², A. MOLINARI³, D.G. PREATONI¹, L.A. WAUTERS¹¹ Unità di Analisi e Gestione delle Risorse Naturali – *Guido Tosi Research Group*, Dipartimento di Scienze Teoriche e Applicate, Università degli Studi dell'Insubria, Via J. H. Dunant 3, I-21100 Varese, Italy² Dipartimento di Scienze Teoriche e Applicate, Università degli Studi dell'Insubria, Via J. H. Dunant 3, I-21100 Varese, Italy³ Istituto Oikos srl, via Crescenzago 1, 20134 Milano, Italy

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It is known that the presence of secondary metabolites, organic compounds of low molecular weight, in seeds of some conifer species such as Norway spruce (*Picea abies*) and silver fir (*Abies alba*) can affect food choice of Eurasian red squirrels (*Sciurus vulgaris*). The red squirrel is the only arboreal squirrel native to Europe and it is widely distributed over the northern boreal forests and in subalpine conifer forests where a co-evolution between squirrels and their food plants has been documented.

Co-evolution between silver fir and red squirrel has been investigated in Italian Alps during ASPER (Alpine Squirrel Population Ecology Research) Project, and chemical analysis revealed a much higher concentration of limonene; a cyclic terpene, in seeds of silver fir as compared with those of Norway spruce. Data on space and habitat use of radio-tracked red squirrels show that this species feeds rarely on silver fir seeds and that the seeds of Norway spruce (*Picea abies*) are largely preferred. To test whether the presence of limonene can actually affect red squirrel food choice we started a Cafeteria experiment in which limonene-treated hazelnuts and untreated ones were offered to red squirrels. Six wooden plates with two separate dishes each, were attached to tree trunks and monitored by a Scout Guard

550V phototrap recording a one minute clip at every squirrel pass. The first dish was filled with 10 g of limonene-treated hazelnuts, the second with 10 g of untreated ones. Clips have been analyzed with Cowlog software and statistics were made using R software. Hazelnuts without pericarp were cut in two pieces and bait treatment has been done with 200 μ l of limonene for every 10 g of hazelnuts in a closed bowl for 24 h.

We used three feeding stations in each of two study areas. The first near Vaprio d'Adda (MI) in which few individuals of the invasive alien species Eastern grey squirrel (*Sciurus carolinensis*) were observed. The second near Vanzago (MI) where grey squirrel are absent. The hypotheses were that: (1) the first hazelnut taken (first visit) by a squirrel should be an untreated one; (2) squirrels should take first all the untreated hazelnuts; and (3) the treated nuts should be taken only after all the untreated ones have disappeared, or should be left. Here we will present the results of this experiment and discuss the problems that can arise from doing cafeteria experiment under natural conditions using free ranging (and not captive) animals. The study has been partially financed by PRIN project (PRIN 2010-2011, 20108 TZKHC) and LIFE project NAT/IT/00095.

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Red deer reintroduction in the Gran Sasso – Laga National Park

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Red deer (*Cervus elaphus*) became almost completely extinct in Italy by the end of the XIX century. Despite the several reintroductions made in the northern Apennines and in scattered protected areas in central Italy from 1950, the distribution of the species in central Apennines is still fragmented, with several isolated populations. The reintroduction of red deer in the Gran Sasso and Laga Mountains National Park (PNGSL) aimed to reconstitute the original biological diversity in order to improve ecosystem functionality and enhance connectivity between distinct population in central Apennines.

The reintroduction started in 2004 and has been completed in December 2011, with the release of a total of 133 deers, in three different sectors (north, centre and south) of the Park. Eighteen reintroduced deer were found dead. Among the released animals, 29 deers were equipped with VHF collars and 10 with GPS collars. VHF collared deer were located at least 3 times per week in 4 different time slots, while GPS locations were recorded every 5 hours.

Here we provide an overall summary of the work done over the last 9 years considering both the positive results reached and the pitfall that contrasted the achievements of the main objectives of the reintroduction.

Data acquired by radiotelemetry allowed us to analyze post re-

lease movements by measuring the total distance travelled, the farthest distance from the release site and habitat use of released deer. Not all deer behaved the same, but we observed a strong individual variability: some individuals dispersed far from release site, while others settled down with limited excursions outside the release area.

Although no consistent data are available on the abundance of the population present in the Park, the reintroduction seems to have had a positive outcome, in relation to the increase of the rutting areas observed year after year and the numerous collected sightings which show that deers have now recolonized much of the protected area.

A critical assessment of the results obtained through monitoring reveal several flaws associated with conservation and monitoring that are not completely solved. One of the main problems encountered was the malfunctioning of radio collars that did not allow the acquisition of data for many of the released individuals, hampering to get long term information on survival and on post release behavior. The presence of stray dogs in the area is as well a highly problematic issue, as in some cases free ranging dogs disturbed deers even causing their death. Poaching occurred as well, but we documented only two cases, in both circumstances deers stayed continuously in the proximity of anthropic features.

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Monitoraggio della popolazione di cinghiale (*Sus scrofa*) in territorio appenninico: due metodi a confronto

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Il presente lavoro ha utilizzato due diversi metodi per studiare consistenza numerica, struttura e distribuzione della popolazione di cinghiale *Sus scrofa* (Linnaeus, 1758) all'interno del territorio del Parco Regionale di Monte Cucco (PG), lavoro svolto per conto dell'Ente gestore (Comunità Montana Alta Umbria).

L'area di studio comprende i territori comunali di Fossato di Vico, Sigillo, Costacciaro e Scheggia - Pascelupo.

Il Parco nei suoi 10643 ha comprende territori montani, territori alto-collinari e una ristretta fascia pedemontana contraddistinta da coltivi e vivacemente mosaicizzata.

Il suo massiccio, di natura prevalentemente calcarea, culmina nella cima del Monte Cucco (1566 m), e racchiude emergenze naturalistiche di grande rilevanza.

È stato utilizzato il fototrappolamento contemporaneamente alle stazioni notturne di illuminazione con il faro nel periodo compreso fra il dicembre 2012 e il maggio 2013.

Stazioni faro (nelle aree aperte): sono stati eseguiti 23 rilevamenti notturni in 59 stazioni di osservazione scelte in modo opportunistico, utilizzando un faro da 2000000 di candele abbinato ad un binocolo 10x50. Le uscite sono state ripetute in più sere

(da due a quattro volte) ripetendo le medesime stazioni. Ogni volta è stata compilata un'apposita scheda e i risultati sono stati espressi come I.P.A..

Fototrappolaggio (nelle aree boscate): sono state utilizzate fototrappole BolyGuard 5.0 MP, (sempre attive nell'arco delle 24 ore) per sorvegliare 18 governatoi foraggiati con mais in due occasioni (il giorno stesso dell'installazione delle fototrappole e nell'arco di due o tre giorni successivi). Le fototrappole sono rimaste attive complessivamente per 341 notti/trappola che hanno permesso di raccogliere 723 tra foto e video.

I due metodi hanno consentito di raccogliere una notevole mole di dati non solo relativi alla specie cinghiale ma anche ad altre 6 specie di Mammiferi selvatici: istrice, lepore, tasso, volpe, lupo e capriolo.

Entrambi i metodi risultano validi, se ripetuti nel tempo, per un'analisi della dinamica delle popolazioni. Il fototrappolamento ha dato senz'altro risultati migliori riguardo lo studio della struttura di popolazione e stima della densità. Per quanto riguarda la distribuzione, i due metodi hanno dato risultati simili e complementari.

IX Congresso Italiano di Teriologia

Connectivity of the global network of protected areas for terrestrial mammalsL. SANTINI¹, S. SAURA^{1,2}, C. RONDININI¹¹Global Mammal Assessment program, Department of Biology and Biotechnologies, Sapienza Università di Roma, Viale dell'Università 32, I-00185 Rome, Italy²Department of Forest Management and Economics, E.T.S.I. Montes, Universidad Politécnica de Madrid, Ciudad Universitaria s/n, 28040 Madrid, Spain

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Centuries of human activities have drastically shaped the earth surface confining wildlife in ever more rare and sparse habitat fragments. Within the strategic Plan for Biodiversity 2011-2020, Aichi target 11 aims to the expansion of the current protected area system and the maintenance and improvement of its connectivity. The present study aims at providing the first overview of the functionality of the protected area networks of the six continents at different spatial scales as perceived by terrestrial mammals.

We used a graph theory approach to compare the protected area networks of different continents and assess which mammal species categories most and least benefit from the current spatial arrangement. We also assessed the networks at the country level,

both as isolated networks and as part of the continental network, in order to assess their potential role at a larger scale and identify transboundary areas for which connectivity should be improved. Although connectivity is species-specific and depends on species habitat selection and dispersal abilities, our results suggest that increasing protected area coverage and investing in protected area size (rather than in their number) represents a good strategy for improving multi-species connectivity. We discuss the role of the different spatial arrangements of the continental and country networks in providing connectivity for different terrestrial mammals and identify conservation priorities for network improvement.

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Can a social network contribute to scientific research? The case study of Facebook group "wild boar is a passion"

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The idea of this research arise from the publication of a post made by one of the participants of the group of the social network Facebook "cinghiali che passione", a group of hunters and keen on dogs who gather wild boar hunters in Italy. One of the directors, Mr. Moreno Rossetti, asked to more than 2500 members of the group to bring in a post the results of hunting that their team has achieved in the last two hunting seasons, the ATC (territorial hunting organization) and the province where hunting was carried out. The answers of the group members have been "posted" between December 2013 and February 2014, with a total up to 180 records. The data were statistically analyzed to obtain geo-referenced zoning of the phenomenon at the provincial, regional and national levels.

The group also collected a considerable amount of photographs, which was analyzed by identifying phenotypic characters in or-

der to highlight crossing of the wild boar (*Sus scrofa*) with the domestic pig (*Sus scrofa domesticus*). In particular, we have found the following phenotypic characteristics: abnormal coat color, skin and/or hoof depigmentation, body shape and profile, size and shape of ears, length and profile of the head.

Over 200 photos were included into a database containing the location of harvesting. Thus, on a large scale, it was possible to obtain a distribution of the phenotypic characteristics of wild boar detailed at provincial level.

With a communication tool as Facebook it was possible to obtain a large amount of information on the dynamics and status of wild boar crosses with domestic pig in Italy. Although it was impossible to standardize data collection the social network was demonstrated to be a rapid and chip method to obtain data on a wide scale.

Survey on roe deer abomasal helminth fauna in a game reserve of CroatiaM. SINKOVIC¹, P. BERALDO², E. PASCOTTO², R. CASSINI¹¹ Department of Animal Medicine, Production and Health, University of Padova, Italy¹ Department of Food Science, Division of Veterinary Pathology, University of Udine, Italy

In the last decades many researchers investigated parasitic diseases of wildlife, following an ecological approach. Different epidemiological and ecological indexes were developed to assess the stability of the relationship between host and parasite populations, such as the index of aggregation k , the richness index and the importance index (I), which is based on prevalence and abundance values of parasite species. Also roe deer populations were studied using the ecological approach in different areas of southern Europe, in order to evaluate the structure of their parasite biocenosis, to identify parasite species more prone to interspecific transmission and finally to evaluate possible sanitary risks where different domestic and wild host populations live in sympatric conditions. The subject of this study is the host-parasite relationship of abomasal helminth fauna and roe deer population living in a small area (6200 ha) of the Istria region, which has never been investigated previously.

Twenty two (11 male and 11 female) roe deer (*Capreolus capreolus*), coming from selective hunting in Buje Game Reserve (Croatia), were investigated for the presence of abomasal nematodes from July 2012 to January 2013. All the shot subjects were opened in fields by gamekeepers, isolating the abomasum from viscera. The abomasum was cut open along the greater curvature over a bowl, washed with tap water and the abomasal content was sedimented into 1 litre plastic cone at +4° C overnight. The sediment was added with glycerol until a final concentration of 50%; the mixture was blended well and maintained at +4° C overnight for equilibration and then cryopreserved at -20° C. Before being used, the chilled samples were thawed at +4° C overnight and equilibrated to room temperature for three hours until nematode collection and identification.

Prevalence (P), mean intensity (MI), mean abundance, relative abundance (RA), importance index (I) and parameter k of the negative binomial distribution (K) were estimated for each parasite species. Prevalence and abundance of parasites found in roe deer sharing pastures with sheep were compared with the ones living far from sheep farms, using respectively the Pearson Chi-squared test and the Mann-Whitney U test.

All animals were positive for the presence of abomasal nematodes, with total burden ranging from 3 to 2460 adult parasites. Totally, 7 species of parasites were found: *Ostertagia leptospicularis* (P=90.9%; MI=173; RA=31.6%; I=42.1), *Haemonchus contortus* (P=54.5%; MI=376; RA=41.4%; I=33.0), *O. kolchida* (P=77.3%; MI=74; RA=11.5%; I=13.0), *Spiculoptera spiculoptera* (P=54.5%; MI=102; RA=11.2%; I=9.0), *Trichostrongylus capricola* (P=63.6%; MI=23; RA=2.9%;

I=2.7), *O. ostertagi* (P=4.5%; MI=109; RA=1.0%; I=0.1) and *S. mathevossiani* (P=13.6%; MI=13; RA=0.3%; I=0.1). On the basis of the importance index, *O. leptospicularis*, *H. contortus*, *O. kolchida*, *S. spiculoptera* and *T. capricola* were classified as dominant species, whereas *S. mathevossiani* and *O. ostertagi* as codominant species. In order to have a complete picture of helminth fauna, *O. leptospicularis* and *O. kolchida*, such as *S. spiculoptera* and *S. mathevossiani*, were considered separately in the previous description, although many Authors suggest that these are alternative morphotypes of the same polymorphic species.

The parameter k was ranged from 0.05 to 0.41, confirming a general aggregated distribution of all seven species. No differences in prevalence and abundance values were encountered between roe deer living near to or far from sheep farms.

The species encountered in the study area were already observed in roe deer populations investigated in other areas of southern Europe. Their number (richness index=7) appears to be low if compared to roe deer populations of Italian alpine areas, where they share common pastures with wild and domestic bovids. However, the low richness may be affected also by the limited sample size.

The parasite community of the investigated roe deer population is characterized by highly species-specific dominant parasites (i.e. *O. leptospicularis* with its minor morph *O. kolchida*, and *S. spiculoptera*) and two other dominant species (*H. contortus* and *T. capricola*) that are generalistic species probably adapted to this wild host. In particular, *H. contortus* has been observed in wild ruminant populations mainly in areas where sheep grazing is widespread. In the present study, the absence of correlation between higher *H. contortus* burden and proximity to sheep farms may indicate that this parasite historically contaminate the entire territory (the study area was traditionally vocated to sheep farming) and that it is now possibly maintained by roe deer populations, also in the areas where its domestic reservoir host is absent.

In conclusion, although the low richness index, other epidemiological indexes seem to describe a quite good heterogeneity of host and parasite populations, which are the basis of a stable host-parasite relationship. The high MI of *H. contortus*, in consideration of its known pathogenic potential, may represents a possible cause of clinical disease. A more complete interpretation of this aspect may be revealed by the planned histopathological examination of abomasus.

Wild rabbit management in Sicily: implication for critical endangered predator

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The wild rabbit (*Oryctolagus cuniculus*) is considered a key species for the raptor communities in the Spanish Mediterranean ecosystems; the elevated reproductive rate allows it to support a high predation; it may thus influence the structure of raptor communities and support their density. Decrease of the rabbit population would affect overall species diversity in the predator community. For many predator species wild rabbit constitutes a significant portion of the biomass consumed especially for larger ones, because of its medium-small size, abundance and accessibility. Bonelli's eagle (*Aquila fasciata*) is currently threatened in all of Western Europe where its main prey species is the wild rabbit, during both the reproductive period and, especially, the phase of dispersion. In Sicily this lagomorph, non-native, is the only species of mammal of small-medium size widespread and relatively common. It presents large populations in some areas but it is also absent or much less widespread and abundant in other areas due to various factors: environmental change, disease (myxomatosis and RHD), habitat fragmentation. In this region, Bonelli's eagle is considered as critically endangered and currently it is estimated there are only 20-25 breeding pairs. For the purpose of its preservation is considered important, as well as contrasting the poaching and theft of chicks from nests, to maintain heterogeneous habitat, reduced by increasing human pressure and environmental fragmentation. Based on the eco-morphological characteristics of the species, its feeding habits and availability of prey species in Sicily, it is highlighted the importance of wild rabbit for this bird of prey in the island. Eco-morphological indicators of the skull (deep maxilla and short coronoid distance) classify Bonelli's eagle as primarily

mammalivores; its size (average weight of equal to 2250 g) and thus its metabolic and energetic requires, make that the species needs medium size prey to satisfy its necessity in the best way and therefore more advantageous for the performance of the entire life cycle. Based on the literature, the average weight of rabbits preyed by this bird of prey is of 774.7 g during the breeding period and 816.9 g in the phase of dispersion (whose about 60% results as adult). Besides the daily consumption of food by an adult is estimated in 250 g/day, while the average intake of a chick during its 60 days in the nest is calculated as 11.814 g. It should also be noted that the daily amount of biomass consumed is related to the presence of the rabbit ($r=0.95$; $=0.000$; $n=14$) in the diet; moreover the frequency of predation of wild rabbits and birds is negatively correlated ($r=-0.99$; $=0.000$; $n=6$). The positive correlation between weight and KcalME/day ($r=0.92$; $=0.000$; $n=31$) permits to estimate as 356.4 KcalME/day the energy requirements of a single pair of eagles, not considering the individual needs during the reproductive period. These considerations emphasize the importance of predation by this raptor versus rabbit; although this bird is able to replace its main prey species with other species, this has local nature and are not known consequences especially in the long term. For these reasons, in terms of management, in Sicily is not adequately considered the role that the rabbit plays within ecosystems, being almost exclusively privileged hunting-related or agronomic aspects. The maintenance of suitable habitats and appropriate future management of the rabbit is necessary for the preservation of the small population of Bonelli's eagle currently present in Sicily.

Bats distribution and conservation in the Tuscania Natural ReserveC. SOCCINI¹, V. FERRI¹, M. CIAMBOTTA², L. LANZETTI³, E. ROTA³, F. PALOMBO², A. VENTURA²¹ Studio Natura Arcadia, via Valverde 4, 01016 Tarquinia (Viterbo, Italy), e-mail vincenf@tin.it² Department of Zoology & Evolutionary Biology, University of Rome Tor Vergata, via Cracovia 1, 00133 Rome, Italy³ Ufficio Parchi, Provincia di Viterbo, Settore VII, Via Saffi 49, 01100 Viterbo, Italy

P041

The Tuscania Natural Reserve set up in 1997 by Regional Law 29 of Lazio. It covers 1901 hectares entirely within the municipality of Tuscania. Its Managing Agency is the Province of Viterbo with the Municipality of Tuscania. The area is mainly hilly ranging from a maximum of 224 m asl at San Savino (in the northern of the Reserve) to the 170-190 m asl of the town, reaching a minimum elevation of 30-40 m asl along the Marta river and in the southernmost reaches of its territory. The terrain is cloven by ravines and gullies of great scenic impact, with lush vegetation. The project records the presence and the distribution of bat species, evaluates the quality of existing bat habitat and develops recommendations for conservation and enhancement of habitat for bats along the Marta River and its tributaries. The study began in the early spring of 2012 and it terminated in the autumn of 2013. We used more bat survey techniques excluding capture methods: acoustic surveys, with ultrasonic detectors,

and visual observations, with spotlights and infrared camera. To document the presence of bat species, index and compare habitat use by bats within and adjacent the protected area we used geographic information system data. This system we used also to characterize the landscape surrounding roosting habitat and the types of roosts to understand patterns of occurrence and habitat requirements of bats in the preserve area. We did a total of 20 surveys at 18 foraging bat sites and 12 surveys of 27 potential bat roosting sites. We found varied and abundant bat fauna: 16 species including five species of local concern. The species with more abundance result: *Pipistrellus pipistrellus*, 35.35% of all surveys sites), *Pipistrellus kuhlii*, 17%, *Hypsugo savii*, 14.42% and *Miniopterus schreibersii*, 9.30%. We have also confirmed the large maternity roost of *Rhinolophus euryale* with more than 650 adult females.

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Roost selection by bats outside the breeding season: bat activity and cave structure

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PI154

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Bats and wind farms: a model for collision risk assessment

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The increasing spread of wind farms has shown that even bats, in addition to birds, are subject to mortality due to collision with rotors. Although the causes of these collisions are yet unclear, assessing the real impact of wind farms on bats and define correct mitigation measures is compulsory.

Between 2011 and 2012 we collected data on bats distribution and activity in an area proposed for the placement of 9 wind turbines, in the province of Parma, in order to identify, with standardized monitoring, the presence of the different species throughout the whole period of activity (from April to October). To define appropriate mitigation measures, we have developed a Risk Model to assess the potential impact on bats of each of the 9 proposed turbines. We calculated this model by relating the probability of bat presence in the neighbourhood of the blades with the probability that the turbines are active, together with an estimate of the "value lost" in case of an impact for each species, in terms of "Priority of Conservation". We calculated the Prior-

ity of Conservation value by taking into account species rarity, chorology and average size of a population as well as selectivity and environmental fragility of the species. Bat activity used for the model was determined at ground level. The Risk Model's scale varies between 0 (no risk) to 1 (certain risk). We calculated this model for three seasons: spring (April, May, June), summer (July, August) and autumn (September, October).

We found a different collision risk for each turbine and for different seasons. In summer, we found the largest number of turbine at high risk, probably due to the warmer temperatures that allow a higher bat activity, both in number of individuals and in the number of species. The Risk Model can be used to identify the periods of highest sensitivity of bats to the presence of a wind farm, in order to set up appropriate mitigation measures, such as switching down single turbines or increasing cut-in speed at certain periods. This would reduce bat fatalities minimizing the loss of energy production.

I Chiroterri del Parco Nazionale dei Monti SibilliniC. SPILINGA¹, E. CHIODINI¹, F. MONTIONI¹, S. CARLETTI¹, E. PETRUZZI¹, P. SALVI², A. ROSSETTI¹¹ Studio Naturalistico Hyla snc, Tuoro sul Trasimeno, Perugia, Italy² Parco Nazionale dei Monti Sibillini, Visso, Italy

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Nell'ambito del progetto di ricerca "Presenza, distribuzione e aspetti ecologici di mammiferi rari e localizzati nel Parco Nazionale dei Monti Sibillini (*Microchiroptera*, *Felis silvestris silvestris* e *Martes martes*)", dal 2012 è in corso un'indagine sui Chiroterri all'interno dell'area protetta, volta ad indagare presenza, distribuzione e aspetti ecologici delle diverse specie. L'area di studio include l'intera area protetta, all'interno della quale sono state selezionate, sulla base dell'estensione delle diverse categorie ambientali presenti, aree rappresentative, in grado di fornire informazioni sul diverso utilizzo degli habitat da parte dei Chiroterri. Oltre ad una preliminare analisi della letteratura disponibile, la verifica delle principali collezioni museali e la consultazione di banche dati, la ricerca di campo è stata condotta attraverso l'indagine bioacustica tramite *bat-detector*, sessioni di cattura *in vivo* mediante l'utilizzo di *mistnet* e individuazione ed ispezione dei potenziali *roost* (cavità ipogee e manufatti).

Relativamente all'indagine bioacustica, il numero delle stazioni di rilevamento da effettuare è stato fissato proporzionalmente all'estensione delle diverse categorie ambientali presenti nell'area protetta. Partendo dalla carta dell'uso del suolo, è stato effettuato un accorpamento delle categorie ambientali in cinque macrocategorie: formazioni arboree, formazioni erbaceo-arbustive, colture, antropico, zone umide. Sulla base dell'estensione di ciascuna categoria è stato definito il numero di stazioni di rilevamento bioacustico da effettuare, per un totale di 61 stazioni, ripartite nelle diverse categorie come illustrato di

seguito: formazioni arboree 23; formazioni erbaceo-arbustive 22; colture 14; antropico 1; zone umide 1.

I siti potenzialmente idonei alle catture, in quanto sfruttati per il foraggiamento e l'abbeverata, sono stati selezionati opportunisticamente.

L'individuazione dei potenziali *roost* è stata effettuata mediante l'analisi della cartografia disponibile, la consultazione del Catasto Speleologico umbro e marchigiano, la consulenza di Gruppi speleologici locali e l'individuazione diretta sul campo. L'ispezione ha riguardato nello specifico cavità naturali, artificiali e manufatti antropici.

A conclusione del primo anno di attività la *checklist* preliminare delle specie di Chiroterri presenti nel Parco Nazionale dei Monti Sibillini risulta costituita da nove specie, di seguito elencate: *Rhinolophus ferrumequinum*, *Rhinolophus hipposideros*, *Rhinolophus euryale*, *Pipistrellus pipistrellus*, *Pipistrellus kuhlii*, *Hypsugo savii*, *Nyctalus leisleri*, *Miniopterus schreibersii*, *Tadarida teniotis*.

Il lavoro proseguirà almeno per tutto il 2014 e sulla base delle liste regionali di riferimento ci si attende un incremento importante del numero di specie presenti all'interno del parco.

Tutti i dati raccolti, oltre ad accrescere le conoscenze relative alla presenza e distribuzione dei Chiroterri nell'area protetta, costituiranno un'importante base per indirizzare la gestione di alcuni ambiti del parco con particolare riferimento a tutto il comparto forestale.

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Conservation and management of mammals in China

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P156

China is a densely inhabited country with over 1.3 billion population size and 9.6 million km² of terrestrial area which ranks fourth among the world's nations. The topography of China ranges from the highest elevation on Earth (Mount Everest, or Chomolungma 8850 m) to one of the lowest (Turpan Basin, 154 m below the sea level). Also topography varies greatly in China, a vast land of lofty plateau, large plains, rolling land and big and small basins surrounded by lofty mountains. Habitats range from tropical to boreal forest, and from extensive grasslands to desert. This wide variety of habitats has contributed greatly to the richness of China's mammal fauna.

China is considered a "megadiversity" country and has the third highest diversity of mammals among all countries (following Brazil and Indonesia). Up to present, 583 species of mammals were found in China which accounts for 10.8% of world's total mammal species (5416). Many species are endangered, endemic or mainly distributed in China the endemic or mainly distributed Families (sub-families) and Genera include Aliuropodiidae, Ailuridae, Urospilinae, Echinisoricinae, *Budorcas*, *Moschus*, *Elaphodus*. One of these is among the most recognizable of the world's mammals, the Giant Panda (*Ailuropoda melanoleuca*).

Similarly with the tendency of world's biodiversity loss, more than 20% of mammal species in China are endangered and listed in IUCN Red List, CITES Appendices and China Species Red List. The mammals in China have been seriously threatened by a variety of causes including habitat loss and fragmentation, excessive utilization, genetic diversity loss, environmental pollution, alien species invasion and the spread of epidemic diseases. The government of China understands the serious situation of biodiversity loss. China is signatory to most major conservation conventions, such as the Convention on International Trade in Endangered Species (CITES; 1981), the Convention on Wet-

lands (Ramsar; 1992), the World Heritage Convention (1985), and the Convention on Biological Diversity (CBD; 1993). And, China's government also issued lots of domestic legislations for wildlife protection. However, many efforts often fall short in their implementation when conflicts occur between economic developments and wildlife conservation.

All measures for wildlife conservation can be divided in two aspects: *ex situ* and *in situ*. The specific protected area is one of most recognizable method of *in situ* without any doubt. The system of protected area in China includes many kinds of forms, such as Nature Reserves, National Forest Park, Scenic Landscape and Historical sites, Geological Park and Wetland Park. All of them are administrated by different governmental agencies. By the end of 2010 over 8000 protected areas had been established in China (not including Taiwan and Hong Kong), encompassing over 18 percent of China's land area, among them, over 2500 nature reserves (under the management of more than 10 governmental agencies) cover over 15 percent of the land area.

With the increase of awareness toward biodiversity conservation and environmental protection, China's government launched six giant nationwide projects for biosystem restoration since the end of last century, one of them is called "Project for Construction of Wildlife and Nature Reserves", in which lots of extremely endangered mammal species were involved for special cares, for example, the Giant Panda, Tiger, Tibetan antelope, Golden monkey, Asian elephant, Gibbon, Musk deer, Przewalski's gazelle, and so on. Through the efforts of more than 15 years, more and more endangered mammal species in China have been conserved and the situation is changing gradually, and we are willing to believe it would be better and better in the future if everyone on Earth could pay more attention on biodiversity conservation.

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La fauna del sito di Grotta Reali (Rocchetta a Volturno, Isernia) nel Musteriano finale: aspetti paleoecologici e paleoeconomici

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The site of Grotta Reali (Rocchetta al Volturno, IS) has allowed an important Mousterian occupation to be highlighted within a territory where the presence of the Neanderthals was previously unknown. Three main occupation layers have been discovered in which Neanderthals and carnivores alternatively occurred.

The palaeoecological analysis, carried out on the small mammals assemblages, has showed a diversified environment dominated by an open grassland habitat and glades with wooded areas

and water habitats (stream, river or marshes).

The large mammal assemblages are mainly composed of Ungulates (red deer, chamois, wild boar, horse and aurochs) while, among Carnivores, wolf, fox, bear and hyaena are present. The presence of some deciduous teeth of bear and hyaena, corresponding to the layers where Neanderthals are absent, suggest that, in some periods, the cave was used as a den by these species.

Bat feeding activity in different habitats at Site of Community Importance IT7110104 “Cerrete di Monte Pagano e Feudozzo” (Abruzzo, Italy)

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P043

In July, August and September 2013 a bat monitoring program was carried out within the Site of Community Importance (SCI) IT7110104 “Cerrete di Monte Pagano e Feudozzo” (Abruzzo, Italy) (surface 9 km²) managed by the Ufficio Amministrazione Foreste Demaniali Castel di Sangro, in order to draw up a bat checklist and to define management recommendations for the most suitable habitats for bat foraging. Monitoring was conducted by active (Pettersson D1000X) and passive equipment (SM2Bat and Batlogger) for a total of 139 hours in 61 different sampling sites within SCI.

The site is predominantly characterized by woodland, mostly Turkey oak *Quercus cerris* (43.4%) and to a smaller extent by beech *Fagus sylvatica* and mixed deciduous woodlands. The remaining part is covered by shrubland (23.4%), meadows and pastures (9.2%). Elevation ranges from 900 to 1200 m.

Ultrasound identification was performed by SonoChiro[®] software. Bat calls were considered to be correctly identified at species level only when probability of correct identification was higher than 70%. If lower, identification was performed by specialists. When species identification was not possible, bat calls were attributed to the genus or the group of species proposed by the software, if probability was higher than 70%. All the other bat sequences were classified as “Chiroptera sp.”.

In order to evaluate habitat suitability for bats, the number of contacts was standardized as an activity index (n. of contacts / h). A contact was considered as a bat sequence lasting 5 seconds at the most and imputable to an individual. A total amount of 1909 contacts was obtained corresponding to 20 bat species, between which many were interesting as to their conservation or biogeographic interest or for updating their distribu-

tion knowledge in Italy: *Rhinolophus hipposideros*, *Rhinolophus ferrumequinum*, *Myotis oxygnathus*, *Myotis myotis*, *Myotis bechsteinii*, *Myotis emarginatus*, *Barbastella barbastellus*, *Minioterus schreibersii*, *Pipistrellus pygmaeus*. More than 72% of contacts was from *Pipistrellus pipistrellus*, which is also the most widespread species followed by *Hypsugo savii*, *Pipistrellus kuhlii* (both recorded in over 30% of sampling sites) and *Myotis* sp. group (ca. 20% of sampling sites). The highest activity index was recorded in Turkey oak woodland (21.43 contacts/h) followed by meadows and pastures, bushes and beech wood and differences between habitat categories were statistically significant ($\chi^2=62.0544$, d.f.=7, $p<0.01$). All 20 species were recorded inside Turkey oak wood while other habitats showed a lower richness at species level. Because of *Pipistrellus pipistrellus*' dominance in Turkey oak woodland, equirepartition index was lower compared to shrubland and meadows and pastures. Some species (*Barbastella barbastellus* and all *Myotis* sp. group) appeared to be strictly linked with woodland habitats in general as their activity indexes were higher in this habitat than in the others. *Myotis* species also conspicuously foraged on meadows and pastures probably because of food availability (biomass and species diversity and richness) and because the study area is primarily covered by trees with relatively small patches of open-habitats also suitable for species strictly connected to the ecotones. Data are consistent with an area of significant conservation meaning. Our findings were useful in order to provide management recommendations, especially for woodlands and pastures, which significantly increase environmental diversity that are fundamental for bat diversity and a well-structured bat community.

An attempt to mitigate wolf-human conflict in Liguria (N-W Italy)

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P015

Likewise other regions all over Europe, after half century of absence, during the eighties wolf recolonized Ligurian mountains, from the Apennines in province of La Spezia and Genova and reached the Alps in province of Imperia. People were no longer accustomed to living alongside the predator and this resulted in severe conflicts, whose outcome was often illegal killing via traps and poison. Since wolf presence became stable, depredation of livestock represents the most widespread conflict, especially because livestock graze unattended in forests or mountain pastures and no protective systems are used, such as guarding dogs, night-time enclosures and shepherd surveillance. In order to mitigate the conflict and to protect the species, the regional monitoring project “Wolf in Liguria” launched in 2012 a preventive campaign supporting the installation of electric fences and acoustic alarm devices.

Starting from a risk model map based on livestock variables, depredation data, as well as environmental variables related to pastures, we classified every single pasture on the territory and

we assessed them a vulnerability level: those with high probability of depredation were supported with prevention systems. Up to 2011 only few pastures were equipped with prevention systems (n=6), in 2012 and 2013 we installed them in sixteen pastures more, eight per year.

We tried to estimate the effectiveness of our prevention program analyzing wolf diet during the last four years. Analyzing wolf scats collected equally in space and time, we identified the main food categories and prey species consumed by the predator. The results were expressed as frequencies of occurrence and mean percent volumes, which were analyzed in order to detect annual variations.

We observed a decrease in livestock consumption over the last four years: we hypothesized a functional response of wolves to changes in accessibility of domestic prey, which led them to greater use of wild prey. Our preliminary results may represent a fundamental step in human-wolf conflict resolution.

IX Congresso Italiano di Teriologia

Contrasting pattern of *Eimeria* spp. oocyst emission in chamois (*Rupicapra r. rupicapra*) and red deer (*Cervus elaphus*) from Italian Alps

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P176

Parasites have often been considered as partial limiting factor of wildlife populations, underlining their impact on animal welfare. Despite previous surveys showed a possible relation between coccidial infection and juvenile mortality in livestock, little information is available on the detrimental effects of protozoa infections on wild ungulate population dynamics.

Therefore we investigated oocyst emission in chamois (*Rupicapra r. rupicapra*) and red deer (*Cervus elaphus*) as dominant species in Alps whose census data are available, and we modelled through Generalized Linear Models in order to evaluate which epidemiological factors may influence oocyst emissions. Overall 96 chamois and 68 red deer faecal samples have been monthly collected through transects within the Alpe Veglia-Alpe Devero Natural Park, in 2011 and 2013 from June to November. Samples have been analyzed by FLOTAC techniques to estimate oocyst per gram of faeces (OPG). The overall oocyst prevalence was 66% and 75% respectively in chamois and red deer. In

chamois, kids emissions are significantly higher than those of adults, suggesting that classes 0 are more susceptible than older age classes due to their immature immune system. Moreover higher summer faecal OPG emissions were recorded in both chamois and red deer suggesting the positive effects of advantageous conditions of temperature and humidity even though the presence of newborn could also play a role influencing this major emission. In red deer there are no significant differences between classes 0 and adults, nevertheless in 2013 calves oocyst emissions were significantly higher than those registered in 2011. This could be caused by the snow coat persistence until July that causes energy expenditures in calves and could reduce the strength of their immune system. Future in-depth analyses about *Eimeria* spp. and other protozoa, such as *Giardia* spp. and *Cryptosporidium* spp., because of their impact on populations, have been planned, also in relation to data emerged from census, to investigate any influence between them.

IX Congresso Italiano di Teriologia

First evidence of a Parvo-textitlike virus in a red deer (*Cervus elaphus*)

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P206

Parvoviruses (family *Parvoviridae*, subfamily *Parvovirinae*) are small (18-26 nm in diameter), non-enveloped viruses which infect vertebrates. Members of the subfamily *Densovirinae* are known to infect arthropods. Parvoviruses replicate in the cell nuclei and most of them need rapidly dividing cells for replication. Consequently, they are able to infect a variety of organs with high replication rates, especially in lymphoid and epithelial tissues. Hemorrhagic enteritis and hemorrhagic mesenteric lymph nodes are common post mortem findings. In European wildlife, parvoviruses affect many carnivorous species such as wolf (*Canis lupus*), red fox (*Vulpes vulpes*) and Marsican brown bear (*Ursus arctos marsicanus*) (Canine parvovirus 2).

A 10-month-old female red deer (*Cervus elaphus*) was found dead in absence of clinical signs at a deer farm located in the Udine province (North Eastern Italy) and it was delivered to the IZSve laboratory in March 2013. The game farm houses 20 red deer reared for meat consumption and no other species. The carcass was necropsied and gross pathological data were recorded. According to the lesions, bacteriological and virological examinations were conducted.

Necropsy revealed poor body condition, rumen impaction, re-

activity of mesenteric lymph nodes and hemorrhagic enteritis. *Clostridium perfringens* was isolated from intestinal tract, while the search for *Salmonella* spp. and *C. difficile* was negative.

A parvo-like virus was observed from intestinal lesions by means of electron microscopy but it was not possible to isolate the virus. It is unclear if this detection represents an occasional finding or the virus may have played a role in the pathogenesis of enteritis. Other two deer died at the same farm but showed different pathological features characterized by heavy parasite infections and absence of hemorrhagic enteritis.

Parvoviruses are not frequent in ungulate species. Nevertheless, recently described *Partetravirus* (formerly *Hokovirus*) have been detected in swine, ovine and cattle; seropositive wild boars have been detected in Germany and these viruses have been found to be widespread in wild boars from Romania. Unrelatedly, clinical disease in hosts has not yet been associated to animal partetraviruses. A taxonomy revision proposal is under discussion and the ungulate viruses would be included in the genus *Bocaparvovirus*, *Copiparvovirus* and *Tetraparvovirus*.

According to the authors' knowledge, this is the first time that a parvo-like virus has been evidenced in a wild ruminant species.

Carnivori di interesse conservazionistico nel Parco Nazionale Foreste Casentinesi Monte Falterona Campigna

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P193

Nel 2012 è stata avviata una collaborazione tra PNFCMFC e DCBB (già di Biologia Cellulare e Ambientale) - UniPG per lo "Studio su Carnivori di interesse conservazionistico e gestionale nel Parco" tramite Metodo naturalistico e Metodo genetico. *Martes martes* (All. IV Dir. Habitat) è la specie-target primaria, sulla cui presenza nell'area protetta non si disponeva di dati scientifici oggettivi.

Prima fase; sono stati cercati, raccolti e vagliati i dati pregressi: 74 reperti oggettivi e osservazioni dirette, dei quali sono state validate 34 informazioni puntuali nel tempo e nello spazio. Gatto selvatico europeo (All. IV Dir. Habitat): 25 foto-video-catture e 3 esemplari *in carne*; corrispondenti ad un numero minimo di 28 individui distribuiti, nel tempo tra Settembre 2007 e Ottobre 2012, nello spazio su 34993 ettari (MCP). Martora: esemplare *in pelle* conservato presso il Museo di Marano sul Panaro (MO) rinvenuta *in carne* nei pressi dell'Eremo di Camaldoli il 18.01.1997. Puzzola (All. V Dir. Habitat): ripetutamente video-catturata nel Febbraio 2011 presso carcassa di cervo sul confine più settentrionale del Parco ed il 23.09.2011 occasionale rilievo fotografico di madre con figliata di 4 in tana presso San Paolo in Alpe nel cuore del Parco. Lince eurasiatica (All. II Dir. Habitat): 2 osservazioni dirette, 1 fotocattura, 1 foto di pista su neve tra 2002 e 2008.

Seconda fase: nel periodo Agosto 2012 - Dicembre 2013 risultano:

- Transetti percorsi (km) = 529
- Area boscata (km²) = 294.7
- Sforzo ricerca unitario (transetti/area boscata) = 1.795
- Depositi fecali analizzati = 191
- Depositi fecali non determinati = 68
- Depositi fecali Martora = 4
- Depositi fecali Faina = 43
- Depositi fecali Volpe = 76

Dopo il primo ritrovamento, rimasto isolato nel tempo e nello spazio per quasi 16 anni, compatibile con un fenomeno di estinzione locale, *Martes martes* "torna" a fare parte della fauna del Parco. Lo sforzo di campionamento profuso, quasi 2 km di transetto per km² di foresta, si considera adeguato per affermare che, nel Parco, nel periodo di studio, il mustelide è presente con un deme a bassissima densità relegato all'estremo margine settentrionale dell'area protetta (Valle del Tramazzo).

Le abbondanze relative dei due carnivori sintopici altamente eurieci, faina e volpe, rispettivamente 10.75 e almeno 19 volte superiori a quella della martora, suggeriscono, in termini sinecologici, una possibile causa del peculiare status di *Martes martes* nel Parco. *Felis silvestris silvestris*, dopo il processo di colonizzazione del Parco nei primi anni del Terzo Millennio, conferma l'avvenuto infeudamento di una popolazione stabile, probabilmente vitale, con possibile funzione di *source* biogeografico-ecologica. L'assenza di dati riferibili al felide nella Seconda fase dello Studio è completamente attribuibile al protocollo di ricerca di campo, interamente dedicato alla raccolta di reperti attribuibili a *Martes martes*, la prioritaria tra le specie-obiettivo. I risultati dello Studio contribuiscono ad evidenziare due fenomeni contrapposti di espansione d'areale in atto per martora e per gatto selvatico europeo: il mustelide appare procedere in direzione meridionale da *source* settentrionali, il felide procede decisamente, nell'ultimo decennio, dal sub-areale storico centro-meridionale verso l'Appennino settentrionale. Il mancato rilevamento di *Mustela putorius* nel materiale geneticamente esaminato non può dipendere da errori di campionamento, considerato che il protocollo di ricerca adottato è congruente e compatibile anche con il rilevamento di tale specie; gli esiti delle due fasi di Studio sostengono l'ipotesi che la puzzola sia, nel Parco, ancora più rara e localizzata della martora; situazione altrettanto, se non più, compatibile con i fattori sinecologici già citati per la martora. Quanto a *Lynx lynx*, non rilevata nella Seconda fase dello Studio, la sua eventuale presenza nel Parco deve essere attribuita ad immissioni clandestine o accidentali operate in più luoghi dell'Appennino Centro-settentrionale, a partire dai primi Anni Novanta dello scorso secolo. Lo Studio è *in progress*, nel terzo anno di lavoro sarà verificata l'opportunità di affiancare ai metodi naturalistico e genetico, anche il trappolamento video-fotografico e/o meccanico, particolarmente adatto a *Felis silvestris* e possibilmente propedeutico ad un progetto radiotelemetrico.

Hanno collaborato, raccogliendo dati sul campo e/o rendendo disponibili quelli in loro possesso: CTA - CFS del Parco, UTB - CFS di Pratovecchio, Stazione CFS San Benedetto in Alpe, Associazione Amici del Parco, Marco Lucchesi, Paola Fazzi, Enrico Schifano, Giancarlo Tedaldi, Claudio Bertarelli, Sara Lefosse, Danio Miserocchi, Marco Magrini, Paolo Molinari, Pier Luigi Bianchini, Maurizio Capece, Monica Bruni.

Presence of *Polychromophilus melanipherus* (Apicomplexa: Haemosporida) in *Miniopterus schreibersii* (Mammalia, Miniopteridae) colonies in Italy

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P195

Polychromophilus melanipherus (Apicomplexa: Haemosporida), a malaria-like haemosporidian blood parasite, was determined in the blood of *Miniopterus schreibersii* (Chiroptera: Miniopteridae) in Roma's agricultural surroundings by Dionisi in 1899. After a few papers on its presence in different part of Italy in the 60-70's, no more new studies regarding this parasite have been published. The species is known to infect other members of the Miniopteridae in Africa and possibly other species like *Myotis capaccinii* in Europe. The main vector is suspected to be *Nycteribia schmidlii* (Diptera: Nycteribiidae), a host-specific ectoparasite of *M. schreibersii*.

As part of a more complex approach to comparative genetics of bats, vectors and haemosporidians, 5 colonies of *M. schreibersii* were checked in the Peninsula and Sicily during summer 2012 for the presence of the blood parasite.

The bats were captured at their roosts and nycteribid flies were

collected using soft forceps and stored on 96% ethanol. A drop of blood was taken by puncturing the uropatagial vein and collected on white blotting paper (3MM, Whatman) which was left to dry and later stored in separate envelopes. From the same drop a smear on glasses was prepared and dry in the field and later stained in Giemsa.

The 5 colonies were checked located in: a) San Marino Republic (15 specimen) b) Riolo Terme (RA) (15 specimen) c) Montecatini Val di Cecina (PI) (15 specimen), d) Velo Veronese (VR) (3 specimen) e) Pachino (SR) (16 specimen).

In all the 5 colonies the haemosporidian blood parasite was found but with different prevalence: a) 80%, b) 53.33%, c) 26.67%, d) 33.33% and e) 68.75%. Ecological parameters that can influence the prevalence are under study as well as the project aim to enlarge the samples and analyse prevalences by seasons.

Activity patterns of wolves *Canis lupus italicus* in Central Italy

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P144

This study was conducted in Abruzzo Lazio and Molise National Park (PNALM) in Central Italy from January 2010 to March 2011 as a part of a broader research project on Large Carnivore conservation in 2005 through 2011. Seven wolves were captured and fitted with a GPS collar set up to record a localization every 30 minutes for 10 days (high rate) during winter season, and every 3 hours for the rest of the time (normal rate). During high rate period, cluster checking was carried out in order to gather further evidence on the types of activity.

To avoid autocorrelation of data, only the localizations collected at 6:00 am and 6:00 pm were used when estimating home range. Average home range size (ad hoc fixed kernels at 95%), was 104 km² (±37). No correlation was found between the number of localizations used and the home range size (R=0.03, p=0.9). Wolf territories within PNALM were partially overlapped (20%) suggesting that there was no significant competition for limiting resources. Dens and rendez-vous sites occupied the core area of the home range.

Even though wolves were more active at night and twilight (Diurnality Index=-0.24), they did not hunt or explore as often during the night, as shown in the cluster analysis. There was a significant difference (KW H=87, p=0) in daily activity levels with higher values between 05:00 am and 06:00 am and lower values between 12:00 am and 01:00 pm. Differences were found

among activity levels of different wolves in relation to the hourly classes of the day (KW H=15.6, p=0.008). Monitored wolves showed significant differences in activity values (KW H=38.8, p=0) but their endogenous rhythm was not synchronized with environmental periodicity (Degree of Functional Coupling $\mu=0.37$, SD=0.11). Circannual activity levels differed monthly (KW H=19.7, p=0.048): October activity appeared more intense than in May when activity was modest.

Using activity and GPS data obtained from two reproductive females, it is possible to infer that pups were born on May 28th-29th.

No relevant differences (KW H=5, p=0.41) arose from comparing distances covered by different individual wolves that travelled an average 12.6 km/day (±2.4) considering the Euclidean distance between localizations taken every 30 minutes. A correction factor was calculated in order to make more accurate the Euclidean distance calculated with locations taken every 3 hours: values should be increased by 35%-40%.

Our results confirm other studies conducted on wolves in Europe. However, interesting exceptions were found in terms of characterization of different wolf activities, mean daily distance traveled, and home range size. These exceptions appear to be related to the unique features of the study area.

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