Parco Nazionale del Cilento e Vallo di Diano

EOW

European Otter Workshop

Padula (Salerno), Italy - October 20-23, 2005

SCIENTIFIC PROGRAM AND ABSTRACTS

Università "La Sapienza" di Roma

Università del Molise

Ministero per i Beni e le Attività Culturali

2005
Parco Nazionale del Cilento e Vallo di Diano
Vallo della Lucania, (Salerno), Italy

European Otter Workshop

Padula (Salerno), Italy

October 20-23, 2005

Parco Nazionale del Cilento e Vallo di Diano

in collaboration with

Università "La Sapienza" di Roma

Dipartimento di Biologia Animale e dell'Uomo

Università del Molise

Dipartimento di Scienze e Tecnologie
per l'Ambiente e il Territorio

Ministero per i Beni e le Attività Culturali

Soprintendenza per i beni architettonici e per
il paesaggio e per il patrimonio storico
artistico ed etnoantropologico per le provincie
di Salerno e Avellino

Homage to Claus Reuther

Claus Reuther died on December 29 2004 of an heart attack. Claus Reuther dedicated his life to the protection of otters and their habitats. Chairman of the IUCN SSC Otter Specialist Group, he created and lead during 25 years the Aktion Fischotterschutz and later the German Otter-Stiftung. In 1987, he initiated the Otter-Zentrum, which has been visited by more than 1.5 million people.

Scientific Committee

Luigi Boitani, Università di Roma 'La Sapienza'
Antonio Canu, WWF Italia
Piero Genovesi, Istituto Nazionale Fauna Selvatica
Anna Loy, Università del Molise
Claudio Prigioni, Università di Pavia
Ettore Randi, Istituto Nazionale Fauna Selvatica
Gabriella Reggiani, Istituto di Ecologia Applicata

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Gabriella Reggiani, Istituto di Ecologia Applicata
Laura De Riso, Parco Nazionale del Cilento e Vallo di Diano
Nerio Baratta, Parco Nazionale del Cilento e Vallo di Diano
Piero Ferrara, Parco Nazionale del Cilento e Vallo di Diano

Program

October 20, Thursday

17.00- 20.00 REGISTRATION

October 21, Friday

9.00 – OPENING AND WELCOME FROM AUTHORITIES

9.50 – Michaela Bodner – Memento of Claus Reuther

10.00 – 13.00 SESSION 1 - DISTRIBUTION, GIS MODELLING, HABITAT SUITABILITY AND RESTORATION

CHAIRMAN: **LUIGI BOITANI**

10.00 -10.30 **Vadim E. Sidorovich** and Grigorij G. Januta (Belarus) - *Distribution of otters* Lutra lutra *in Belarus: research methods, density variation and key factors.*

10.30-11.00 Coffee break

11.00 -11.30 **Manlio Marcelli**, R. Fusillo, L. Boitani (Italy) - *Modelling otter range distribution. Implications for conservation of Italian population.*

11.30-12.00 **Xavier Janssens**, P.V. Baret, J de Kermabon & P. Defourny, (France, Belgium) – *The occurrence of otter (*Lutra lutra*) in the Cevennes (France): a GIS-based model.*

12.00-13.00 Poster presentation

13.00-14.30 LUNCH in the Certosa, offered by the Parco Nazionale del Cilento e Vallo di Diano

14.30 – 15.30 SESSION 1 – GENERAL DISCUSSION

CHAIRMAN: **LUIGI BOITANI**

15.30 – 18.30 SESSION 2- GENETICS AND CONSERVATION

CHAIRMAN: **ETTORE RANDI**

15.30 -16.00 **Ettore Randi** *et al.* (Italy) - *Assessing the patterns of genetic diversity in otter populations in Europe.*

16.00 – 16.30 **Hugh Jansman** *et al* (The Netherlands) - *Monitoring the re-introduction of otters in the Netherlands using non-invasive genetics and telemetry*.

16.30-17.00 Coffee break

17.00-18.30 Poster presentation and discussion

October 22, Saturday

9.00-13.00 - SESSION 3- HOME RANGE, POPULATION DYNAMICS, DIET.

CHAIRMEN: **JIM CONROY, CLAUDIO PRIGIONI**

9.00 – 9.30 **Jim Conroy** (UK) *The role of diet in the ecology of the Eurasian otter (*Lutra lutra*) in northern Europe with especial reference to studies in Shetland*

9.30 – 10.00 **J. Ruiz-Olmo** and R. Jiménez (Spain) *Mediterranean otters: living in an heterogeneuos habitat (stability vs. fluctuations)*

10.-10.30 Coffee break

10.30-12.30 Poster presentations and discussion

13.00-14.30 LUNCH in the Certosa, offered by the Parco Nazionale del Cilento e Vallo di Diano

14.30- 18.00 SESSION 4 - THREATHS AND CONFLICTS

CHAIRMAN: **MICHAELA BODNER**

14.30 – 15.00 **M. Santos-Reis** et al. (Portugal) *Fish farming and otters in Portugal: is there a conflict of interests?*

15.00 – 15.30 **P. Chanin** (UK) *Road casualties*

15.30 – 16.00 coffee break

16.00-16.30 **Arno Gutleb** (The Netherlands) *Prenatal exposure to endocrine disrupting compounds and possible implications for wildlife.*

16.30 – 18.00 Poster presentations and discussion

20.30 DINNER offered by the Parco Nazionale del Cilento and Vallo di Diano

October 23, Sunday

9.00-12.00 - Round Table on Otters in Italy (in Italian)**: Il futuro della lontra in Italia. Strategie di conservazione.** MODERATOR: Anna Loy

INTRODUCTION: Antonio Canu (WWF Italia), Pietro Genovesi (Istituto Nazionale Fauna Selvatica), Pierluigi Fiorentino (Ministero dell'Ambiente e del Territorio), Livia Mattei (Corpo Forestale dello Stato)

8.00 – 17.00 Post Congress Tour to the river Calore (minimum 10 people). Details will be given at the meeting

Abstracts

SESSION 1 – DISTRIBUTION, GIS MODELLING, HABITAT SUITABILITY AND RESTORATION

SESSION 2 – GENETICS AND CONSERVATION

SESSION 3 – HOME RANGE, POPULATION DYNAMICS, DIET

SESSION 4 – THREATHS AND CONFLICTS

SESSION 1 – DISTRIBUTION, GIS MODELLING, HABITAT SUITABILITY AND RESTORATION

Oral presentations

DISTRIBUTION OF OTTERS *LUTRA LUTRA* IN BELARUS: RESEARCH METHODS, DENSITY VARIATION AND KEY FACTORS

Sidorovich Vadim & Januta Grigorij

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In Belarus there is a dense river network (usually 0.3-0.6 km/km ^{2}). The majority of rivers are still fairly natural (about 60-90% in different regions) and have sufficient prey supply for otters *Lutra lutra*. Therefore, in either protected or remote wild areas, where otters are only rarely killed by people (hereafter areas with low human-caused mortality in otters), usually from 2 to 7 (up to 10), on average 3-5 otters inhabited 10 km stretch of rivers with a natural bed. There, two model rivers were monitored for 22 years: Western Berezina medium-sized river - from 5.9 to 8, on average 7.1 otters were registered per 10 km stretch (coefficient of variation = 8.5%); Volka small river - 2.4-3.8 (mean 3.1, c.v.=12.9). In other areas which are non-protected and easy accessible for people, where human-caused mortality in otters is fairly high (hereafter areas with high human-caused mortality in otters), the otter density is usually significantly lower and more variable. There, two model rivers were also monitored for 20 years: Nischa medium-sized river - from 1.4 to 5.4, on average 3.8 otters were censused per 10 km stretch (c.v. = 28.9%); Ahonka small river - 0.7-2.8 (mean 1.8, c.v.=27.7). Drainage reclamation of wetlands and canalising of rivers have been intensively carried out in all regions of Belarus in 1960s-1980s. Approximately from 5 to 30% of rivers were impacted by the drainage reclamation. Even after several years of recovering in the drained river valleys the otter number was registered to be decreased 2-4 fold in areas with low human-caused mortality in otters, while stronger decline (4-10 fold) was recorded in the areas, where human-caused mortality in otters was fairly high. Constriction activity of beavers *Castor fiber*, first of all their damming, gradually improved the deteriorated habitats. So, in 10-15 years after the habitat destruction otter population has almost completely recovered in the drained woodlands, but only some recovery was recorded in drained areas used for intensive agriculture. The method used for otter census and the population monitoring was as follows. Model rivers of various dimensions (mean width and depth) and flowing rate were chosen in both areas with low and relatively high human-caused mortality in otters. There, otters were censused in winter during suitable environmental conditions (1-3 days after the last snowfall, absence of strong frost and large emptiness under ice) by walking along watercourses (usually ice-bound) and recording of otter tracks. By investigating otter tracks, we distinguished how fresh they were, then fore and hind complete footprints (with the proximal pads) were measured. Wherever possible the sex of individuals was determined by examining the positioning of urine mark and scat: males leave urine marks on the snow in front of a scat, whereas females deposit both the scat and urine in the same place or sprinkle urine behind the scat. Mapping of the above-described track information appeared sufficiently to separate track of different neighboring individuals, and, so, count otters and calculate the species density along rivers and other watercourses. Having census data for different habitat types (various watercourses) as well as density of stream network and proportion of different stream types therein, otter population density per 100 km2 may be

estimated. In Belarus, having density of rivers with a natural bed about 0.2-0.7 km/km2, the population density of otters usually varied between 4 and 19, on average 7-11 otters per 100 km2. Seemingly all key factors determining otter distribution and numbers in Belarus were revealed during more than twenty year study. The positive factors are as follows. Firstly, it is dense river network (0.2-0.7, mean 0.4 km stretch of river with a natural bed per km2) which provide much favorable habitats for otters year-round. The second factor is intensive construction activity of numerous beavers that leads to a marked increase in prey supply and gives to otters a lot of well-protected and enough comfortable shelters especially for breeding. According to the data gained up to 60%, on average 11% of small watercourse valleys were inundated by beavers, and the damming provided up to 135 fold (mean 10 fold) increase in water area in the valleys. Creating of ponds by beavers led to an increase in aquatic prey biomass: in the warm season – up to 1403 fold, on average 372 fold; in the cold season – up to 1082 fold, on average 127 fold. Thirdly, it is a high species diversity (from 17 to 38 fish species), density and biomass of fish in water-abundant aquatic ecosystems: only the officially registered fishing bag varied from year to year on average from 130 to 250 kg/km (maximum 580 kg/km), in lakes - 16-23 kg/ha. Nevertheless, such rivers comprise fairly small part (9-13%) of the river network. The fourth positive factor is high density of common frogs *Rana temporaria* which concentrate in streams for hibernating and, so, create huge biomass therein (usually 0.8-20, up to 39, on average about 6 kg per 100 m of stream stretch). In contrast, there were several essential threats to the otter population. A decade ago the main factors negatively affected the otter population were, firstly, drainage reclamation of marshy river valleys, and, secondly, illegal trapping mostly during catching of beavers. Currently, the both threats are not so essential as it used to be. Both trapping and draining have declined in Belarus during the last decade. Meantime, another well-known threat for the otter population suddenly arose there. It is fishing with a net having fykes which is currently wide-spread in Belarus, and many otters drown in fykes each year. Still water pollution and road kills are not so marked threats for otters as it is in the West.

MODELLING OTTER RANGE DISTRIBUTION: IMPLICATIONS FOR CONSERVATION OF ITALIAN POPULATION

Marcelli Manlio, Fusillo Romina & Boitani Luigi

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Eurasian otters (*Lutra lutra*) have disappeared from north central Italy in the last decades, but remain in the southern regions. As a consequence Italian otters seem isolated from the network of central European populations. Basic information on habitat requirements and evaluation of management options for conservation of population are not still available. We surveyed a pool of 326 sites by standard method from September 2002 to August 2003 in the southern regions of the peninsula. Percentage of occurrence in the study area was 38.0. Analyzing presence-absence data from the survey we fitted an autologistic model to estimate spatial structure of otter range and environmental suitability within and out of the range. At univariate analysis stage we tested correlation with otter's presence among GIS variables quantified in multiple concentric buffers (2000 – 40000 m). Furthermore we analyzed landscape predictors also in the drainage areas of sample points. We considered four sets of GIS covariates: 1) land use, 2) idrography, 3) human, 4) topography. Univariate tests were performed with Spearman rank correlation corrected for spatial autocorrelation. At the end of model development four significant determinants were retained: 1) human density at 36 km radius (negative relationship); 2) proportion of wood.-scrub

vegetation in the riparian zone at 10 km radius and 3) presence of lakes or dams at 14 km radius (both positively associated with presence of the otter), 4) stream order (non monotonic relationship). The inclusion of the autocovariate term (30 km radius) increased the correct classification of the model from 72.4 to 86.6% and weakened the statistical evidence of human density effect. Probability of presence estimated by autologistic regression was used to construct a map of the range distribution and habitat suitability. Presence of otter showed high values in the central area of the range decreasing towards peripheries. In the Northern portion presence was confined to a small fragment. Human influence seems to act only in some large blocks inducing fragmentation of geographic range. However, other factors as past persecution of the species, low dispersal, and the sink status of the northern population are to be invoked to explain the absence of the otter in the north-east of study area. Structure of range distribution and quality of riparian landscapes evidenced geographic zones having priority to favour recolonization of unoccupied stream networks by habitat restoration.

THE OCCURRENCE OF OTTER IN THE CEVENNES (FRANCE) : A GIS-BASED MODEL

Janssens Xavier[1,2], Baret Philippe V.[2], de Kermabon Jean[3] & Defourny Pierre[1]

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The Eurasian otter (*Lutra lutra*) is an elusive semi-aquatic mammal. Its absence is difficult to prove and censuses can be full of negative observations that can be false. A model is proposed to correct this bias by predicting occurrence probabilities where surveys are negative. In case of otter signs observation in one place, the probability to find the species in another place is assumed to decrease if the distance between both places increases. This approach is tested on a 13-years otter survey dataset (3,464 data) from the National Cevennes Park (3,200 km², France). Four methods are compared and the validation is performed with 61 survey-points that were prospected each year in the Cevennes. False-negative observations are corrected independently from the model, in case of positive survey during the previous and/or following year. Observations are compared to predictions given each modelling method. The results highlight that, despite the high mobility of the otter, the distribution of its marks is limited by distances weighted by costs of moving as derived from advanced GIS (Geographical Information System) analysis. Otter doesn't occur everywhere along the same watercourse, even if the number of confluences is null, and crosses watershed limits in some places. The modelling proves the interest of describing the landscape and defining spatially weighted distances to predict otter occurrence where its search is unsuccessful.

Poster presentations

BUILDING HSI MODELS FOR THE NEOTROPICAL RIVER OTTER USING PRESENCE-ABSENCE DATA

Carrillo-Rubio Eduardo

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The lack of sufficient data regarding Neotropical river otter (*Lontra longicaudis*) populations and their distribution range has created many difficult management issues. Assisting wildlife managers by predicting areas most likely to be inhabited by otters is essential for the study of otter populations. Habitat selection by the otter was analyzed in a 25 km section of the Lower San Pedro River in central Chihuahua using two site categories: presence (n=21) and absence (n=25). Significant differences were found between both categories ($P<0.1$), and of 17 variables initially measured, four (average river depth, average river width, distance to adjacent talus/bank vegetation cover, and proportion of bank vegetation cover) provided good discrimination using logistic regression (95.65%). The data was then used to create habitat suitability index models using 90% confidence intervals for the four variables derived from the logistic regression model. The next step is to assess the accuracy of the models using out of sample data, comparing predicted habitats to areas currently occupied by otters.

ECOLOGICAL NICHE FACTOR ANALYSIS IN OTTER (*LUTRA LUTRA*) POPULATION FROM CILENTO AND VALLO DI DIANO NATIONAL PARK (SOUTH ITALY)

Cannetiello M., Bruno E., Di Bello S., Ruocco M., Valore M. & Fulgione D.

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Few examples of habitat-modelling studies of otter exist in the literature, although from a conservation perspective predicting their distribution would prove particularly useful. Analytic solutions to accommodate the lack of absence include the ecological niche factor analysis (ENFA). The functional niche is a useful conceptual tool for understanding habitat suitability, where the functional niche is defined as the area occupied by a species in an *n*-dimensional functional space. Otter distribution range has done a strong reduction during last decades, inducing isolation of the Italian population. Here it is a species to which to lend ecological and evolutionary consideration. In the present study we examine otter' ecological niche as a tool to inferred management of fluvial riverine habitat. Study area involves partial Calore basin (Cilento, South Italy). Census considers vegetation cover, bank structure and feeding habits. The multidimensional structure of niche shows a prevalence of the component in Ciprinids. Temporal switch of this food variable mainly involve reptiles and amphibians. The spatial variable that characterize the niche of the otter embrace the structural complexity of the vegetation and the dimension of the water body. The results show, moreover, an interesting overlap of niche among some months of the year. In these periods, belonging also to different seasons, the otter uses the same spatial and alimentary resources. Finally, we think that these preliminary results are useful for conservation. In fact, the effect of otter population loss in riverine ecosystem will depend on the potential for functional compensation (degree of functional niche flexibility) of the species within an environmental changing.

RESTING HABITAT SELECTION BY TWO OTTERS IN THE NATIONAL PARK OF CILENTO AND VALLO DI DIANO (CAMPANIA, ITALY)

Fusillo Romina, Marcelli Manlio & Boitani Luigi

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Otters may spend up to 70% of their time resting. Availability of suitable resting places may represent an important habitat requirement for the species especially in densely-inhabited areas. Habitat requirements and behaviour of otters in freshwater habitats of southern Europe is still poor known, and it has never been studied in Italy. We studied the resting habitat ecology of two otters captured in the Calore river basin, within the National Park of Cilento and Vallo di Diano. Otters, a male and a female, were radio-tagged and tracked respectively for 12 and 8 months between winter 2004 and winter 2005, collecting daily locations. Fifty-two resting sites for the male and 40 for the female were identified and described. At each resting site we recorded the structure type, distance to water, water depth and wetted riverbed of the nearest watercourse. Vegetation were sampled within a radius of 10 m from the resting site; furthermore vegetation and morphological features were described along 50 m reach of the nearest stream. Resting sites features were compared with those at randomly selected sites, that also were located within the home range of otters and at > 50 m from the nearest resting site. Most of resting sites were couches located in dense bramble scrub, but woody debris along the bank and in riverbed were also used. Bed of reeds, cavities and tree roots system represented other structure type used. Canopy closure, water depth of the nearest watercourse and distance to water were factors significantly contributing to resting habitat selection by otters.

EFFICIENCY OF 26 OTTER PASSES IN BRITTANY (FRANCE)

Grémillet Xavier & Simonnet Franck

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Road traffic and the road network are growing in Brittany (France). The Groupe Mammalogique Breton (G. M. B.) has been involved in otter protection for several years. For approximately 10 years the G. M. B has observed a recolonization from headstreams toward down streams, coasts and East-Brittany. These latter areas should be recolonized in the coming years. There, the road network is particularly dense. Consequently, road collisions are threatening otter recolonization. Since 1991, the G.M.B. has pressed for the construction of otter passes in order to prevent road casualties. In fact the real efficiency of these otter passes is still unknown. We studied 26 passes. We checked on the physical condition of the passes some years after their construction. We looked for indicators of the presence of otters and other riparian mammals on the pass and both upstream and downstream in order to seek verification that the passes were used and to compare the effectiveness of the passes in relation to type of road, type of pass and nature of the water course.

REINFORCING OF THE EURASIAN OTTER (*LUTRA LUTRA*) POPULATION IN ISRAEL: TRANSLOCATION AS A STEP TOWARDS RECOLONIZATION

Guter Amichai [1,3], Dolev Amit [2,3], Saltz David [2] & Kronfeld-Schor Noga [1]

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[3] Israel Mammal Research Center, the Society for the Protection of Nature in Israel, Tel-Aviv, Israel.

The Eurasian otter (*Lutra lutra*) is the only otter species in Israel, and is listed in the "Red Book of Vertebrates in Israel" as Critically Endangered. Until the mid 20th century, otters were abundant in Israel all over the coastal rivers as well as along the Jordan River from its source to the Dead Sea. However, in the last decades its range has shrunk considerable and is now restricted only to the northern parts of the Jordan River watershed. Otters are no longer exist along the Mediterranean coast plan. Currently, the otter population in Israel is estimated at no more than 100 individuals. Two factors put the otter population in Israel at risk: 1) Habitat deterioration – pollution, drainage and drying of streams and wetlands have brought about the extinction of sub-populations in three of the five catchments in where otters were historically present. 2) Fragmentation – Israel located in semi arid geographic zone and the distribution of wetlands is patchy and the connection between wetlands is limited. Anthropogenic land-use practices in the form of extensive agriculture, roads and settlements have probably brought about the complete disconnection between the two remaining sub-populations. The Israeli otter populations form the southern border of the species distribution. It is unclear whether they are connected to their counterparts in Syria and Lebanon and whether populations exist there at all. In the last three years, the Israel Mammal Research Center promoted steps to prevent further deterioration of Israel's otters and wetland habitats. Based on our experience from these years, and on recent studies abroad, we believe that translocation of individuals from healthy populations, within Israel, to former habitats, may be the only chance to protect this species from extinction. Our program aims to concentrate the efforts to improve the otter status and distribution in its historic range, by: 1) Translocating otters from occupied areas in the Hula valley, in northern Israel, to the Yisreal valley from which they were extirpated last century, but where conditions, in terms of wetland habitat and water quality have improved since. 2) Improving existing wetland habitats located in proximity to agricultural areas, and securing or creating geographic corridors from these improved sites to areas where otters are currently present. 3) Recruiting local inhabitants in the near region as partners to the success of this project.

EVALUATING HABITAT SUITABILITY FOR OTTERS THROUGH A FINE SCALE GIS APPROACH

Loy Anna[1], Carranza Maria Laura[1], Di Marzio Piera[1], Di Martino Paolo[1], Giannoni Valerio[1] & Reggiani Gabriella[2]

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The Eurasian otter survives in Italy with a viable population occurring in the Southern part of the peninsula. A standard survey run in the years 2000-2003 in the Molise region, located in Central Italy, revealed the existence of a small and likely isolated

nucleus of otters in the Volturno and Biferno river basins, which represent at present the north-eastern limit of its extent of occurrence in Italy. To investigate on quality and distribution of environmental factors that may influence otter survival and expansion in this area, , we produced a road casualties risk map and an habitat suitability map based on a fine scale GIS approach. The risk map was created considering all roads occurring within 300 m from the river stretches. The habitat suitability map was derived from the integration of three layers related to vegetation cover, fish biomass and water quality. A detailed CORINE land cover map (scale 1:5,000) of a 500m wide buffer area from each side of the Volturno river has been produced using on-screen digitizing procedures on digital aerial orthophotos. Fish availability and water quality maps were derived from the interpolation of point data available for the river basin. The general habitat suitability map was obtained through the integration of these layers. The map shows a general medium-high suitability for otters in the majority of the Volturno river basin. Considering the primary role of riparian vegetation as an indicator of dens availability and secure areas for otters movements, a narrower 50m buffer was also created along all river stretches. Inside this buffer, number and shape of patches were computed through the algorithms AREA, MPS, and MPE in Arcview (ESRI Ltd). All indices indicate that riparian vegetation is continous and abundant in the area, offering a high density of dens and resting sites.

SURVEY OF EURASIAN OTTER (*LUTRA LUTRA*) IN APULIA REGION SOUTH-EAST OF ITALY

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This research, realized nineteen years after the survey of Cassola (1986), considers alone the Apulian territory, in the south-east of Italy, it is interested from five interregional catchment basins and five regional ones. The main water course, the Ofanto and Fortore river, Cervaro, Candelaro, Carapelle, and Celone torrent has origin for more in the north-western zone of the Apulia, to the borders with the Molise, the Basilicata and the Campania region, places in which orography more turns out to be marked (Dauni Mounts, Appennine) and they are developed mostly in the Apulian plain, flow then, in the Adriatic sea. Important are the apulian lagoons of Lesina and Varano. Beside these natural lagoons they are from mentioning the Alimini Lake and those craft them, represent from the Occhito dam on the Fortore river, the Capacciotti and the Locone dam, derivation of the Ofanto river. For how much it concerns the wetland, the more important are that coastal of Guaceto Tower, the Margherita of Savoia salinas and the Cesine marsh. The smaller wetland have not been considered why not thought suitable in order to accommodate the Eurasian otter (*Lutra lutra*). Surveying is begun in the February of 1998 until the spring of 2005. The first phase is articulate, for a cognitive approach of the areas with in inspections on the field, bibliographical interviews to the local population, searches on the historical presence of the otter in the apulian territory and on the ecological study of the monitorate areas (river morphology, water regimen, vegetation cover along river banks, etc). The second phase has been based following the IUCN/SSC Otter Specialist Group standard methods (Reuther, 2000). The choice of the place has been based essentially on the topographical position, on the facility of attainment of the accesses to the situated one and to the historical places of mark, beyond that on experiences passages and the requirements of cover of the areas. The monitoring has put in evidence an express trend negative for the species to leave from 1970. The only site turned out positive is the feature of the course of the Ofanto river from the mouth to the border with the

Basilicata and Campania region (included affluent its and the dam ones crafts them) (Cripezzi et alii, 2001). Interesting is the notice, much sure one, of an individual ended in a net for the peach of Anguilla anguilla in the lagoon of Lesina in 2002 and of a currently visible individual of otter (2005) in the lagoon (Trombetta, in verbis), during the survey has unfortunately not been found no sign of presence. The otter turns out absent in the Fortore river (Apulia region) while the presence of a small nucleus in the feature between Campania and Molise region (Marcelli in verbis). In the remaining wetland, otter was present until 1970, the species currently turns out to be absent.

HABITAT SUITABILITY FOR RIVER OTTERS, *LUTRA LUTRA* (L.) ON THE KRKA, CETINA, LIKA AND UNA RIVERS IN CROATIA

Medunić-Orlić Gabrijela & Bogić Ivana

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Growing development in Croatia (highroad, tourism, construction activities, hydroelectric dams, etc.) has caused higher pressure on nature resources, consequently on river otter habitats. For qualitative nature conservation and proper management of nature in Croatia it is necessary to conduct different scientific researches. Researches of the otter species, *Lutra lutra* (L.), their distribution, population and habitats suitability are first step towards the conservation of this legal protected species. Conservation of otter will lead towards the conservation and preservation of the rivers. Field surveys and identification of habitats and potential habitats on the Krka, Cetina, Lika and Una rivers in Croatia by using the Standard method were first part of this work. After that, habitat's parameters: water quality (class of water according to dissolved oxygen, organic matter, microbiological and biological indicators defined by European Environmental Agency and Croatia law), vegetation cover, human impact factors and human population density are correlated in order to identify how they affect habitat suitability for river otters.

MOVEMENT, HABITAT AND POPULATION DYNAMICS OF THE OTTER IN IRELAND – AN APPROACH COMBINING GIS, MULTIVARIATE ANALYSIS AND MATHEMATICAL MODELLING

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The Eurasian otter (*Lutra lutra*) is listed in Appendix II of the EU Bern Convention (82/72/EEC), Annex II of the EU Habitats Directive (92/43/EEC), Appendix I of CITES and in the 2004 IUCN Red List as a near-threatened species (Baillie *et al.*, 2004). The otter was found to be present in 90% of the sites surveyed in the last national spraint survey of Ireland. In spite of the apparent importance of the Irish otter population, information is limited to a small number of spraint surveys at a national and local scale. At present information on suitable habitat, territory size, space use, demographic rates, and population density are very scarce. This project aims to develop a spatially explicit population simulation model for the otter. Such models predict population size and stability, and the effects of landscape modification on the population. This information will be used primarily to help in the evaluation of Ireland's proposed SAC network. It will also be useful in Environmental Impact Assessments (EIAs); predicting the effect of habitat degradation, increased fragmentation or barriers to dispersal on the otter. Information on the habitat and space-use of otters

across a range of landscape types (e.g. rivers, lakes, bogs) using radio-telemetry are being collected. A cadaver survey is also underway to investigate demographic patterns, including age-specific mortality and fecundity. Cadavers are also being used to investigate PCB loadings and parasitic ecology of Irish otters. Preliminary results on 2 otters tracked gave territory sizes of 7.2km and 8.5km respectively for an adult female and juvenile male. Both ranges overlapped though the intensively used areas did not, and included a wide range of habitat types including woods, farmland and a small town of 2,000 people. Trapping was carried out using soft-catch leg-hold traps coupled with trap transmitters and the trapping rate for 9 otters (2 escaped) was 2.9 trap-nights per otter. Tracking data for 7 otters is expected to be compiled by early October. We have collected 23 otter corpses so far and expect to have completed processing this sample by October.

DISTRIBUTION AND HABITAT USE OF THE OTTER IN RELATION TO LAND USE IN THE ARAGLIN VALLEY, SOUTHERN IRELAND

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The survey, conducted from October 1995 to June 1996 in the Araglin Valley (counties of Cork, Tipperary and Waterford), has permitted to define the distribution and habitat use of the otter in the study area. Otter signs (tracks, spraints, jelly, holts, etc.) were observed, identified and/or collected walking along both banks of the watercourses (Araglin, Glenfinish and Douglas) and average environmental conditions (river depth, river width, flow regime, vegetation cover, etc.) were recorded for each site. From the analysis of otter signs, it was found that the otter occurred throughout the entire study area except above waterfalls and on streams which had low water flows or temporarily dried up. In compare to the previous surveys, new sites for the otter presence were found. Statistical analysis suggested a significant relationship between spraints and other otter signs that can be a proof of otter presence. Significant correlations were recorded between otter signs and river depth, river width, lying-up availability and presence of holt, but non-significant trends were found between otter signs and vegetation cover and speed of water. Positive relationship was recorded between spraints and vegetation cover in the agriculture and moorland habitats. On the contrary, negative correlation was found in the forest sites. These results can be explained by otters selecting habitats with good holt availability and deep pools where it is easier to hunt. In conclusion, the otter population can be considered healty in the Araglin Valley. The data presented here is unique in terms of the detailed approach and, for the first time, preliminary results of interactions between land use and otter population were presented.

HOW MANY OTTERS LIVE HERE? ESTIMATING NUMBERS AND DENSITIES OF OTTERS USING GIS

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Knowledge of distribution, numbers and densities of a species is essential for its conservation and/or management. However in case of the European otter such data are difficult to obtain as it is night active, secretive and solitary. Snow tracking is considered as the most cost effective method for estimating otter numbers in relatively small areas. The data on otter densities in six different areas of the Czech Republic obtained by snow tracking (1-28 adult individuals per 100 km^2) were related to various landscape factors taken from digitalised maps 1:50.000 and the relation between the otter numbers and the length of ponds' banks was found. The population size of otters within the territory of the Czech Republic was estimated to range between 1.600 to 2.200 adult individuals in dependence whether the population development in the last decade is considered or not. As dependent cubs constitute about 24% of the adult population, additional 500 to 700 individuals are expected. Present extrapolation allows to estimate the potential number of otters which could live in the Czech Republic (4.300 adult individuals) if otters would be present all over the country.

HOW MANY OTTERS ARE THERE IN ITALY?

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Within the Mediterranean basin, Italy is the country with the most critical situation for the otter (*Lutra lutra*). In this paper we analyse the change in otter distribution throughout the last 20-years and estimate the overall population size using data collected from 2001 to 2004 in the Pollino National Park, which represent a large portion of otter current range. According to the 1:25 000 national maps (IGMI, Istituto Geografico Militare Italiano, 10x10-km squares), we evaluated a current otter range of 9500 km^2, disjoined in two areas: Molise region (9.5%) in central Italy, and Basilicata, Campania, Calabria and Puglia (90.5%) in southern Italy. From 1984-91 to 2000-04 otter range vanished in the north, decreased in the centre and increased in the south. It is not clear if this increase is due to the development of otter surveys or to an effective expansion of otter distribution. Otter presence is currently recorded for 66 watercourses, with different percentage of positive sites (river stretches) for otters (i.e. 81% and 53.4% for Agri and Crati catchments respectively). By genetic typing of fresh otter spraints, 34-37 animals were estimated in the Pollino National Park, corresponding to a density of 0.18-0.20 otters/km of watercourse. Extrapolating these densities to the linear development of the main watercourses hosting otters (about 1140 km), we assessed a total population size of 205-228 otters. A similar evaluation (190-206 animals) was obtained as proportion between the distribution area of otters in the Pollino National Park and surroundings (about 1700 km^2) and the overall estimated range. In the next future, one of the greatest risks for the otter is the isolation of the central Italian populations, relatively distant from those of the southern

range, which represent the potential natural source of colonisation. In addition, it is worrying the recent disappear of the species in the River Crati (only some tributaries still host otters), which could compromise the southward expansion of the mustelid. A National Action Plan for the conservation of otters is needed and an annual monitoring by non-invasive surveys is recommended in order to define the population trend.

MONITORING OF THE OTTER RECOLONIZATION OF POLAND

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The Standard Method was used for three field censuses of the otter distribution in Poland. In the first national survey in 1991-1994 evidence of otters was found throughout the country, with 80% positive of 2000 sites visited. Only two areas, Silesia in the south and Central Poland had very few signs of the species. The following census of Central and Eastern Poland (1996-1998) showed the otter expanded its range and recolonized much area of Central Poland, including ca 700 km of rivers in the tributary of river Bzura. The number of positive 10x10 km UTM squares increased twice as compared to first survey (in 1991-1994). The rate of expansion was very high in comparison to other studies in Europe which can be most probably contributed to functional cohesion of network of rivers and lakelands in Poland. The expansion of otter was accompanied by change in habitat selection: the index of preference for optimal habitats (unregulated rivers with tree and other vegetation cover) decreased while suboptimal and marginal habitats (channels, regulated rivers in towns etc) were occupied more frequently as compared to first survey. The survey of Lublin province (Eastern Poland) in 2003 documents further increase in the range and percentage of sites with the evidence of the otter. The negative side-effect of the expansion of the species is increasing pressure of fishpond owners to permit shooting of otters and/or develop state system for damage compensation.

FIRST SYSTEMATIC SURVEY OF OTTER *LUTRA LUTRA* IN CROATIA. PRELIMINARY RESULTS

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According to the Red Data Book of the Republic of Croatia published by the State Institute for Nature Protection in 2004 the Eurasian otter *Lutra lutra* is classified as Data Deficient (DD) due to the lack of sufficient data required to assess the population status and distribution. Otter presence is reported for some rivers, but no systematic monitoring for the presence of otters in Croatia has been carried out yet. In February 2005 we started a systematic survey of otters in the Croatian rivers following the standard method recommended by the IUCN Otter Specialist Group. A total 27 sites were checked for otter sings between June 2004 and July 2005. All sites are located along the rivers Krka (5 sites), Cetina (7 sites), and Lika (15 sites). Otter signs were found in 19 over 27 sites (70%) . Positive sites were found in Krka and Lika rivers, with 80% and 100% of positive sites respectively. No signs of otters were found along the Cetina river. All positive sites are located between 30 and 550 m asl. These preliminary results suggest that otters in Croatia might still occur in good numbers. Nevertheless, the absence of signs of otters in one over three rivers checked indicates

the need to complete the survey on all Croatian rivers to have a more realistic estimate of the status of the species in the country.

SESSION 2 – GENETICS AND CONSERVATION

Oral presentations

ASSESSING THE PATTERNS OF GENETIC DIVERSITY IN OTTER POPULATIONS IN EUROPE

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Thanks to a joint effort of the IUCN Otter Specialist Group (which was strongly endorsed by the late Claus Reuther), and of the Italian Wildlife Institute (INFS), we collected and analysed more than 700 individual otter samples from 20 countries in Europe and Israel (including natural, reintroduced or restocked populations, and captive-reproduced individuals), plus scat/spraint samples (n = 250) from southern Italy. These samples were genotyped at the Laboratory of genetics of INFS using 11 autosomal microsatellite loci and mtDNA sequences. Moreover, after cross-calibration of allelic molecular weights, we added ca. 650 individual genotypes obtained from English and Swedish otter populations. Genetic data were analysed aiming to describe the main patterns of genetic diversity in otter populations sampled across Europe, to estimate population structure and subdivisions, and eventually identify the genetic consequence of translocations. Results showed that otters in Europe are genetically variable, but not strongly differentiated geographically, suggesting recent origins from a common source population. Some local populations showed, however, signals of genetic divergence, perhaps due to recent isolations and strong bottlenecks. In particular, an otter population in southern Italy (which was genotyped using an improved non-invasive protocol) showed shallow genetic distinction from all the other populations in Europe. Otters from Israel were sharply divergent from all the other populations in Europe, showing that microsatellites can be used to describe population divergence. While the microsatellites were variable as usual in mammalian populations, the mtDNA sequences showed unusually low variability, and could not be used to reconstruct a phylogeography of extant otter populations. However, genetic distances and inferred genealogical relationships allowed identifying some mtDNA haplotypes which were sharply distinct from all the other. These haplotypes most probably originated in the UK captive stock (Otter Trust), and could be of non-European origin. These mtDNA haplotypes, and a few microsatellite alleles can be used as molecular markers to trace the origin of released captive-bred otters.

MONITORING THE RE-INTRODUCTION OF OTTERS IN THE NETHERLANDS USING NON-INVASIVE GENETICS AND TELEMETRY

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Between 2002 and 2004, 21 otters have been released in the re-introduction area in The Netherlands. Details of this project can be found on the website: <www.otter.alterra.nl>. Within this project Alterra is responsible for the monitoring. This is mainly done using telemetry and DNA typing of spraints. The aim of the monitoring is to check the behavior of the otters during the exploration phase, check where they settle down, analyze their activity pattern, range, interactions, reproduction and whether there are still bottlenecks that have to be adjusted in order to reduce the risk of casualties. All otters received an implanted transmitter and a DNA sample from all otters was taken before release. The telemetric results will be briefly discussed in the presentation. At Alterra laboratory, experiments were performed regarding conservation and extraction methods of DNA, distribution of the DNA in spraints, and PCR conditions in order to increase the success rate of analyzing DNA from spraints. In the dense vegetation of the marshes in the re-introduction area, spraints can be found and gathered relatively easy in the period of November-April. Almost 200 fresh spraints were collected during that period last year. One nuclear marker was used to discard samples without DNA (~30% discarded). Of the remaining samples, several PCRs were carried out for 5 tetranucleotide microsatellites. In the case of parental assignment or confusing identification, two additional primers were used. Sex was also analyzed using a SRY primer. Approximately 30-35% of the remaining DNA extractions from spraints resulted in the identification of the otter. This percentage could be increased to 45-50% when telemetric information regarding the possible otters around the spraint location was used in combination with incomplete genetic data. Allelic Drop Out and False Alleles resulting in error rates of ~30% and ~10% respectively were found to be a major problem. Ten different individuals have been identified (4 ♂, 5♀, 1?) since last November. From those four were new born otters, and their parents could be determined based on the allele combinations. DNA typing of spraints is an interesting method, but is still time consuming, costly and the success rate has to increase to become an interesting method to apply on a larger scale. Due to the many genetic errors this method can lead to a huge overestimation of the population when the data are not critically screened. The Dutch re-introduction project is an interesting example to evaluate this non-intrusive method since from all released otters a DNA sample has been taken. Therefore we are able to check for genetic errors in more detail. Interesting facts regarding the population ecology as dispersion, reproduction and parentage could not have been gathered without this technique. After the batteries in the transmitters fail, this technique is still able to tell you the location of the individual otters. All together it is recommended to continue in optimizing this promising method.

Poster presentations

NON-INVASIVE GENETIC SAMPLING OF THE EURASIAN OTTER (*LUTRA LUTRA*) USING HAIR SAMPLES

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The material for the genetic characterisation of wild Eurasian otters (*Lutra lutra*) has previously been derived from carcasses and spraints. Hair samples however have proved to be a much more reliable source of DNA than spraints, and offer the opportunity of sampling the living population non-invasively. Until now there has been no research into methods of sampling hairs from wild otters or on the DNA extraction efficiency from these hairs. A hair trap was therefore developed and tested on otters in captivity. Traps were entered on five nights out of seven and successfully collected hair on three nights. Preliminary trials indicate that hairs can also be sampled from otters in the wild using this method. The suitability of genetic analysis from otter hairs was examined using paired samples of hair and tissue taken from 15 individual otters recovered from road mortalities. DNA was extracted from the tissue samples using a Protinease K digestion in a PCR compatible buffer. This process had a 100% success rate. Individual root hair segments were treated by Chelex Ionic bead resin treatment and Protinease K digestion in a PCR compatible buffer. The Chelex method gave a 55% amplification success rate while the Protinease K method gave a much higher amplification success rate of 87%. The DNA extracts were typed for 8 microsatellites Lut 435, 457, 615, 617, 715, 832, 833, 835 and 902 using the latest versions of the primers. Proportions of allelic dropout and false allele detection associated with hair DNA extracts were estimated by comparing the genotypes of hair extracts with the genotypes from tissue. Preliminary attempts to develop a ZFX/Y assay to sex otters identified polymorphisms between ZFX and ZFY sequences, but typing based on restriction digests requires further optimisation. The use of recovered DNA from hair offers a step forward in the study of Eurasian otter populations as its continuing endangered status in many countries creates legal and ethical constraints on capturing animals for marking or radio tracking.

POPULATION STRUCTURE IN THE EURASIAN OTTER IN SWEDEN THROUGH NONINVASIVE GENETIC SAMPLING

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Conservation and management of threatened or vulnerable species require data on population structure. However, these data may be very difficult to obtain for elusive and nocturnal species. Non-invasive genetic sampling has become an alternative for such species. Through repeated sampling of faeces over years, we have genetically identified the different individuals in an Eurasian otter population in Sweden. With genetic data, we have estimated population size, sex ratio, and turn-over rate of

individuals in the area. This study gives further knowledge about the population structure of the Eurasian otter and shows that non-invasive genetic methods are useful tools to obtain these kinds of data.

TESTING THE ABILITY TO RESOLVE POPULATION PARAMETERS OF EURASIAN OTTERS WHEN USING THE METHOD OF DNA FINGERPRINTING ON SPRAINTS

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The method of DNA fingerprinting using DNA extracted from spraints is non-invasive and potentially able to provide significantly more information on individuals and populations than traditional methods. Several research projects are currently improving methods of extraction and typing of DNA from otter spraints while other studies are starting to actually use this method as a way to census and monitor otter populations in the field. Our study seeks to fill the gap between these two kinds of studies, by providing a first estimate of the ability of DNA fingerprinting to resolve population parameters of otters in the field. We applied the methodology to a population of newly reintroduced otters of which we knew the genetic profiles. We monitored the population for a period of seven months after release, collecting spraints to be used for DNA analysis. We then compared the results from the spraint sampling programme and the subsequent DNA fingerprinting, with the composition of the population and evaluated the number of animals detected, the sex ratio of the population, the frequency with which each animal was detected, and the pattern of spraint deposition. We discuss the results in the light of the benefits and constraints of the field side application of this methodology.

DISTRIBUTION OF OTTERS GENOTYPES OBTAINED FROM NON-INVASIVE SAMPLES IN A REINTRODUCTION AREA

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Between 1995 and 2000, 42 otters were released in north-eastern Catalonia (Spain), ten years after the last record of otter presence in this area. Our group is monitoring the evolution of this reintroduced population by genotyping DNA obtained from otter spraints and jellies with microsatellite markers. During winter 2004, we collected 128 samples which were stored in ethanol 96º at -20ºC until DNA extraction. A first test on sample quality was performed by amplifying a mitochondrial fragment prior to genotyping. Successfully amplified samples were analyzed with 10 microsatellite markers and a Y-chromosome marker, by singleplex or following a multiplex pre-amplification protocol. Blood samples of 25 founders were obtained before releasing and stored at -20ºC prior to extraction and genotyped with the same markers. The aims of this study are to identify individual otters in the reintroduction area, to try to establish paternities, and to monitor the evolution of genetic diversity by comparing the allelic frequencies of the sampled wild population with those of founder otters. This

information is necessary to evaluate the reproductive success and viability of this reintroduced population. We have obtained partial or complete genotypes from 40% of the samples. Genotypes belong at least to 18 different individuals distributed over three basins in northeast Catalonia (rivers Muga, Fluvià and Ter). None of these animals apparently matches with any of the 25 founders analysed. We found new alleles not characterised among founders, this could be due to a samples bias, since not all founders were analysed, or to current gene flow from other otter populations.

FACTORS AFFECTING THE SUCCESS RATE OF SPRAINT DNA ANALYSIS

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Genetic typing of spraints is a new but increasingly used method for studying Eurasian otter (*Lutra lutra*) populations. It allows identification of individuals, assessment of population size, sex ratio and population genetic structure, as well as estimates of relatedness and minimum home range size. However, the method is presently very time-consuming and costly, and hampered by a low analysis success rate and other methodological problems. DNA extracted from faeces is generally of low quality and quantity, and the amount of amplifiable DNA between the samples is highly variable. Within our project, the influence of multiple variables on the amplification success rate of microsatellite DNA extracted from spraints was investigated. Fresh spraint (otter faeces) and anal jelly samples were collected in the field and divided into several sub-samples with different preservation/extraction method and variable storage time. Other analysed factors included type of sample (spraint; spraint with jelly; anal jelly), collection time (time when sample was collected in the field), freezing time (time when collected sample was put into -20 °C freezer), collection temperature (air temperature at time of collection), minimum temperature (minimum air temperature in the preceding night), state of the sample in the field (unfrozen; frozen but possible to divide into tubes; deep frozen, therefore collected into plastic bags and divided into tubes after arrival from the field), locality, and amplified locus. In general, the success rate (i.e. number of successfully genotyped samples) varied from 40 % (spraints) to 80 % (anal jellies). A generalised linear mixed model was used to investigate the influence of these factors on positive or negative PCR (polymerase chain reaction). Initially, the influence of single factors was tested, followed by combined models and factor interactions. All analyses were carried out using SAS statistical software. Following factors were significant in single factor models: type of sample, collection and freezing time, collection and minimum temperature, state of the sample, preservation/extraction method and locus. Storage time and locality had no significant effect on PCR success rate. The highest proportion of positive PCRs was found for anal jelly samples (68 %), followed by spraints with jelly (56 %); and the lowest for spraints (39 %). Increased temperature had a negative effect on PCR success rate. Further statistical analyses are being carried out at the present, to identify the most suitable conditions for effective non-invasive genetic sampling in Eurasian otters. The

project is supported by the Grant Agency of the Czech Republic (grant no. 206/03/0757).

GENETIC DIVERSITY, RECOLONISATION PROCESSES AND GEOGRAPICAL MODELS IN SOUTHERN UK OTTERS (*LUTRA LUTRA*)

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The Eurasian otter (*Lutra lutra*) has declined significantly across its European range and in the UK there has been a severe decline, particularly during the late 1950's and early 1960's. By the mid 1970's the UK population was largely confined to strongholds in parts of Scotland, Northern Ireland, mid and West Wales and the West Country. In recent years the otter population has started to recover. Otter surveys confirm an increased distribution of otters in Wales, exceeding BAP (Biodiversity Action Plan) targets. Scotland has also shown signs of recovery, and in England, population expansion and recolonisation is believed to be occurring both through breeding and by dispersal, from the west (South west England and the Welsh borders) and from the north (Scotland). However, little is known about the degree of genetic loss due to the decline, potential barriers to recolonisation, routes of dispersal, or the contribution of reintroduction programmes to population increases. The project aims to use tissues collected from over 500 otters (complete with geographic location) found dead on roads in Wales and England, to analyse the genetic diversity and structure of otter populations. Using molecular genetic analysis of the otter population, we will identify whether and when bottlenecks occurred, whether population decline has resulted in a loss of genetic variability, and to what degree. Spatial patterns in genetic data will be analysed, to identify clines, isolation by distance and genetic boundaries to gene flow; the contribution of introduced animals will also be assessed. Geographical information systems (GIS) data will be used to map spatial genetic patterns and to generate hypotheses about the potential cause of genetic boundaries such as landscape or environmental features.

ASSESSMENT OF OTTER POPULATION SIZE IN TREBONSKO (CZECH REPUBLIC) USING A NON-INVASIVE GENETIC METHOD

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The otter (*Lutra lutra*) is an elusive animal, being rarely observed and difficult to study. Information on its abundance and population structure is often insufficient. In the last few years a non-invasive genetic method based on the DNA extraction from non-invasively obtained material has become available. Using this method it is possible to identify individuals and their sex, and to obtain information on population size and structure. In the Czech Republic, non-invasive genetic research of an otter population is being carried out in the 100 km^2 area in the Trebonsko Biosphere Reserve &

Protected Landscape Area. It is a fishpond region with a lowland river and a high number of large eutrophic fishponds, mostly connected by a complex system of channels. Fresh spraint (otter faeces) samples were collected in the cold months of 2003 and 2004. Their position was recorded using GPS. They were soaked in different buffers or ethanol and stored frozen. In total, 250 samples have been collected and 106 samples have already been analyzed. DNA was extracted using Qiagen and Invitek stool kits. The samples were typed at six microsatellite markers (Lut 701, 715, 717, 832, 833 and 914) and Lut-SRY/914 was used for sex identification. The analyzed samples cover approximately 65 % of the research area. Around 60 % (64 samples) have been successfully genotyped and 28 individual otters have been identified, 17 males and 11 females. A further 144 samples will be analysed and the sex, relatedness, movement and minimum home ranges of all individuals will be assessed. The project is supported by the Grant Agency of the Czech Republic (grant no. 206/03/0757).

SESSION 3 – HOME RANGE, POPULATION DYNAMICS, DIET

Oral presentations

THE ROLE OF DIET IN THE ECOLOGY OF THE EURASIAN OTTER (*LUTRA LUTRA*) IN NORTHERN EUROPE WITH ESPECIAL REFERENCE TO STUDIES IN SHETLAND

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Otter numbers, at least in parts of northern Europe can fluctuate quite dramatically in a very short period. For example the population appeared to decline by over 30% in 12 months. In this paper, I will describe the results of a long-term study monitoring otter numbers on Shetland, examine what might be described as 'normal' behaviour at times when populations are strong and the changes that occur in that behaviour at the time of decline and recovery. The implications of this as regards the survival of local populations will be discussed. I will also examine what these changes mean viz a viz otter surveys and SAC monitoring.

MEDITERRANEAN OTTERS: LIVING IN AN HETEROGENEOUS HABITAT (STABILITY VS. FLUCTUATIONS)

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Otter (*Lutra lutra*) is a semiaquatic Mustelid. So, this species inhabits aquatic ecosystems (freshwaters and atlantic marine). This means that otters need water and that this resource acts as a limiting factor. For example, there are not otters living in the deserts. However, there are otters living in semidesertic or dry areas lacking in

water. This is the case of the Mediterranean ecosystems, were there are water shortages in Summer time. For example, during the 1994-96 Spanish Otter Survey, otters were found living in 50% of the sites dry in Southern Spain, and in most of the sites with the water restricted to small and unconnected pools. In other way, such ecosystems have heavy rains and floods, mostly during spring and autumn time. Finally, Mediterranean countries have high mountains, and otters can live in very different altitudes and climates across a single home range (from frozen waters to floods and droughts). So Otters are inhabiting in very extreme situations, and present different ecological and ethological patterns than elsewhere in Central, Northern and Eastern Europe. We present some results, showing how otters must be able to answer in different ways according to changes in the resources, specially food, shelter and water. This, also, have important effects on its conservation.

Poster presentations

USE OF SMALL AND MEDIUM-SIZED RESERVOIRS BY OTTERS IN A MEDITERRANEAN AREA IN THE SOUTH OF PORTUGAL (MONFURADO NATURA 2000 SITE)

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Medium-sized water reservoirs are aquatic systems common in Mediterranean areas, where rivers flows are strongly irregular and many dry during summer periods. However, studies concerning otter's use of these systems are scarce. The main goal of the present study was to access the use of these water reservoirs, in a Nature 2000 Site located in southern Portugal, and to determine the environmental factors that have more influence. The occurrence and quantification of otter signs in transects along their margins, in wet and dry seasons, were used as surrogates of intensity of use. Otters used the majority of the reservoirs under study (77% in the wet season and 70% in the dry season). Higher sprainting intensity was observed in dry season. Presence of the species was related with prey availability, land use in the surrounding area, human disturbance, characteristics of surrounding water courses and reservoirs' perimeter. We computed the Spearman's correlation coefficient between spraint intensity and each of the environmental descriptors studied. Positive correlations were found with food availability, some reservoir's characteristics and number of water courses around them; negative correlations were with types of water courses and land uses with no vegetation cover (dry season) and cattle settlements (both seasons). On wet season we also found some positive correlations between number of presence signs and two types of land uses with vegetation cover. Multivariate Regression analyses showed a positive association of spraint intensity with number of marking sites, water availability, Montado (*Quercus* sp. forest) with shrubs (dry season) and American red swamp crayfish abundance (both seasons). Annual cultures and the quantity of water courses in the surrounding area were also important but presented a negative association with sprainting intensity (dry season). Elevation is also associated positively with number of presence signs, while levels of nitrogen in water and distance to farmhouse present a negative association (wet season). Our results suggest that small water reservoirs are important to the otters in the study site, being these used in both

seasons, which may help to explain the species broad distribution in the area. Due to the small size of the reservoirs studied, none seems to act as barriers. We emphasise the benefit that the species gets from the presence of small and medium-sized water reservoirs in areas where most water courses dry total or partially during summer. The reservoirs are probably suboptimal habitats, used essentially for feeding and often associated with availability of refuges in small streams nearby. Lower water pollution, cattle and human pressure are also related with higher otter use. Specific management actions for the Monfurado Natura 2000 Site are required, concerning these water reservoirs. Their location and management must reflect a compromise between human needs, conservation of riparian vegetation and availability of other water reservoirs.

ENVIRONMENTAL AND GEOGRAPHIC CORRELATES OF DIET VARIATION OF THE OTTER (*LUTRA LUTRA*) IN ITALY

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Reduced range of otters in Italy calls urgently actions favouring the expansion of the extent of occurrence and the increase of occupancy. Several studies evidenced the importance of food availability in regulating factors such as reproductive performance, mortality, and density of otters. Basic information on the abundance and quality of trophic resources available to otters at range-scale in Italy appears thus important for conservation purposes. Monitoring and managing key food resources may represent a strategy for otter conservation. Diet analysis may shed lights on resources really available to otters across their distribution giving also the opportunity to indagate which factors, and where, influence the trophic resources. We hypothesized that geographic, hydrographic, anthropogenic variables, and climate affect otter prey and mainly fish. To study diet variation across the otter range, we collected and analysed 1853 spraints from 43 sites of 16 different basins. Spraint collection was stratified with respect to water habitat, including artificial water bodies. We recorded reach-scale environmental variables (hydro-morphological features, water regime, temperature, bank and riverbed vegetation), furthermore we quantified landscape attributes in the drainage area of the sites and within 4-10 km concentric buffers. Diet composition was quantified by relative frequency of occurrence (RFO), biomass percentage and relative abundance (RA)**.** The Levin's niche breadth index B (applied to RFO) was used to quantify trophic diversity. Diet variation was also evaluated in terms of number of prey species in basic categories (fish, amphibians, crustaceans, reptiles, invertebrates, birds and mammals). RFO, and Levin's B and fish richness in diet were used as response variables in statistical analyses. We performed a direct gradient analysis on RFO and multiple regression on B and fish richness to relate trophic and environmental variables. Results showed the importance of location (geographic coordinates), stream gradient, water habitat availability and river condition as sources of variation in number of prey, diet composition and trophic niche breadth. Controversial effect were evidenced for land-cover and anthropogenic variables. Otter trophic diversity showed also variation in relation to probability of presence modelled as a function of contagion measure of otter distribution.

THE EUROPEAN OTTER (*LUTRA LUTRA*) IN THE MEDIUM BASIN OF THE FORTORE RIVER (MOLISE-PUGLIA). HABITAT, DISTRIBUTION AND FEEDING

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Fortore River springs from Sannio Mountain in Campania region and it runs for many kilometres on the border between Puglia and Molise regions. Along its basin, the Occhito lake with a ponderous dam that splits the valley in two separate zones was realized in the '60s. In this area, the otter was firstly reported from Altobello (1920) and only recently further studies on its distribution in this region were presented (Mancini et al. 2001, Loy et al. 2002). The authors reports here information coming from a project finalized to collect information on the otter presence and to promote its conservation along the middle Fortore valley. The distribution, habitat quality and characteristics, relationship with neighbouring basins, food availability and biological water quality (by E.B.I.) were analyzed on a total surface of 452 Km^2 covering the territory of 10 communes between Molise and Puglia regions in the Fortore river basin. Moreover, the local vertebrate and invertebrate communities were sampled to check specie list and availability of the potential preys; moreover, a GIS recording the environmental data, was also realized. 10 regular sites were found along 50 Km of river and lake coast. Even though it is not possible to know the actual population size yet, the preliminary results extend the knowledge on sites usually frequented by the otter in the middle basin of Fortore. The decreasing conservation state of the area is also described by environmental suitability and pollution maps. Among the possible food resources, are still available in this area 9 fish species, 9 amphibians, 12 reptiles, 17 small mammals and 13 potential bird preys (on around one hundred nesting on a total of 185 in the local checklist). On the whole, the number of individuated taxa and the possible evaluation of the population allowed to define that food resources are still sufficient to support otter survival. The general water quality of Fortore river and its affluent appears to be quite good with a second class E.B.I. mean level; meanwhile, only the lower part of Tappino and Cigno streams reached the E.B.I. third class. Among the aquatic macro-inverterbrate, very important is the substantial presence of *Potamon fluviatile*, which was found in all the sampled sites. The relationship of the otter population with the surrounding groups in Molise, Campania and Puglia regions and also the strong conservation measures that have to be integrated in the local planning are also discussed, which regards immediate environmental upgrading projects, limitation of human effects from hunting, fishing and quarrying activity as well as the identification and establishment of wildlife sanctuary.

FEASIBILITY STUDY AND OTTER EXPERIMENTAL RELEASE IN ATERNO-PESCARA BASIN (ABRUZZO): RESULTS AND PROBLEMS

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The Aterno Pescara basin (about 190 km of extension) was described considering all the otter's interest aspects for establishing which of them caused the local extinction of the species. The following parameters were considered: water quality (physical-chemical and bacteriological analyses); fishes (species composition, availability and biomass); heavy metal, PCB and OCs contamination level in the fishes' tissue; river flow; vegetation types, extension and coverage; roads and villages; barrages and disturbance/conflict sources (for example dams and fish farms). Every information collected was checked and the causes for the local extinction of the otter have been hypothesized. To verify these hypotheses, six radio marked otters were released in the area. Radio implantation technique, release and monitoring working programme, problems raised after 18 months of radio tracking, are presented as crucial phases of our feasibility study.

OTTER EXPERIMENTAL RELEASE IN ATERNO-PESCARA BASIN (ABRUZZO): HOME RANGE AND SPACE USE

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During an otter experimental release in the Aterno Pescara basin, a radiotelemetry study was carried out. Six animals were released and 18 months of radio tracking was done for an amount of 3500 locations and 49 continuous (h 24) observation. Home range sizes, seasonal variations and core areas, related to sex and age of the animals, have been stated; territory colonization dynamic, dispersal, daily home ranges and intensity of use, length and speed of the movements in the 24 hours and several movements patterns utilized have been described. Home range sizes obtained from this research are resulted similar to the values obtained from the researches conducted on European and Canadian otters; differences observed between sexes have been confirmed with significant higher values for the males (at least concerning the seasonal data).

OTTER EXPERIMENTAL RELEASE IN ATERNO-PESCARA BASIN (ABRUZZO): ACTIVITY RHYTHMS

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During an otter experimental release in the Aterno Pescara basin, a radiotelemetry study was carried out. Six animals were released and 18 months of radio tracking was done. Activity in the different periods of the day, total activity percentage, beginning and end of the activity related to the local ephemeris, differences between sexes and activity seasonal variations were analyzed. Released otters showed mainly nocturnal and crepuscular rhythms, with daily activity around 5,6%. Total activity percentage in 24 hours has been close to 50% and no significant difference among the animals and sexes are resulted. Most activity is resulted during the winter season, it gradually decreased reaching the lowest value during the summer season.

OTTER EXPERIMENTAL RELEASE IN ATERNO-PESCARA BASIN (ABRUZZO): DENS AND RESTING SITES – STRUCTURE AND USE

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During an otter experimental release in the Aterno Pescara basin, a radiotelemetry study was carried out. Six animals were released and 18 months of radio tracking was done. To have information on one of the most important aspect for the species survival, exact localization and different characteristics of the resting sites have been described through the radio-tracking work. 140 resting sites were analyzed to evaluate data on their commonest characteristics; use and selective choice have been related to sexes and river types. The localization in the home range, the distance among them and from the core areas, spatial distribution pattern, frequency and pattern of use, social relations existing during the use of same resting sites have been stated.

DENSITY AND HOME RANGE OF OTTER *LUTRA LUTRA* ON PART OF THE BLACKWATER CATCHMENT (IRELAND)

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The study was carried out along the entire Araglin Valley and Kilworth catchment, from October 1995 to June 1996, and it has permitted to define the density and home range of the otter in the study area. Otter signs (tracks, spraints, jelly, holts, etc.) were observed and identified walking the entire length (both banks) of all watercourses. Data on the estimated number of otters suggests that otters are widespread within the

study area. The lowest number of otter signs was recorded in the Kilworth catchment. In winter and spring the highest number of spraints was found and this trend was mostly recorded in the home range 2. Four active holts were recorded: two in the Araglin river, one in the river Douglas river and one in the Glenfinish stream. An overview of various results shows the presence of six or seven otters living in three home ranges. It is reasonable to argue a hierarchic distribution of the otters in the study area. Two sub-adult males utilised the two home ranges at each end of the Araglin Valley: one in the Kilworth catchment (home range 1) and another one in the upper Araglin river (home range 3). An adult male was resident in the central home range (home range 2) which included that of a family group (adult female with two or three cubs). The three definite home range boundaries were delineated by high levels of sprainting and scraping: two in the Araglin river and one in the upper Kilworth catchment. On ten occasions tracks of cub/juvenile otters (<5 cm) were recorded: five times in December, three times in February and twice in May. The presence of a family group (cubs with female otter) were also found, either near the holt on the Araglin river or near the home range 1 boundaries.

FOOD HABITS OF THE OTTER IN THE ARAGLIN VALLEY, SOUTHERN IRELAND

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The diet of the otter (*Lutra lutra*) was studied in the Araglin Valley (counties of Cork, Tipperary and Waterford, Ireland) from October 1995 to June 1996. Percentage frequency of occurrence (F%), relative percentage of frequency (Fr%) and percentage bulk (Sc%) were calculated for 12 food categories based on seasonal data sets. Fish were the predominant food category in each season (Sc% = 70.03) and were mainly represented by salmonids (Sc% = 54.8) and eels (Sc% = 12.8). Stickleback and minnow were caught in small quantities. The other main food categories were frogs (Sc% = 20.9), with a peak during their breeding season (February/March). Mammals and birds were taken only in small quantities. Crayfish occurred in the diet only in February-March, and freshwater mussels were recorded on three occasions. Invertebrates and plant matter were mostly secondary food. Significant variation in otter diet was identified amongst the three main rivers examined and was related to differences among three different habitat types (forest, moorland and agriculture). Fish was the principal prey resource in all habitats, but in the afforested area it was less important food than in agricultural area. Birds were a significant prey only in the moorland. Overall however the otter diet did not differ significantly between forest and agriculture habitats, but there was a significant differences between forest and moorland habitats and between agriculture and moorland. Three home ranges were delineated based on spraint, track, holt distributions enabling a comparison of diets to be made amongst otter groups. In the home range 3 fish prey were relatively scarce, while birds and frogs were more important. On the contrary, fish was more important food in the home ranges 1 and 2. The otter diet differed significantly between home range 1 and home range 3 and between home range 2 and home range 3. The trophic niche breadth of otter, evaluated using Levin's index (B), varied little throughout the study period, with a peak in spring/early summer and a minimum value in late autumn (October-November).

DIET OF EURASIAN OTTERS IN LARGE DAMS OF SOUTH PORTUGAL DURING DRY SEASON

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In this study we used data from 12 large dams in the Alentejo region (S Portugal). From July to September 2002, a total of 102 transepts for otter detection were conducted both in the shores of the lentic systems (reservoirs) as well as in the adjoining lotic systems (rivers and streams). All of the dams showed positive signs of the otter presence and only 13.7% of the transepts gave negative results (14.5% in lentic systems and 11.5% in lotic systems). A total of 681 otter signs were found. From these, 417 scats and prey remains were analysed and 836 prey items, belonging to 33 prey categories, were found. Fish represent 48,4% of consumed prey in reservoirs and 34,3% in lotic systems (percentage of occurrence – PO), being the bulk of the diet together with the American crayfish *(Procambarus clarkii)*. In the overall (both systems), crayfish was more consumed (50,7% PO) then fish (42,0% PO). Neverthless, when we compare the consumed biomass (percentage of biomass - PB), fish are more important (64,5% of total P:, 69,1% PB in lentic systems and 55,8% PB in lotic systems). The most consumed fish species was pumpkinseed *(Lepomis gibbosus)* (13,8% PO) in both systems but in terms of biomass, carp *(Cyprinus carpio)* was more important (Lentic - 56,8%, Lotic; - 41,9% PO). This species is also the one contributing with more biomass (in overall terms and also in the lentic systems, only surpassed by the crayfish in the lotic systems). Focussing only in the lentic systems, in term of occurrences, crayfish was more important in 6 reservoirs (Alvito, Fonte Cerne, Odivelas, Monte da Rocha, Roxo e Monte Novo) and fish in 4 (Pego do Altar, Vigia, Caia e Vale do Gaio). Both are basic resources (PO> 20%) in all reservoirs with the exception of Fonte Cerne for fish. Amphibians also proved to be a basic resource in Campilhas reservoir (20% PO) and reptiles are a constant resource in Lucefécit reservoir (11,5%). Regarding the trophic niche, Simpson Índex (BS) had the lower value in Monte Novo reservoir (0,133) and the highest in Lucefécit reservoir (0,682), the only reservoir with BS < 0,5. These results reveal that in general the otter consumed reduced prey diversity and/or does not explore them regularly. The diversity of fish community in these lentic systems is reduced (7 species, 4 of them exotic and the remaining with no relevant conservation value) indicating a low ecological interest and a high adaptability of the exotic species. Comparing prey availability and otter diet, it was possible to access that generally the otter consumes the most available species in the reservoirs. Carp and pumpkinseed dominate the communities in all 12 lentic systems and are, as already stated, the more consumed species. In the overall, these results agree with the opportunistic character already recognized for the Eurasian otter. Although conditioned by in the restriction to the dry season, they support the hypothesis that reservoirs may constitute an "attraction point" for the otters (in terms of water and prey availability), especially in periods of dryness of the lotic systems such as it occurs in Mediterranean habitats.

DIET OF THE EURASIAN OTTER (*LUTRA LUTRA*) IN THE UPPER CATCHMENT OF THE RIVER AGRI (BASILICATA, SOUTHERN ITALY)

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Diet composition of otters (*Lutra lutra*) in the upper catchment of the River Agri, an important watercourse connecting the main otter populations of southern Italy, was investigated by spraint analysis (N = 555) between May 2001 and January 2003. Spraints were monthly collected along four stretches of river (mean length = 0,825 km, min-max = 0.7-1.0 km, SD = 0.13), two with slow water and prevailing cyprinids (eutrophic habitat), and two with swift water and salmonid fishes (oligotrophic habitat). Data were expressed as frequency of occurrence and as mean volume(Vm%), estimating the bulk of each prey-item in each faecal sample. On the whole, fish represented the dominant food (Vm% = 57.30), followed by amphibians (Vm% = 18.90) and crayfishes (Vm% = 15.60). Birds, insects and reptiles represented food sources of minor importance (each with Vm% < 5.0). Dietary composition differed significantly between the oligotrophic and eutrophic habitats. Fish formed the bulk of otters diet where gregarious cyprinids were available, whilst amphibians and birds played an important role as supplementary food resources where trouts were dominant. The trophic niche, evaluated by Levin's index, was larger for slow water stretches, because of the presence of a more various fish assemblage. In both sampled habitats, the importance of fish decreased in winter, flood increasing water speed and turbidity, and reducing otters preying efficiency, when hibernating amphibians represented a primary resource. Insects and reptiles were eaten more frequently in summer, while birds predominated during their breeding season. Among fish species, cyprinids dominated in spring, salmonids in summer and the introduced largemouth bass *Micropterus salmoides* in autumn. Seasonal variation in fish consumption could be related to changes in fish activity and in environmental conditions, which influenced prey availability for otters. For both habitats, trophic niche breadth showed a minimum value in autumn, when fish were predominant in otters diet, whilst a peak was reached in summer for slow-flowing stretches and in spring for swift water stretches. Our results confirm the opportunistic feeding behaviour of the otter in Mediterranean habitats, otter diet tending to match with seasonal and environmental variation in the relative abundance of different prey items.

FISH SELECTION BY THE EURASIAN OTTER (*LUTRA LUTRA*) IN THE RIVER SINNI (BASILICATA, SOUTHERN ITALY)

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Otter (*Lutra lutra*) diet composition was studied between January 2001 and February 2002, by the analysis of 552 spraints monthly gathered along 6 river stretches (mean length = 725 m, S.D. = 117.3) uniformly distributed along 40 km of the River Sinni (Pollino National Park, Basilicata southern Italy). In the same stretches, fish were sampled by electro-fishing in June and November 2001. All collected fish (1539 individuals belonging to 8 species) were measured and weighted before releasing at capture site. For each fish species, density (number of sampled fishes/100m^2) and

biomass (g/100m^2) were calculated. Because of roach/chub hybridisation, recently verified through the Amplified Fragment Length Polymorphism (AFLP) technique, roaches, chubs and their hybrid forms were visually distinguished in two functional groups - "chub-like" fish and "roach-like" fish -, simply named as chub and roach, respectively. These two groups and *Alburnus* sp. showed a quite higher frequency of occurrence in the fish sampling. The frequency of occurrence (F) of each fish species in otter diet (number of fish of each species/total number of fish found in spraints), was compared by χ^2 test with each fish species availability, as determined by electro-fishing (number of individuals of each fish species/total number of sampled fish). To determine whether a species was preferred or avoided Bonferroni's confidence intervals for the proportion of use were checked. Fish (mainly Cyprinids) represented the main food resource for otters (F% = 77.4), followed by amphibians (F% = 31.2) and crayfishes (F% = 6.5). Otters sharply avoided bleaks (*Alburnus* sp., $p<0.001$), while selected other cyprinids (*Leuciscus cephalus* $p<0.05$, *Barbus* sp. $p<0.05$, *Rutilus rubilio* $p<0.01$) and *Perca fluviatilis* ($p<0.01$). Bleaks were the most abundant small fish in sampled cyprinid community: 82.7% of sampled fish less than 5 g of body weight were bleaks.

TECHNIQUE USING SURGICALLY IMPLANTED INTRAABDOMINAL RADIO TRANSMITTER FOR OTTERS OF THE CILENTO AND VALLO DI DIANO NATIONAL PARK

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This work illustrates an innovative system for surgically implanted intraabdominal radio transmitters matured over the previous experience carried out on 5 individuals for the otter project of the Majella National Park and optimised for the research project on the ecology of otters of the Cilento and Vallo di Diano National Park. This method has made it possible to overcome the difficulties presented by traditional techniques in the use of transmitters, making it successful for research into the species and act as a guarantor for the wellbeing of the animals. For this specific experience carried out on two individuals, transmitters of different sizes were inserted into the abdomen of the individuals, both Telonics – the IMP 400 of 9.7x3.3 cm and the IMP 300 of 8.1x2.3 cm. The surgical technique used was a laparotomy of the hip, given the anatomical conformation of the animal (short limbs) and its motorial typology (sliding on the abdomen), with a dorsal-ventral cutaneous incision and discontinuation of the underlying muscle layers in the direction of the relative fibres. The transversal layer and the peritoneum were instead excised so as to avoid laceration with the introduction of the transmitter. Simple sutures using separate stitches were made on all the disconnected layers, with the exception of the subcutis which was sutured with U stitches, and the cutis which was sutured using the continuous intradermal technique. This choice led to an almost immediate healing of the cutis and at the same time, avoided excessive tissue reactions in the underlying layers. Due to the necessity for containing as much as possible the stress caused by manipulation and in order to guarantee a fast and profound anaesthetic action, preference was given to injection, with initial inoculation containing a mix of xylazine and ketamine, with subsequent doses of bolus containing ketamine only. The substitution of trichotomy of the surgical area with the application of disinfectant gel (Neomedil solution 2%) was a determining factor in reducing the release times of the animal into its habitat (48 hours after capture), which made it possible to highlight the incision line at the same time avoiding

the risk of a lowering of body temperature. These technical choices proved to be essential for the success of the operation and the post-operative rehabilitation period, as is shown by the immediate and full reinsertion of the animals into their habitat.

TECHNIQUE USING SURGICALLY IMPLANTED INTRAABDOMINAL RADIO TRANSMITTER FOR OTTERS OF THE MAJELLA NATIONAL PARK

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This work illustrates the techniques used for the surgically implantation of intraabdominal radio transmitters aimed at the telemetry research of otters freed into the Majella National Park.
The choice of this type of system is based on the need to overcome the difficulties presented for the species with the use traditional techniques used for remote sensing (pouches, collars). The experience was carried out on 5 individuals (3 males and 2 females), who were implanted with the Telonics IMP 400 9.7x3.3 cm devices. In addition, sterilization of the males via vasectomy was carried out in order to avoid reproduction whilst maintaining the reproductive behaviour of the animals unaltered.
A surgical hole was made into the hip (laparotomy with dorsal-ventral incision) in preference to the linea alba in order to avoid consequences caused by the rubbing of the abdomen, which would be quite probable given the anatomical conformation of the animal (short limbs) and its motorial typology (sliding on the abdomen). The surgical incision area was trichotomised and dimensionised differently from one individual to the other in order to reduce the risk of excessive heat dispersion in water as much as possible. The muscle layers were disconnected in the direction of the relative fibres, whilst the transversal layer and the peritoneum were instead excised so as to avoid laceration with the introduction of the transmitter. Single sutures using separate stitches were made on the muscle layers, the subcutis was sutured with U stitches and the cutis was sutured with various types of stitches in order to evaluate the various degrees of efficiency. On this regard, the most suitable was the continuous intradermal technique, as it led to a more rapid healing of the cutis.
Without having the possibility to perform anaesthetic experimentation, the protocols found in literature were taken into consideration and those more responding to the needs of our experience were chosen and adapted as required. The most valid was the inoculation containing a mix of xylazine and ketamine, with subsequent doses of bolus containing ketamine only, due to its ease of use, anaesthetic efficiency and more rapid waking times.
Post-operative therapy included the synergic action of allopathic and homeopathic drugs used simultaneously in order to favour a more rapid recovery of the animals.
This work has highlighted how a careful surgical technique that guarantees a rapid recovery of the physical conditions of the otters, in addition to a valid and easy to use anaesthetic protocol are essential factors for the success of the operation and the rehabilitation stages.

SESSION 4 – THREATHS AND CONFLICTS

Oral presentations

FISH FARMING AND OTTERS IN PORTUGAL: IS THERE A CONFLICT OF INTERESTS?

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Despite the small size of the country, Portugal bear a high potential for fisheries due to its 940Km of coastline, extensive EEZ (the fifth in the world) and about 150 thousand hectares of superficial water bodies. It is also one the European countries where more fresh fish is consumed by inhabitant since remote times. Over the time, most of the consumed fish were sea species being the freshwater ones less eaten. With the depletion of the marine fish stocks fish farming become increasingly important since the beginning of the 90's and have been financially encouraged by the European Community Structural Policy as a way to reduce pressure upon those stocks. Fish farming activities in Portugal have an uneven importance and distribution. Most are sea-related and concentrated in the estuarine areas of the central region (in 2001, 56% of all marine fish farms were located in river Tejo and Sado estuaries), which in turn are protected areas due to their wildlife values (mainly as important bird's breeding areas). These fish farms, resulting from the recovery of old salines, mainly produce seabream *Sparus aurata* and seabass *Dicentrarchus labrax*, bought from hatcheries and stocked at very early stages of their life cycle. Additionally wild born and caught Senegal sole *Solea senegalensis* and common sole *Solea solea* are raised inside the fish ponds and sold at high prices. Inland fisheries, on the other hand, produce mainly trouts (*Salmo trutta* and *Onchorynchus mykiss*), are fewer and scattered in the centre and north of the country and directly related to freshwater streams. While this economic activity grew, so did the problems between fish farmers and the otter (*Lutra lutra*). Portugal is considered to be one of the strongholds of otters in Europe and the species benefit from a protection status. The fact that most of the operative fish farms are located in estuarine areas, which in turn are included in the national network of protected areas, resulted in restrictive attitudes to fish farming related activities, adding another element to the conflict scenario. This type of conflict between protected species and the exploitation of biological resources is common and affects several different economic activities and species. This is the frame of a European project that was designed for the development of a procedural framework for action plans to reconcile conflicts between the conservation of large vertebrates and the use of biological resources (FRAP - Framework for Biodiversity Reconciliation Action Plans - contract number EVK2-CT-2002-00142). The project focuses on fisheries and fish-eating vertebrates as a model case and includes ecological and socio-economic approaches using three fish eating species (Eurasian otter, cormorant *Phalacrocorax carbo sinensis* and grey seal *Haliochoerus grypus*) and different types of fishery in eight European countries (www.frap-project.net). Data presented refers exclusively to the Portuguese situation, and aim to improve the understanding on the predation of otters in fish farms and on the perception of the conflict by the various interest groups, to find sustainable solutions. Formulating and assessing solutions for the local conflict is the expected output. This process will rely on a participatory approach to the

development and evaluation of mitigation or compensation strategies, capable of providing an effective reconciliation of the conflict.

ROAD CASUALTIES

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Otter road casualties are frequently cited as a threat to otter populations and in recent years considerable efforts have been made to mitigate this. In this paper I will consider the evidence for impacts on recovering populations of otters in the UK and discuss approaches to determining what measures are effective, and when and where they should be used.

PRENATAL EXPOSURE TO ENDOCRINE DISRUPTING COMPOUNDS AND POSSIBLE IMPLICATIONS FOR WILDLIFE

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Endocrine disrupting chemicals (EDCs) are biologically active compounds and mimic endogenous hormones, thereby altering hormone modulated responses. EDCs have been shown to alter important aspects of vertebrate homeostasis and are able to disrupt embryonic development, sexual differentiation, reproduction, immune function, behaviour, and other responses mediated by hormones. EDCs have gained increased attention as is has become clear that these environmental contaminants are endocrine active in humans, domestic animals and wildlife species. Special attention has to be directed to the effects of intrauterine and lactational exposure of the developing organism. This early-life-stage exposure can result in lifelong alterations of hormone homeostasis. The neonate is especially critical to the effects of hormonal imprinting that takes place at the first encounter of the appropriate hormone and receptor, a process that is needed for the normal maturation of the receptor. Nevertheless in the perinatal period molecules similar to the endogenous hormones can bind to the receptor, provoking distorted imprinting. These molecules can be synthetic hormones, hormone analogues and members of other chemical groups that are able to bind to the hormone receptor. This distorted imprinting results in lifelong consequences in respect to hormone binding, feedback mechanisms etc. and finally leads to alterations of physiological or morphological parameters. The potential consequences of EDC exposure are a critical issue for wildlife populations and subtle modifications of reproduction, immune system, or behaviour have been shown for a several classes of vertebrates including humans. Therefore this is an important issue with wide ranging implications.

Poster presentations

OTTER POST MORTEM RESEARCH IN THE UK: PAST, PRESENT AND FUTURE DIRECTIONS

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Over the past two decades otters found dead in England and Wales have been collected for post mortem analysis and information on their location has been recorded. During this time increasing environmental awareness has led to improvements in water and habitat quality, and otter populations across the UK have expanded from strongholds in the North and West. By identifying areas where road traffic mortalities have occurred, and by recording reproductive status, it has been possible to target mitigation schemes, particularly in areas with multiple mortalities and mortality of breeding females. In addition, data and samples collected during post mortem analysis now form an important resource from over 750 animals found across much of the UK, which are being used to investigate a wide range of research hypotheses, with various collaborators. Health indicators such as condition and adrenal weight are recorded, as well as any signs of disease or infection. Dietary studies range from identification of gut contents to stable isotope analysis, used to identify spatial and temporal variation in the relative contribution of marine and freshwater food sources. Morphometric analysis of intact skulls has revealed aspects of sexual dimorphism which may relate to differences in feeding behaviour. Information on endo- and ecto-parasites is contributing to the sparse knowledge of parasitology in otters, and may contribute to information on disease transfer. Heavy metals levels in bone are reflecting changes in emissions policy with a dramatic decline in lead levels over time, and spatial comparisons of pesticide levels measured in liver could help target pollution control efforts. Aging information from teeth and morphometrics will be used in conjunction with pollution studies to control for the effects of bioaccumulation. Information gathered on fighting injuries contributes to our knowledge of behavioural ecology, while chemical analysis of scent glands may enable identification of sex from spraint, thus increasing the power of this important survey tool. A major new research project involves molecular genetic analysis of all the samples collected so far, to identify spatial genetic patterns, look for evidence of a genetic bottleneck and track recolonisation pathways. Sample collection is ongoing, and new research directions are being developed. Advances in spatial analysis techniques such as Geographical Information Systems (GIS) combined with comprehensive data collection from all animals found, will continue to provide essential knowledge of this charismatic but difficult to study animal.

OTTERS AND ROADS

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The occurrence of otter signs and holts in 578 squares, 50x50 m in size, varied both with distance from water-bodies (sea-shore, river or lake) and from technical infrastructures (roads and buildings) in a coastal habitat in Central Norway. Signs occurred in 10 %, 25 % and 35 % of the squares that were located < 100 m, 100-500 m and >= 500 m from infrastructures respectively (square center distances). All holts and signs occurred within 200 m from water-bodies. Among 1970 road-killed otters reported dead during 1987-2004 in Norway, 99% of the casualties took place on roads in municipalities with a coastline, and only 1 % in inland municipalities. In comparison,

87 % of the municipalities with an otter population were on the coast and 13% had no coastline. So far, few accident points have been accurately located on maps (n=43). Among these the nearest water-body was a stream in 44 % of the cases (often close to the sea), the sea in 37 % of the cases, a river in 16 % of the cases and a lake in 2 % of the cases, and 86 % of the 43 mapped accident points were within 100 m of such water bodies. The otter casualties on roads showed a strong seasonal variation, with minimum in June, and maximum in November. Similarly to what has previously been found in Britain, the monthly figures summed over all years were strongly correlated with seasonal precipitation. The correlation with seasonal river-flow found in Britain is less obvious for Norway, where much of the winter precipitation in most watersheds is retained as snow until spring thaw. River-flow in most Norwegian watersheds is at a maximum in spring, at a time when precipitation is usually low and the figures for road-killed otters are at a minimum. Precipitation also affects light conditions and visibility, and makes roads slippery. In Norway, the season of maximum precipitation coincides with the dark season. Thus, driving conditions and drivers' behaviour, as well as otter behaviour during spate flows and flooding, may explain the observed patterns. The latter explanation has been suggested for Britain.

TESTING DIFFERENT TYPES OF ELECTRIC FENCES TO PREVENT OTTER PREDATION AT FISH FARMS

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With increasing numbers of Eurasian otter *(Lutra lutra*) this species will become more and more a conflict species of major concern. Otters are considered to be a pest at commercial fish ponds and are a high priority species for conservation. No special permissions are granted for the killing of otters on fish farms and in most parts of Germany no compensation is currently paid for damage caused by otters. Therefore preventive strategies such as fences have to be used in order to keep otter predation on a tolerable level. Until now we have tested an electric fence in a semi-natural enclosure with good results. Thus, we decided to test different types of electric fences in a fish pond area to find the most efficient fence design to exclude otters. Since 2003 we have installed three different types of fences: type I: an electric fence with two wires (wires on heights of 10 and 20 cm); type II: a combination of wire mesh (height 60 cm) and a single electric wire on the top of the mesh; type III: a 60 cm broad band of pond foil with a hump in the middle and an electric wire on the top of the hump. Monitoring video cameras that will register and record otters and other predators are installed.

OTTER CONSERVATION IN SCOTLAND'S FIRST NATIONAL PARK

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Loch Lomond and the Trossachs National Park (LL&TNP) was established as Scotland's first national park in July 2002. The park contains a diverse range of freshwaters and has adjacent coastal habitats suitable for otters (*Lutra lutra*) and their prey. Otters are found throughout the region and surveys suggest that they have recently reoccupied areas of their former range. LL&TNP Otter Monitoring Group was established by the Ranger Service in 2003 to determine the conservation requirements of otters and to

provide education on otters to residents and visitors to the park. The greatest threat to otters in the park at the present time is thought to be from road mortality. A road mortality recording scheme was therefore initiated in May 2005 that involves constant effort surveys on main roads within the park. This work is being used to inform decision making on transport related activities and is also providing valuable data on age-related mortality and samples for genetic analysis. On-going educational activities with residents and visitors, have raised the profile of otters and their habitat requirements within the park.

THE IMPACT OF OTTER DISTURBANCE ON THE CONDITION, STATE OF HEALTH AND STRESS INDICATOR LEVELS IN COMMON CARP (*CYPRINUS CARPIO* L.)

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The condition, health, growth and survival rate of carp may be affected by stress. Otters predating carp, in particular during winter, may be one of these stress factors. Therefore fish farmers perceive otters as a problem not only because of losses due to predation, but also because of secondary losses. The project aimed at quantifying the impact of otter disturbance on carp during over wintering period. The fish were placed into three experimental ponds. The experimental ponds were fenced to prevent the entering of wild otters living in the area. The first experimental group of fish was not disturbed by otter for the whole over-wintering period, the second group was visited by tame otter once per week and the third group was visited by otter three times a week. The analysis of blood samples of experimental fish showed changes in nitrogen, glycid and mineral metabolism as well as levels of hormones and fat reserves. Higher response to stress in metabolism of fish with lower intensity of disturbance by otter suggest that fish exposed to high levels of disturbance can lead to metabolic adaptation of fish to stress.

OTTERS AND FISH-FARMING IN THE CZECH REPUBLIC – THE CONTINUED STORY

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Throughout history, humans and otters have come into conflict when their usage of resources, e.g. fish, has overlapped. Illegal killing, direct persecution, and a negative public attitude towards otters is considered the main threat and conservation problem in the Czech Republic. Between 1997 and 2003, a national survey was undertaken to assess present distribution of the Eurasian otter (Lutra lutra) in the Czech Republic. Fifty percent of all quadrats were recorded as positive, i.e. an increase of 21.5% in approx. 10 years. Although distribution now appears to be widespread, the density of positive sites is highly uneven, with three separate centers with populations of over 40 % connected by large areas of very low density or absence. The highest density of otters (81-100 % of sites monitored positive) was observed in South Bohemia, with progressively lower densities found toward the edges of the population. In South Bohemia there is a long historical tradition of fish farming (700 years) and the otter, as a fish eating predator, has always been a cause of conflict with human fish farming activities. The snow survey results showed that the density of otter population in these 'prime otter' areas reaches up to 38 individuals per 100 km^2. To lower illegal persecution of otter's, a new law regarding the responsibility for losses caused by

protected species (inc. otter) was endorsed in April 2000. By the end of 2004, more then 550 000 Euro was provided in compensation for 300 cases. However, many private owners, angling societies, and fishery companies are unsatisfied with the system of compensation. They complained, in particular, that the law omits secondary damage to fish stocks, that it does not include running waters, and of the high level of bureaucracy. To ensure more effective conservation of the otter population a management plan is under preparation. The main aims are: a) not to allow reduction of the area with otter presence according to situation in 2004; b) not to allow decreasing of numbers of otters in the areas of Natura 2000 designated for otters; c) to establish a system of legislative and economic measures solving the co-existence of otter and fish-farming; d) to improve the relationship of fishermen towards the otter. The main planned measures are: a) public relations and environmental education; b) legislative measures; c) habitat conservation and management; d) monitoring of population; e) research activities.

KEY LANDSCAPE FACTORS FOR OTTER VISITING RATES AND FISH LOSS IN PORTUGUESE MARINE FISH FARMS

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In Portugal the number of fish farms has increased in the last decade, as they were encouraged financially by the EU to reduce pressure upon sea fish stocks. While this economic activity grew, so did the problems between fish farmers and the otter (*Lutra lutra*). This type of conflict between protected species and the exploitation of biological resources is common and affects several economic activities and species. Hence an European project entitled: Development of a procedural framework for action plans to reconcile conflicts between the conservation of large vertebrates and the use of biological resources: fisheries and fish-eating vertebrates as a model case (FRAP - Framework for Biodiversity Reconciliation Action Plans, contract number EVK-CT-2002-00142) was developed. Sado Estuary, a Portuguese coastal Natural Reserve, was chosen as study site for the FRAP project focusing on otter damages and fish farms relationships. Damages are reported by fish farmers as significant, and are the basis of anconflict. For this study, 14 fisheries were selected, varying in size, stocking levels and harvesting cycle. In order to assess otter visiting rates and to collect scats for otter diet analysis, weekly surveys of the fish farms perimeters were conducted from July 2003 to June 2004. Scats were classified as fresh (from the previous night), dry (from two or three nights before) or old (up to one week old). This classification was used in the development of visiting rates estimators to maximize the information collected in an attempt to assess daily visiting rates. Additionally, bank vegetation, bank structure, hinterland use, alternative prey availability and existence of preventive measures (fences, electric fences, dogs, etc) were recorded as descriptive factors for landscape analyses. Several metric variables (distances, areas in buffers) were also assessed with resource to a GIS data base. Data on otter predation on commercially important fish was evaluated through scats' analyses, expressed in terms of numeric frequencies and ingested biomass and used as a surrogate variable for damages. Variables with no relation to damages or visiting rates or correlated with other descriptors were discharged to allow continuing with a multivariate approach using Multiple Linear Regression Models (stepwise backward) for the final framework. Surprisingly, visiting rates were not significantly related to damages. Nevertheless they are negatively influenced by preventive measures and the distance to the nearest

streams, and positively related to the refuge cover area in a 1km buffer (R^2 = 0.58; F = 4.5; P=0.03). Damages were best represented by the consumed biomass and were also negatively influenced by the distance to the nearest streams, and positively related to the distance to refuge cover areas (R^2 = 0.84; F = 28.2; P=0.000). The overall interpretation is that preventive measures like electric wires are effective and that damages in this study area are higher in fish farms further away from water lines of some importance (streams and brooks), especially if close to refuge cover areas.

Patronages

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ESTIMATION OF THE ABUNDANCE OF OTTERS IN THE NOGUERA RIBAGORÇANA RIVER (N.E. OF SPAIN): A COMPARISON BETWEEN DNA ANALYSIS, VISUAL, AND TRACKS CENSUSES

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Determining population size or estimation of species abundance is often difficult but fundamental to the correct application of management and conservation measures. Traditional techniques are visual censuses (Ruiz-Olmo et al. 1995a) and track censuses (Sidorovich 1992). The elusive behavior of otters and the low densities in some areas, however, make it hard to get correct estimates of the abundance by using these methods. The nocturnal behavior of the otter hampers the visual census technique, while the presence of an environment that allows the use of tracks (snow or mud) is needed for the second one. A high correlation between these two methods was found by Ruiz-Olmo et al. (2001) in a study carried out in different Iberian Peninsula areas. Most recently, genetic censuses have arisen as a new method to determine the abundance and population size for many species. However, the genetic techniques also have their limitations: the estimation of abundance strongly depends on the DNA quality of the samples used. Especially when non-invasive samples are used in genetic censuses, genotyping errors can occur. On the other hand genetic census are less constrained by behavior or environmental conditions (related to a place where it is not possible follow tracks), thus offering new possibilities.

The main aim of this study was to compare the abundance estimates of an otter population in the North-East of Spain based on three different methods: (1) Visual censuses, in accordance with the method described in Ruiz-Olmo et al. (1995a); (2) Track censuses, in accordance with the method described in Sidorovich (1992); (3) Genetic censuses, in accordance with the methodology applied at Alterra-Centre for Ecosystem Studies during the Otter Reintroduction Project in the Netherlands.

The Noguera Ribagorçana River (North East of Spain, pre-Pyrenees) is a well studied otter area. During June 2005 a visual census and genetic census along 22,3-25 km of the river were conducted simultaneously. In august track censuses were also done. The study area is limited in the north by the Sopeira dam and in the south by the Canelles dam (between the province of Lleida and Huesca); the Canelles water reservoir was not included in the study. For the genetic census the total area was divided in ten different sampling locations. A total of 90 samples were collected during the sampling season. The rate of samples with sufficient DNA for further study was 25%. The error rate estimate was within the range for non invasive studies. The total number of individuals estimated by the three methods was similar 4-5 for visual and track censuses and 5-7 for genetic censuses.

The three different census methods gave comparable estimation of the abundance of otters in the population. All three have their limitations. Genetic censuses are known to result in over estimations, due to genotyping errors. By allowing a strict protocol on whether to include samples or not, we've tried to reduce this problem, thus providing a minimum estimate on the number of otters present. The initial low rate of success found in the genetic study (25% of the samples provided sufficient DNA) could possibly be explained by the weather conditions (high temperatures) during the sampling season.