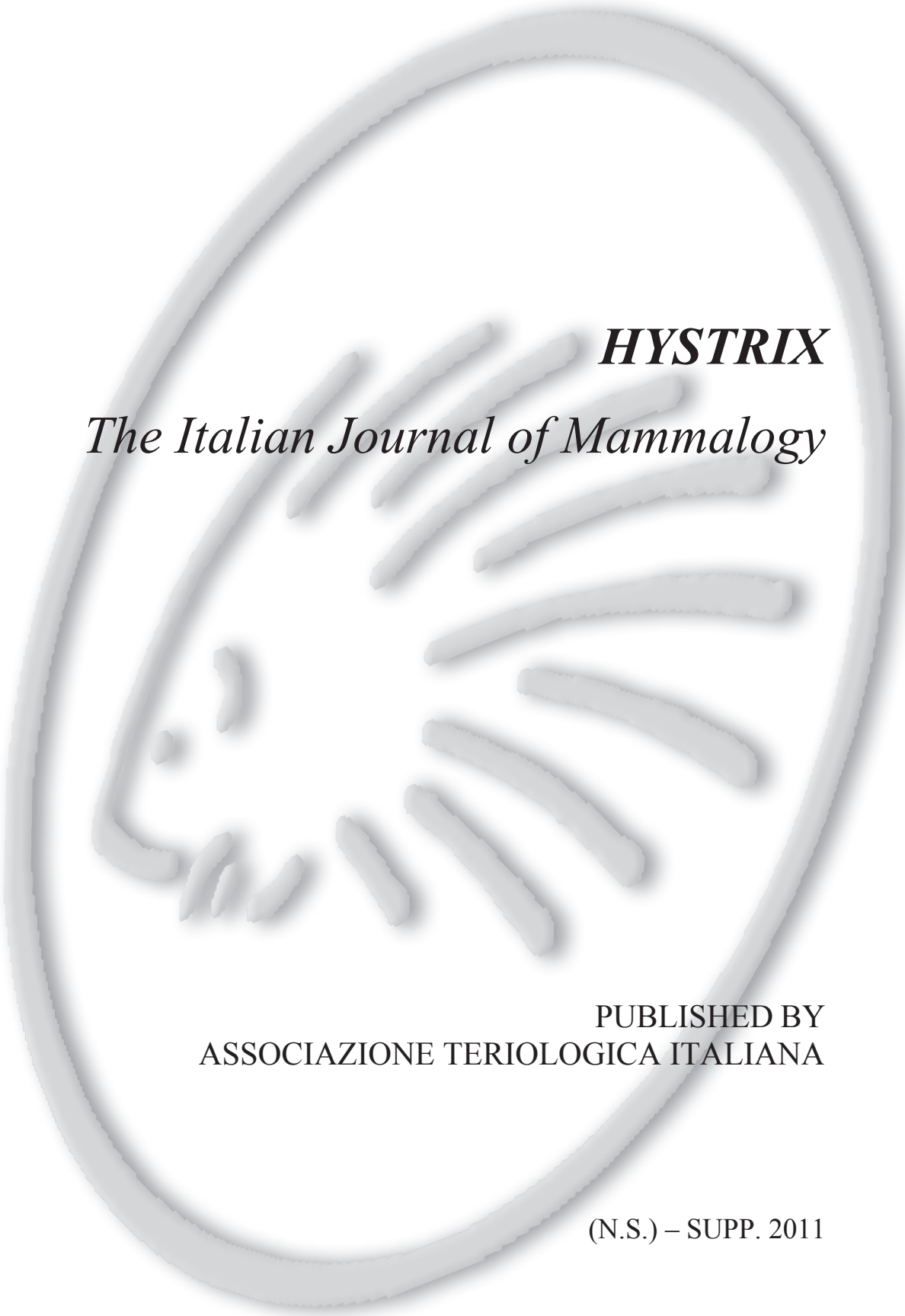

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IUCN XIth International Otter Colloquium

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IUCN Otter Specialist Group
Leading global otter conservation

XIth International Otter Colloquium

Pavia, Italy 30 August - 4 September 2011

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XI[th] International Otter Colloquium
'Otters in a warming world'

ABSTRACTS: ORAL & POSTER PRESENTATIONS

Edited by

CLAUDIO PRIGIONI, ANNA LOY,
ALESSANDRO BALESTRIERI, LUIGI REMONTI

IUCN Otter Specialist Group
Leading global otter conservation

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XI[th] International Otter Colloquium

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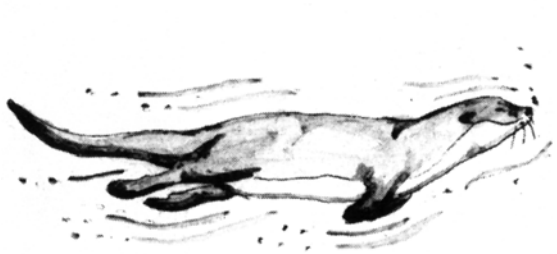

SESSION 1

Global warming and otter conservation

CLIMATE CHANGE THREAT TO THE EUROPEAN OTTER: THE IMPORTANCE OF CONSERVATION STRATEGIES AT EUROPEAN SCALE

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Climate change implies the need for new conservation strategies, accounting for the future dynamics of the factors currently threatening endangered species.
We assessed climate change threat to the European otter, a flagship species for freshwater ecosystems, considering how current conservation areas will perform in preserving the species in a climatically changed future. We used an ensemble forecasting approach considering six modelling techniques applied to eleven subsets of otter occurrences across Europe. We performed a pseudo-independent and an internal evaluation of predictions. Future projections of species distribution were made considering the A2 and B2 scenarios for 2080 across three climate models: CCCMA-CGCM2, CSIRO-MK2 and HCCPR HADCM3. The current and the predicted otter distributions were used to identify priority areas for the conservation of the species, and overlapped to the current network of protected areas.
Our projections show that climate change may profoundly reshuffle the otter potential distribution in Europe, with important differences between the two scenarios we considered. Overall, the priority areas for conservation of the otter in Europe appear to be unevenly covered by the network of protected areas, current conservation efforts being insufficient in most cases. To enhance otter conservation, the network should be integrated within a more general conservation and management strategy incorporating climate change projections. Otters playing the role of aquatic top-predators, our study further highlights the potential sensitivity of European freshwater habitats to climate change.

ECOTOXICOLOGY OF THE EUROPEAN OTTER (*LUTRA LUTRA*) ON THE RIVER LOIRE (FRANCE) AND PREDICTABLE TRENDS DUE TO GLOBAL CHANGE

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Since the beginning of the 1980's, national and local surveys of otter distribution in France underlined the persistence of two little populations along the River Loire, and the natural recovery of the species after legal protection. Both populations are now expanding and meeting on several areas of the River Loire catchment. Road-killed otters have been collected since 1983 and conserved for necropsy and dissection, identification of age, sex and biometry, genetic, diet and ecotoxicological studies under the coordination of Muséum d'Orléans and VetAgro Sup. European community and French "Plan Loire Grandeur Nature" supported this toxicological program. More than 200 otters were collected and analysed, and data were completed by the analysis of otter spraints collected in different parts of the catchment.

Contamination of otters by organochlorine pesticides, herbicides, PCBs, heavy metals and anticoagulant rodenticides was studied by gas / liquid chromatography or atomic absorption spectrometry. Analyses were performed on livers, kidneys, muscles, fat tissue, brain and spraints. Complementary analyses were conducted on other species, including other fish-eating top-predators like osprey or cormorant, but also fish and aquatic invertebrates. The main goal was to obtain sound information about contamination of aquatic communities and bioaccumulation in predators.

Results pointed out a widespread contamination of otters, with quite high measured values for PCBs, cadmium, copper and mercury. Secondary poisoning by anticoagulant rodenticides was confirmed. Important individual and geographic variation was noted, with increasing accumulation of compounds in the downstream parts of the catchment. Considering the present growth of the population, toxic contamination is not supposed to constitute a major threat to short-term otter conservation. Nevertheless, biomagnification into the food chain and higher downstream concentrations may disrupt biological corridors of recolonization in a mid- or long-term perspective.

Among the consequences of global change on river systems, intensification of floods or dryness on one hand, and modification of fish and invertebrates communities on the other hand, are expected. Our toxicological results will be used in prediction models to evaluate the impact of global change on the dynamics of contaminants in food webs, especially for top-predators like otters.

HOME RANGES, ACTIVITY PATTERNS AND HABITAT SELECTION OF MEDITERRANEAN OTTERS (*LUTRA LUTRA*): THE NEED TO COPE WITH HIGHLY VARIABLE ENVIRONMENTAL CONDITIONS

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The paucity of sound biological data required for the correct conservation and management of animal populations and for building useful ecological models is a serious issue in ecology and conservation biology. The Eurasian otter (*Lutra lutra*) does not make exception: in spite of being a widely distributed and studied species, knowledge of many aspects of its ecology and behaviour is still absent, scant and/or controversial, especially in Mediterranean areas.

These are characterized by highly variable environmental conditions and frequent water fragmentation during the dry seasons. Given the recently predicted drastic diminution of suitable otter habitat in South-West Europe due to climate change, understanding the flexibility of otters' ecology in the wet and dry seasons appears to be crucial for conservation.

Our project started in 2007 in the Mediterranean habitat types of Southern Portugal characterized by temporary and permanent streams, ponds and small-medium reservoirs. We captured 47 otters, of which 16 were marked and radiotracked for longer average time periods than previous studies.

Average home ranges of male and female otters were respectively 39 and 17 km. Water availability strongly conditioned otter space use, with seasonal home range size increasing with decreasing water availability. The results were generally supportive of the Resource Dispersion Hypothesis. Nonetheless, some difference in the individual patterns suggests that otters may deal with diverse water availability scenarios in various ways.

Otters were mainly nocturnal, although some variability related to dispersing males and the reproductive status in adult females was noticed. Onset of activity was correlated with sunset (happening on average 77 minutes after it), while its cessation was less predictable. Animals showed high frequency of activity (45 %, 74 % considering only nocturnal locations) compared to other studies. The probability of locating an otter in activity was influenced by season (being higher in wet than in dry season), extreme air temperatures, habitat type in which they were located, wind's presence and moon phase.

Habitat selection analyses provided robust direct data on otter use of small/medium dams and ponds. Lentic habitats were used throughout the year. Otters kept a constant use also of lotic habitats, where rested most of times (in the riparian vegetation, here more available). However, whenever adequate vegetation cover was available, animals rested also in lentic habitats. Both habitats appeared to be therefore necessary for the species in the study area.

Results are discussed from the standpoint of Mediterranean freshwater otter conservation, with particular emphasis on the possible influence of climate change.

SESSION 2

Conservation status assessment: concepts and approaches

TRENDS IN OTTER-RELATED NEWSPAPER ARTICLES IN JAPAN OVER 135 YEARS

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At the time of Meiji Restoration (1868), when Japan opened itself to the western world, the Japanese otter was widespread. This modernization concurred to the drastic decrease of otters, which became extinct in the 1990s. To understand the chronological change of people's interests and attitudes toward the otter, the number and contents of otter-related newspaper articles over 135 years were investigated by the analysis of newspaper databases.

In the Meiji era (1868-1912, age of wealth and military power policy), Japanese otters were overhunted for pelt export, but overhunting issues were not raised by these articles. The relative abundance of otter-related articles was the highest at this age. Articles mainly dealt with man-otter encounters, suggesting that the otter was still common. In the Taisho era (1912-1926, age of democracy), articles mainly dealt with the high cost and great demand for otter skins. From the early Showa era (1926-1945, age of totalitarianism and militarism) to the post-WWII reconstruction (1945-1955), otter-related articles almost disappeared from papers. Other statistics on the otter status were not available too. This indicated that the wartime regime eradicated the people's interests to the otter. During the successive economic growth period (1955-1973), otter population went to the brink of extinction due to environmental deterioration. A local paper introduced the otter as an endangered species in 1950. National papers started to introduce the need for otter conservation in the 1960s, but only a few articles sought the causes for otter decline such as poaching and environmental alteration. Questionnaires to local people indicated, however, that they were not conscious of the decline of the animal at this stage. In the 1990s when the otter became extinct, the number of otter articles oddly increased. The otter became a symbol of healthy environment and habitat-friendly development. From 2000 to date the number of otter articles has progressively decreased for the inevitable lack of news.

This general trend of otter-man relationship - from familiar to almost forgotten wild species -, was common to three nationwide papers, the Yomiuri, Asahi and Mainichi and two local papers. Unfortunately newspaper articles were not an efficient warning tool promoting otter conservation.

AN UPDATE OF OTTER RESEARCH AND CONSERVATION IN ARGENTINA

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Worldwide, there are thirteen species of otter, four of which are found in Argentina: *Pteronura brasiliensis*, *Lontra longicaudis*, *L. felina* and *L. provocax*. In 2002, the 'Grupo de Estudios en Ecología de Mamíferos' ("Research group on mammal ecology", GEMA, www.gema.unlu.edu.ar) has initiated a research program on Argentinean otters. The results obtained by GEMA and other groups and their implications for conservation strategies for these species in Argentina are here briefly discussed.

GEMA investigated the ecology, genetics and distribution of *L. provocax*. Its present geographic range in Argentina is slightly larger than expected, although its distribution is still highly contracted in relation to its historical distribution and the species is considered at risk of extinction. We also found that the main threats to *L. provocax* in Argentina are those that impact on prey availability.

L. longicaudis has a relatively wide distribution in Argentina. Several authors have studied northern populations. Last year, GEMA initiated a research program in the Southern border of its range. The program includes a survey of the distribution of the species in Buenos Aires province, a genetic survey, estimates of population parameters, radio-tracking and behavioural studies. Our first results indicate that: (1) the species is relatively common in the Delta of Paraná River, (2) it tolerates human presence only to a certain degree, and (3) its diet composition differs from that of northern populations, probably due to the costs of thermoregulation while diving.

Cassini reviewed the present status of *L. felina* in Argentina. The last confirmed record was reported more than a quarter of century ago, suggesting that the species may have become extinct. In accordance to IUCN Red List, the Argentinean population of *P. brasiliensis* is thought to be extinct, however systematic surveys have not been conducted to confirm its extinction.

In conclusion, urgent surveys for giant and sea otters are required. Much of the distribution of *L. provocax* is in protected areas, however populations of the Patagonian steppe and the Beagle Channel required local action plans. *L. longicaudis* may represent an excellent model for studying the biology of otters with the main aim of enhancing their conservation.

THE FRENCH ACTION PLAN FOR THE EURASIAN OTTER

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Following a decision of the Ministry of Ecology (MEDDTL), the French Mammal Society (SFEPM) prepared a National Action Plan (PNA) for the Eurasian otter in 2009. The plan was approved by the Ministry of Ecology and by the National Council for Nature Protection (CNPN) in 2010. The document gives a review of the research and conservation activities realised in France during the last years, and provides the framework for future actions.

The principal issues of the plan are: more communication and cooperation between key players (scientists, conservationists, decision makers, roads constructors, hunters, fishers, canoeists), education programs for a better knowledge of otters and the threats they are facing, conservation measures to reduce otter mortality and to protect its habitats, especially food supply, and solutions to the problem of otter predation in fisheries. The long term objective is to ensure the survival of otter populations and the natural recolonisation of the historic range, while avoiding severe conflicts of interests between otters and humans.

Thirty one action sheets have been developed, each with a time schedule, a degree of priority (from 1 to 3) and each being classified into a category (research, conservation or communication). Priority will be given to conservation and communication. Actions planned are for example: a national monitoring program, protection systems in fish-farms to prevent predation by otters, more protected areas for otters, a better consideration of otters in environmental impact assessments, ecological corridors, otter passages to reduce road mortality, creation of otter heavens, education programs, a system to collect otters found dead, the management of a network of people working on otters, the promotion of international cooperation.

The implementation of the plan is coordinated by SFEPM, under the authority of the Ministry of Ecology, which also funds part of the project. Additional funds have to be raised. The work is supervised by the National Otter Action Plan Comity made of about thirty representatives of the groups concerned (Ministry of Ecology, Ministry of Agriculture, National Hunting and Wildlife Agency (ONCFS), National Agency for Water and Aquatic Environment (ONEMA), nature conservation organisations, national parks, reserves, National Museum of Natural History (MNHN), scientists, hunters, fishers, fish-farmers, road constructors…). The different French regions also have the possibility to create a regional comity to supervise the application of the measures described in the plan at a local level. The implementation process has been planned for five years and started in September 2010.

HOW BEST TO CALCULATE RANGE AND POPULATION SIZE FOR THE OTTER? IRELAND AS A CASE STUDY

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The otter occurs throughout Ireland along rivers, lakes and coasts and the country continues to support a large and healthy otter population. However, in Ireland's 2007 conservation status assessment (Article 17 of the EU Habitats Directive), the otter was considered to be in unfavourable (inadequate) condition. While the Range, Habitat and Future Prospects categories were all considered favourable, Population was deemed to be unfavourable.

This paper examines the data behind the 2007 assessment by Ireland, which included 3 national otter surveys and a series of focused radio-tracking studies. Population size was estimated by calculating the extent of available habitats (rivers, lakes and coasts), dividing that by the typical territory size and then multiplying it by the proportion of positive sites in the most recent national survey. But other methods of population estimation are also valid and can produce quite different estimates.

Population trend was calculated as -23.7% based on a simple comparison between the number of positive sites in the first national survey in 1980/81 and the most recent survey in 2004/05. However, the range of the otter in Ireland did not visibly decrease over the 25 year period.

Work is now well underway for the next Article 17 report in 2013. In Ireland, a 4[th] national otter survey is almost complete and further focussed research has been conducted on coastal otters to help improve our understanding of territory size there. The EU Commission is moving towards standardised methods of reporting both range and population size in Article 17 conservation assessments. Discussions between countries within and outside the EU is essential to ensure that the approach chosen by the Commission's makes sense ecologically and is informed by best international practise.

RECENT STRONG DECLINE IN OTTERS *LUTRA LUTRA* IN BELARUS: THE DATA GAINED AND HYPOTHESIS ESTABLISHED

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In Belarus, in 1980s and 1990s, occasional catches by beaver trappers and extermination by furbearing poachers suppressed the otter populations a lot on the most of territory, outside well-protected reserves and hardly accessible wild areas. The species density was markedly lower than its potential carrying capacity. Late 1990s were characterised by losing of interest by people in fur production; and finally furbearing declined in Belarus. However, in late 1990s and early 2000s human fishing with fykes appeared to prevent restoring the otter population in Belarus. At last, fyking was more or less stopped, and otters restored the population up to the mentioned high potential level of number. In mid 2000s the otter population thrived. The species reached its carrying capacity and populated rivers with relatively high density: small rivers: 2-8, mean about 4 inds/10 km of stretch, medium-sized rivers: 4-11, mean about 7 inds/10 km of stretch.

Suddenly, in autumn 2008, the otter population declined 20-50 fold in different areas. Actually, in August 2008 otters were still common, while in December 2008 the population was registered at very low number. In September-October 2008 two dead otters were found, and hunting wardens reported about eleven more such occasions. Otter survey that was gradually undertaken in 2009-2010 evidenced that the otter population was crashed countrywide. For instance, in the winter 2005-2006 in Naliboki Forest on an area of 2750 km^2 lived about 580 otters, while in December 2008 during inspection of approximately 60-70% of the habitats only 8 otters were registered. The situation for the spring of 2011 showed some restoration of the otter population about 5-30% in different areas.

Several hypotheses were raised to explain the decline of otters. So fast decrease in numbers and findings of dead otters suggested an epidemic in the population. Nevertheless, with relatively low possibilities to identify the disease in Belarus and not fresh enough carcasses discovered the disease hypothesis could not be directly confirmed. However, simultaneous strong and fast decline in American minks, in the same areas, suggested the presence of a dangerous disease in the both populations. Just in case, we examined prey supply. No significant changes in fish and common frog biomass were found in small rivers, at least. Concerning reproduction rate in otters, the data gained evidenced more or less normal breeding rate – 24% of the individuals registered in 2009-2011 were cubs (n=283).

At present, the most plausible hypothesis for the decline in otters is as follows. Plausibly despite of strong obligation to vaccinate captive-bred carnivores, by economising money, administrations of furbearing farms (such farms still exist in Belarus) did not vaccinate their American minks in many cases. If an epidemic happened in such a farm, farm-escapers brought diseases to the wild. In effect, the population of feral American minks, which was stable on multiannual scale before, appeared to range with 5 year cycles. The first crash in feral American minks happened in autumn 2003, the second one was in autumn 2008. The second epidemic in American minks coincided with high density in the otter population and presumably in such a situation otters were suppressed by the epidemic. May be the first and second epidemic in American minks were originated from different diseases, and otters was more or less resistant to the first one, but vulnerable to the second one.

ASSESSMENT OF CONSERVATION STATUS FOR THE EURASIAN OTTER: A CONCEPT FOR OTTERS ALL OVER THE WORLD?

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According to the EU Habitats Directive (Art. 17) all member states have to monitor, assess and report on conservation status of species on the annex II and IV of the directive, among them the Eurasian otter *Lutra lutra.* The individual parameters to be assessed are range, population, habitat and future prospects and the main goal are to maintain or restore "favourable conservation status" for the species. The reporting in 2007 for the period 2001-2006 showed that conservation status was favourable for the otter in only one out of nine biogeographical region in Europe, while status was "Unfavourable" or "Unknown" in the other regions. The next reporting on conservation status will be in 2013 for the period 2007-2012 hopefully reflecting that the member states have fulfilled their obligations to improve the status for this species.

The concept of assessing conservation status for the Eurasian Otter in EU could be a useful tool to determine and review on a continuing basis on the status and conservation needs of otters all over the world, and promote the implementation of necessary research, conservation and management programmes by appropriate organisations, decisions takers and governments, which is one of the aims of the Otter Specialist Group.

SEASONALITY IN OTTER SCENT MARKING: IMPLICATIONS FOR MONITORING

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River otters scent mark by depositing scats, urine and anal gland secretions at latrines along the banks of aquatic systems. Latrines are visually conspicuous and easily detected in riparian areas, characteristics that have contributed to focus on surveys for scats to detect the presence of river otters. Relatively little attention has been given to assess seasonal variation in river otter scent marking, although this information could potentially increase the efficacy of surveys. During 1990-2007, the Pennsylvania River Otter Reintroduction project conducted a series of 5 integrated projects that each separately addressed seasonality of scat deposition rates at latrines. Scat marking intensity was assessed at: 1) specific latrines along riverine systems; 2) sections of shoreline in riverine systems; 3) sections of shoreline in associated riverine, lacustrine, and palustrine systems (i.e., those in the same drainages); 4) specific latrines along riverine systems monitored by remote cameras; and 5) bridge crossings. River otter making intensity was highest during spring and fall, and lowest during summer at all marking sites. As an example, the respective odds of a positive (latrine) site at a bridge crossing were 7.8 and 4.5 during spring / fall and summer, respectively. In this paper we review the accumulated evidence demonstrating seasonality in river otter marking habits; examine possible reasons for seasonality in marking; and discuss how this information can be applied to enhance sign surveys for river otters.

WHAT´S ON OTTER BY GBIF?

ANDERS TELENIUS

GBIF-Sweden, Swedish Museum of Natural History, P. O. Box 50007,
SE-104 05 Stockholm, Sweden

GBIF (Global Biodiversity Information Facility) is an international initiative offering public access to natural science collection and observation databases through http://data.gbif.org and a number of regional or thematic portals. By submitting a request for particular information on taxa, geographic regions, time span or data provider (or a combination thereof) a response is generated covering all registered records either displayed as a table of collection content or distributed on a map. Any additional information (e.g. gender, age, status etc.) is also provided whenever available.
GBIF uses a open source software, and the collection and presentation of database records is preferably managed by individual GBIF nodes via the Integrated Publishing Toolkit http://www.gbif.org/informatics/infrastructure/publishing/ developed at, and offered by the international GBIF secretariat. Anyway, data published using other software platforms – such as DiGIR, BioCASE or TapirLink – will continue to be harvested and indexed by the GBIF core infrastructure.
Altogether the database consists of more than 280 million records worldwide, out of which 59131 represent the 13 otter species. As an example, the results of the search for *Lutra lutra* by GBIF are shown, explaining the various content parts of the display. Moreover, the collection/observation statistics on the 13 otter species are briefly summarized.

INDIGENOUS KNOWLEDGE, LOCAL PERCEPTION AND IMPORTANCE OF THE SPOTTED NECKED OTTER (*LUTRA MACULICOLLIS*) ON RIVER HLAN - OUÉMÉ VALLEY COMPLEX, SOUTHERN BENIN

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If some mammal species are conspicuous and can be readily counted, most species are elusive, especially when they are in permanent conflict with local communities. It is the case of the spotted necked otter in Southern Benin, for which scientific knowledge to guide the definition of conservation strategies is still scanty. This study describes the traditional knowledge related to the use of the spotted necked otter (*Lutra maculicollis*) by the residents of two connected wetlands in Southern Benin. Information was collected by interviews and group discussions within 35 villages and 5 animal-based medicine markets. Spotted necked otter has an important medicinal, socio–economic and cultural importance in the study area. Most people (95%) appreciate otter meat, since the species is not considered a divinity. We collected 18 proverbs, 10 local names, 22 medicinal and mythic uses of the species with their significance. Local knowledge, based on age-old practical experience of indigenous people, can reveal useful information on the species biology, ethology and ecology. We suggest that this kind of neglected traditional knowledge should be capitalized to supply information gaps on the biology and conservation of scarcely known species.

NATURAL RECOLONIZATION OF THE EUROPEAN OTTER (*LUTRA LUTRA*) IN FRENCH MASSIF CENTRAL

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Once widespread in France as in the rest of the continent, European otter (*Lutra lutra*) populations have strongly declined and were considered at the threshold of extinction when legal protection was decided in 1972. Local surveys of otter distribution in France performed during the 1980's showed the persistence of a little population in the Massif Central (centre), precisely in the upper parts of the rivers Loire, Dordogne and their main tributaries. Further investigations outlined the natural expanding trend of this population after effective protection. With only one exception concerning an aborted experience in Eastern France, otter was never reintroduced or reinforced in the country, allowing to evaluate the natural expanding capacities of the species and general characteristics of potential habitats.

Several thousand kilometres of riverbanks have been regularly surveyed since the beginning of the 1980's, according to otter monitoring standard protocols. A regular increase in otter population size and range was reported for the Massif Central. The number of road-killed otters has progressively increased while the species recovered ancient territories. Specific otter passages with automatic cameras were built under main roads and highways to minimize collision risk and enhance otter dispersion. From the beginning of the 2000's, expanding otter populations met other old populations strongholds located along the western side of the country. Currently the catchment of the River Loire has been almost completely reoccupied by the species. The otter is furtherly expanding in the catchment of the River Rhône, while the first signs of presence have been recently recorded along the upper tributaries of the River Seine.

ATTITUDES AND BELIEFS TOWARDS OTTER COMEBACK IN SWITZERLAND

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During the second half of the 20[th] century the otter disappeared from Switzerland because of a combination of several factors: reduction of food supply, river pollution, human persecution and the destruction of riparian vegetation.
Even if the otter is still absent in the country, natural recolonisation may occur from neighbouring French and Austrian otter populations. Being the Swiss landscape man-dominated, conflicts between otter and human activities may occur. Although the comeback of the otter in Switzerland has been controversially discussed, no studies of human dimension have been effectuated.
The aim of this study was to understand how the lobbies potentially in conflict with the otter can react to its recovering.
The study was developed in two steps. First, a questionnaire was sent to 200 people living all over the country. Second, we organized a round table with the representative of the lobbies potentially involved in the comeback of the otter. The results were analyzed using the "Bussole 21" approach.
Our study showed that people in general agree with the otter comeback, even if it would be advocated by only 69% of fishermen/fish farmers, of which 39% would favour a natural re-colonization, and 39% a reintroduction program. River revitalization is considered an indispensable pre-condition.

ABUNDANCE INDEX OF NEOTROPICAL RIVER OTTER (*LONTRA LONGICAUDIS*) IN PANTANAL, BRAZIL

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The neotropical river otter *Lontra longicaudis* is one of the less known otter species. Studies using direct observation are difficult to be applied to this species due to its crepuscular behavior in most of its distribution area. In contrast, in River Negro watershed (Pantanal, Brazil) the species is diurnal, enabling the use of direct observation. This work aimed to evaluate the influence of seasonality and habitat composition on *L. longicaudis* abundance on two rivers of the watershed: River Negro (Area 1: 19°34'35"S, 56°14'48"W) and River Correntoso (Area 2: 19º30'18"S, 55º36'45"W). Area 1 was divided in three stretches (A, B and C) and Area 2 in two, with different habitat characteristics. We conducted 19 field campaigns between 2003 and 2006 (14 in Area 1 and 5 in Area 2). Seven of those campaigns were held at wet season and twelve in the dry season.

In area 1 we surveyed 414.2 km of transects (33 sights), giving an average abundance of 0.08 otter/km per campaign. We didn´t find significant differences in abundance between patches ($p=0.59$; ANOVA test). We also didn't observe significant differences in otter's abundance among years ($p=0.86$). But we observed a significant difference in otter abundance between seasons ($p=0.0126$; t test), with higher abundances in dry seasons. In area 2 we surveyed 200 km of transects (7 sights), with 0.035 otters/km per campaign. We didn't observed significant difference in otter abundance between the two stretches ($p=0.62$; t test). No significant difference was found between otters abundance in different years ($p=0.84$) nor between seasons, however, the low number of campaigns held in this area and the higher data variance may have influenced this analysis. Seasonal variation in otter abundance was probably related to prey and banks availability: during wet season, water level increase connecting swamps, lakes, marginal lagoons and oxbow lakes, creating several habitats that allow fish dispersal. In these conditions, prey availability increases and fish are easier to catch when compared to the main course of the river. As a consequence, otter detectability by standard surveys decreases. Also den availability may affect otter seasonal abundance: during the wet season the availability of suitable den-sites is lower and may force otters to widen their home ranges.

WHY CAMERA TRAPS FAIL TO RECORD OTTER PRESENCE

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The elusive nature of the Eurasian otter (*Lutra lutra*) makes difficult the observation of wild individuals. This is true especially where population densities are low, as for the small population that recently colonized the River Sangro (Abruzzo region, Italy). Camera and photo traps are useful tools in wildlife research on such elusive and rare species. As part of an otter survey in this area we tested the efficiency of camera trapping using different camera traps. We initially set two camera traps in front of otter marking sites, i.e. rocks emerging in the middle of the watercourse. We checked for correct functioning at every check of memory card and batteries. Controls of camera traps occurred opportunistically during the survey of marking sites for collecting fresh spraints used for a Non Invasive Genetic Sampling. We used two ScoutGuard SG550 with PIR sensor for a total of 150 days/trap. Despite the correct positioning of the traps in terms of angle set and the ascertained transit of otters at the site, proved by the presence of fresh scent markings, we did not obtain any videos or photos of otters. After these first attempts we tried to use odor baits to keep otters more time on the marking rocks. In this case too, we did not obtain any positive result from camera traps. We therefore hypothesized that body temperature of the otter emerging from the water was too low to activate the PIR sensor.
To test our hypothesis we modified one of the two camera traps by substituting the PIR sensor with a pressure sensor. Than we set simultaneously the two camera traps in the same site, framing a marking rock. We also modified the pressure sensor by separating the ends of the circuit to prevent short-circuits due to humidity or rain. After only two nights the camera traps with pressure sensor caught the first video of an otter, while the other camera did not record any image, neither was activated. According to these preliminary results the low effectiveness of standard wildlife camera traps in wild otter research studies could be improved by the use of pressure sensors, especially when traps are set close to the water.

STATUS OF OTTERS IN THE ASIAN REGION

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Otters (Carnivora, Mustelidae) are important indicators of pollution in wetland ecosystems. In Asia, there are four species of otter inhabiting inland waters, *viz.* Eurasian otter *Lutra lutra*, smooth coated otter *L. perspicillata*, small clawed otter *Aonyx cinereus* and hairy-nosed otter *L. sumatrana*. Marine otter *Enhydra lutris* is found in the Northern seas of Japan and Kuril Islands.

In general, since Asian otters are scarcely known, in various countries efforts have been made to carry out otter awareness programs and training on otter survey techniques. Training programs were conducted in 2007 and 2009 in Vietnam and Cambodia, respectively. As a consequence, many young biologists are now carrying out research and surveys on otters in their respective countries. Ecological work on otters is in progress in Thailand, Vietnam, Cambodia and Indonesia (West Sumatra), with special focus on hairy-nosed otters. As a first relevant result, the presence of the hairy-nosed otter has been recently discovered in the Malaysian state of Sabah. Distribution surveys are also in progress in India, Pakistan, S. Korea and Sri Lanka. Unfortunately, there is hardly any information on otters from west Asia.

The Wildlife Rescue Centres in Cambodia and Bangladesh, which also help to rescue wounded otters, need special mention. Recently, Cikananga wildlife rescue and rehabilitation centre (Indonesia) has been identified by SERO (Safer Environments for the Region's Otters) as the ideal place to provide a safe rehabilitation space for otters with the aim of their reintroduction in the wild. The International Otter Survival Fund (IOSF), Scotland, together with the OSG, is making a special effort to combat fur trade in south-east Asia through a project started in Cambodia in 2008. As a result, attitudes towards otters and their conservation are changing. This project will be eventually extended to Thailand and Vietnam.

In highly industrialized Asian countries such as Japan and Hong Kong there are no wild otter populations. Pollution and destruction of otter habitats are probably the major factors that contributed to otter extinction. Occasionally, otters are reported for islands close to Singapore and Taiwan. Recently the carcass of a smooth coated otter was found in Singapore mainland, suggesting that the otter population may be recovering.

Legal protection of otters is an urgent requirement in some of the Asian countries as otters are still being killed for their fur and organs, which are used for traditional indigenous medicine.

CURRENT DISTRIBUTION AND POTENTIAL FOR EXPANSION OF REINTRODUCED EURASIAN OTTER ON THE RIVER TICINO (N ITALY)

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Once widespread in Italy, the Eurasian otter (*Lutra lutra*) populations have strongly declined during the late 1970s and throughout the 1980s. The last report of otter presence in north-western Italy was in 1983. Reintroduction occurred in the Piedmont River Ticino Park in 1997, when a pair of otters was released from the breeding centre of Cameri. Possibly a second pair was released before the end of the century. Although the low number of individual released, since the reintroduction otter presence has been reported on a ca. 5 km long stretch of the river till 2008. In summer 2008, a survey for otter spraints allowed to confirm otter presence on a 2.6 km long stretch of the river.
Recently a further otter release in the valley has been advocated. Before considering a reintroduction programme it is important to assess otter distribution along the river and the suitability of the whole area for otters. With these aims, between August 2010 and January 2011, we surveyed the river by the standard method, looking for otter signs along 18 600 m long stretches uniformly distributed on 35 km of watercourse; moreover, according to OSG/IUCN suggestions, we 1. reviewed available information about fish availability along the river; 2. assessed the availability of suitable otter refuges and reproductive sites; 3. assessed water quality, as expressed by SECA index (E.B.I. and chemical-physical macro-descriptors), for 23 5 km long stretches of the river (from Lake Maggiore to the confluence in the River Po). A total of 14 otter signs were found on a 7 km long stretch of the river, although most signs (78.6%) occurred on canals and small streams. Marking intensity was 0,2 sprainting sites /100 m of watercourse. The richness and diversity of fish community along the whole watercourse were generally higher than in otter current range, while water quality kept "good" (SECA = 2) and constant all along the river. Considering a 100 m large belt on both river banks, 90% of current otter range was riparian wood, while, on average, only 52,8 ± 35% of the whole riverbanks were covered by wood. Nonetheless, except for the stretch downstream the city of Pavia, all the watercourse potentially offered suitable reproductive sites for the species. On the whole, preliminary data suggest that an about 60 km long stretch of the River Ticino is suitable for otter expansion. Anyway, information about the fish community is rather old (1997) and any feasibility study should include an update of fish diversity and abundance. We also argue that the number of otters currently occurring on the river should be carefully assessed by non-invasive genetic methods.

MODELLING THE OCCURRENCE OF NEOTROPICAL OTTER *LONTRA LONGICAUDIS* IN ITS GEOGRAPHIC RANGE: ESTIMATION BY MAXIMAL ENTROPY

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Lontra longicaudis is widespread from Mexico to Argentina. However, is one of the least studied Lutrinae species, knowledge about its habitat requirements and distribution being quite scarce. One of the reasons is that the use of techniques that can get in the field information of distribution is very costly and time consuming. A new inexpensive way to overcome the lack of field data is to estimate habitat suitability by maximal entropy, which may provide insights about species, such as new information on occurrence and range, when the information is deficient. To reduce this lack of information about *L. longicaudis*, an extensive search was conducted on specialized journals and consulting mammal researchers. We considered all reports with location, name of the collector and date. The main aims were: to collect database of all available otter locations; to identify climatic and vegetation factors influencing otter distribution; and to identify priority areas of study.

Otter distribution was assessed by Maxent from a total of 550 location points. Eight habitat variables were recorded using Worldclim maps, a human population density map and a vegetation map (NDVI), with resolution of 30 arc seconds. To determine the importance of each variable, we used Maxent jackknife analysis. We calculated the average probability of occurrence of the neotropical otter in each river basin. The Maxent result for each pixel was then multiplied by the distance to the nearest location, producing an index whose values were mapped as to show the regions with few studies but high probability of otter occurrence.

Results indicate that potential distribution of L. longicaudis is wider than historical one. IUCN's distribution indicate a range going from Argentina to Mexico, but do not consider Andean region, North Argentina, southeastern Mexico, parts of Central America, and northeastern Brazil, where our analysis shows high suitability. Considering the maxent results, best suitable habitats are rain forests in general, Ecuador, central and west coast of Central America. Maxent's suitability pooled by basins indicate that Amazonian and south-central Brazil basins have a high mean suitability, but adequacy varies a lot inside them. Our Importance index indicate east Venezuela, Guiana, Brazil's coast, North Argentina, and most Central America, as areas demanding priority in studies. Finally, jackknife analysis indicate temperature and rainfall as determinants of habitat suitability to otters.

OTTERS AND DIGITAL TECHNOLOGY: NOVEL OBSERVATIONAL METHODS FOR DATA COLLECTION AND OUTREACH COMMUNICATION

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Wildlife scientists and photographers alike have had great success with the use of cameras equipped with infrared motion sensors ("camera traps") for recording presence, activity and behavior of otherwise elusive animals. A literature review reveals that camera traps are useful for estimating abundance and density of targeted species, and can effectively supplement other data collection methods, especially tracking. Remote cameras are relatively unobtrusive and can be used to identify individuals within a population, providing an alternative or additive method to radio tracking or submerged infrared counters. Limitations persist, however, when camera traps attempt to record uninterrupted behavior, particularly underwater. Further literature review and assessment of available technology suggests that remote underwater video cameras provide the most promising platform for collecting data on the behavior of otters underwater. Presented here are two possible schematics for remote underwater cameras, customized for otter habitats: 1) a submerged unit with an extended video out cable, connected to a monitor and TiVo box, and 2) a self-contained unit controlled by camera circuitry that has been pre-programmed to operate on time intervals during which otters are most active. Both designs will afford customization for habitat and individualized traits of species. As with any untested technology, challenges will arise, and will need to be addressed in the field: otters may not adapt to the presence of the cameras, power management with the units can be problematic, infrared video is imperfect, and destruction of the units by poachers is always possible. However, once collected, digital media's potential for communication of otter research and conservation through social media, public forums, and other digital venues is vast, suggesting that the rewards far outweigh the challenges of this technology. When it comes to charismatic yet elusive animals like otters, it is time to diversify data collection and research communication by pioneering the use of digital media technology in the field.

MONITORING FOR ABUNDANCE AND HARVEST OF RIVER OTTER (*LUTRA LUTRA*) IN KAMCHATKA

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Kamchatka peninsula is one of the few regions of Russia where the river otter population is widely distributed, numerous and healthy. It is associated with a developed river net (up to 1 km of riverbeds per km²) with very clear water, rich food base and favourable hydrological conditions. In 1950-1980 of the past century, an average of 600-700 river otters has been caught annually on Kamchatka (30-50% of the total catch of USSR). Since 1980 the permanent monitoring was conducted to control abundance, reproduction, hunting and resource use. The main monitoring technique was a record of river otter number in the period of maximum animal concentration, within middle and low portions of rivers (January-March) at an elevation of 0-500 m above sea level. Transects were established along riverbeds, and fresh (daily) river otter traces and individuals were recorded. Traces identification is conducted by the size of back leg trace (length and width), and jump length, i.e. the distance to which one leg is put forward to another one. Sex was determined by urinary spots. Animal traces and direction of moving were plotted. In 2006-2009 an average of 1260 km of transects were established (from 1150 to 1420 km). The legal catch was estimated by statistic data of regulatory agencies. On the basis of census data a population density – river otter number per 10 km of river was evaluated. In 1980-1989 the average density was 1.5-1.6 individuals per 10 km, in 1990-1999: 1.6-1.8, in 2006-2009: 2.0-2.1. So, in the 32650 km of rivers of the peninsula, we estimated a winter population of 4.90-5.88 thousand individuals in 1980-1989, 5.22-5.88 thousand individuals in 1990-1999 and 6.53-6.86 thousand individuals in 2006-2009, respectively. The increase in abundance was caused by a continuous decrease of river otter catch by hunters. In 1980's an average of 500-600 individuals were caught annually, in 1990-1994 300-450 and in 1995-2009 only 80-100 individuals, with 5-6 fold reduction. During the last 15 years a demand and prices for river otter skins decreased both in domestic and international markets. At present, we hypothesise that the population density is close to the carrying capacity. On Kamchatka the river otter is a background species and an indicator of river systems condition, and its hunting is authorized only by special permits. Maximum allowed catch must not exceed 5% of animal number in the winter period. Oil and gas exploration and development, base metals and gold mining, constructions of transport communications (pipelines, power lines and roads), mining objects (mines, diggings and plants) are the main threats to the river otter population and its habitats.

MONITORING OF THE EURASIAN OTTER IN THE CZECH REPUBLIC

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Monitoring is an essential part of Management Plan (MP) for the Eurasian Otter in the Czech Republic (CR) for 2009-2018. Within the MP, a quite complex system consisting of 5 main types of monitoring was developed. These monitoring types are: nationwide mapping of distribution, mapping of marginal areas of occurrence, estimates of abundance in selected areas, monitoring Sites of Community Importance (SCI), and collection and analyses of dead individuals.

In this contribution we aim to describe the methodology and reasons for using each type of monitoring in given areas at given regular times. Nationwide mapping of distribution is done by modified IUCN OSG standard method, every five years in the entire country. It shows long term trends in otter occurrence in the CR. Mapping of marginal areas of occurrence uses the same methodology and is done once in five years, between nationwide mappings, in peripheral parts of the range discovered during previous nationwide mapping. It allows to estimate the range expansion of the otter. Snow tracking in 10x10 km squares in several areas representing various types of otter habitat in the CR is used for estimating otter abundance in selected areas. These data are used for estimating otter densities by mathematical formulas, for each quadrate of zoological mapping in the CR, and for calculating damage caused by otters on fishstock under the Czech compensation law. Monitoring of SCIs has to be done in order to report to the EU, as required by the Habitats Directive. Each of the 26 SCIs in the CR designed for the Eurasian otter is regularly monitored (twice in the course of 5 years) by one of the following methods: occupancy or visiting rate; selection of methods depends mostly on size and habitat characteristics of each SCI. Collection and analyses of dead individuals is being carried out continuously in the entire CR. It provides important information about threatening factors and demographic parameters of the Czech otter population.

MANAGEMENT PLAN FOR THE EURASIAN OTTER IN THE CZECH REPUBLIC FOR 2009-2018

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Management Plan (MP) for the Eurasian otter in the Czech Republic (CR) was approved by the Ministry of the Environment in 2009, for a period of 10 years. Eurasian otters are protected by the Czech national as well as European legislation. After the massive decline occurred in the 20th century the species is now recovering. However, it is viewed (especially by fish farmers) as a conflict species, and therefore education, compensation measures and proper monitoring are important in order to ensure long term existence of stable populations. Implementation of the MP is carried out by several institutions under the coordination of the Agency for Nature Conservation and Landscape Protection (ANCLP) of the CR.

Main objective of the MP is to secure conditions for permanent, independent, sustainable existence of Eurasian otters in nature in the CR. Measures are planned in the following areas: biotope management, species management, monitoring, research, education, and other measures.

Thanks to a three-year research project, a lot of new information about the otter population structure and dynamics, genetic variability and threatening factors was collected. A basic Population Viability Analysis (PVA) model was constructed, involving also management simulations. For example, simulating the scenario of yearly allowed hunting of 100 individuals showed a high risk (18% of simulations) of collapse of the entire Czech otter population. Data from regular monitoring support the general view of a slow recovery of otters in the CR. However, traffic and illegal poisoning are still important threatening factors. Several critical road segments were identified and solutions for improving otter safety were proposed. Every year, about 20 orphaned cubs are found, about half of them survives to be released back into nature or stay in one of Czech animal sanctuaries. Seminars and educational programs for children and public are regularly organized as part of the MP. Under the category of other measures, methodology for calculating otter damage on fish stocks has recently been revised and different preventive measures are being tested.

ESTIMATION OF THE SIZE OF THE OTTER POPULATION IN THE COUNTY OF SOMERSET, ENGLAND

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A series of 15 annual co-ordinated surveys, when approximately 130 teams of volunteers inspect nearly 500 sites along 125 preselected stretches of waterway on the same 2 consecutive days, has produced results consistent enough with each other to allow an estimation of the numerical size of the adult otter population across the whole county. The aim is to try to progress beyond mapping those 10km squares that are now positive again for otters after the major collapse of the 1970's. Our region has long had a widespread re-established presence, but in order to counter exaggerated claims about the predator menace on reared fish stocks, and to assess the effect on the otters of the new parasite infecting many of the casualties that we send for post mortem, we need to know more or less how many otters are involved. The waterways of the 8 basic river systems are divided into a total of 190 survey lengths, and as many as possible are surveyed twice on the same consecutive days in April. The results from 500 sites are categorised as positive or negative for any otter signs, and as having fresh evidence on day one or day two. That just over 70% of the sites checked are positive, shows that the survey is searching in enough places; fresh evidence is found at 30% of these sites, indicating that otters utilise about a third of their territory in any one night.

Mapping of this simultaneous information gives a picture of the spread of otters, and incidentally mink, on the intermediate night across the whole county. Analysis of it enables a numerical estimation of the minimum, or approximate, strength of the adult population, (cubs are not included), on an assumed basis of one adult per discovered range.

This estimate is validated by comparison with the results from a DNA survey conducted by the Environment Agency, which looked at the feasibility of using DNA from fresh spraints to assess the strength of a population of otters. Two of the four rivers they used are in our county, so their result of the number of otters identified provides a baseline for comparison with our subsequent findings. And it is validated by consistency with other sources of information: we do another series of checks on a monthly basis, we record all known deaths, and we log all reliable reports from fishermen and farmers etc. So far, none of these sources of information has led to any surprising departures from what our annual survey has revealed. Mapping of the results indicates that our waterways are occupied at or near full capacity, and the low total of between 65 and 70 adult ranges across an area of 3700 square kilometres is useful in countering some of the wilder claims of the fish rearing and angling interests.

SESSION 3

Population dynamics and ecology

PRELIMINARY FINDINGS FROM A NEW STUDY OF THE CONGO CLAWLESS OTTER (*AONYX CONGICUS*) ON THE RIVER DJI DJI, GABON

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The Congo clawless otter (*Aonyx congicus*) is a little-known species inhabiting wetlands of the Congo Basin. In the Ivindo National Park, Gabon, it is locally common on the remote River Dji Dji, a small black-water river in the interior of the park. We report on the results of 2 different visits to the Dji Dji, in December 2009 (wet season) and July 2010 (dry season); a third visit is scheduled in July 2011. We surveyed for otters several sections of the river, using a motorized pirogue and an inflatable kayak. During our brief (3-day) 2009 visit, we did not directly observe any otter and found only 1 scat. However, in our 10-day visit in July 2010, both *A. congicus* and the sympatric *Lutra maculicollis* were readily observed during daylight hours, but not during nighttime surveys. *A. congicus* was primarily observed alone or in groups of 2, which appeared to be mothers with nearly full-grown young individuals (video available). *A. congicus* densities appeared to be the highest where edge vegetation included backwater sections of marsh vegetation, dominated by sedges. In 2 short feeding observations, we saw *A. congicus* to use both edge and open-water habitats. On the edge, a mother and young were observed digging into riverbanks. A solitary otter was also observed while repeatedly diving in central portions of the river, as to capture one unidentified prey. In July 2011we will attempt to survey the whole stretch of the River Dji Dji included in the park boundaries. We will also try to discuss with local villagers about conflicts between otters and fishermen. Finally, we plan to undertake 4-6 weeks of behavioral and diet observations, in collaboration with Gabonese ichthyologists.

A SYNTHETIC REVIEW OF THE DIET OF THE NORTHERN RIVER OTTER (*LONTRA CANADENSIS*)

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The northern river otter (*Lontra canadensis*) is distributed over a wide range in North America, that stretches from the Pacific to the Atlantic Ocean and from the southern United States to Alaska. A number of studies have been conducted on the food habits of otters throughout their geographic range, but a quantitative synthesis of the diet is yet lacking. We examined 91 publications with unique information on the food habits of the northern river otter, 64 of which contained quantitative data that were entered into a database and stored as 99 individual prey lists. Data were recorded by both season and region. These data show that the diet of northern river otters is highly variable, including prey items from 123 families, 79 orders, 24 classes and seven phyla. Fish was the most diverse prey taxon with 41 different families. At 80 percent occurrence, fish also predominated in the overall diet, though the importance of prey items varied by both season and region. Crayfish were frequently the most important food item in the southeastern United States and predominated in summer diet throughout the eastern half of the country, while both birds and amphibians were the most frequent item by season at least once. At the family level, crayfish were the most commonly observed food item across the otter range, occurring in an average of 45% of diet samples, followed by the fish families Centrarchidae, Cottidae, Umbridae, Gasterosteidae, Catostomidae, Cyprinidae, and Salmonidae. We suggest that due to the seasonal and regional unavailability of crayfish, otter preference for this food item has been underrepresented in the literature. The percent occurrence of fish families varied by region with Cottidae, Centrarchidae, Catostomidae, Cyprinidae, and Salmonidae each predominating in at least one region. Few studies provided availability data and/or statistical tests to determine food preferences of river otters. These studies do, however, show that otters take prey according to availability, selecting for less agile fish. Catostomidae and Centrarchidae, for example, were the most commonly selected-for families. We conclude that northern river otters are not only opportunistic foragers but are capable of extreme plasticity in diet as they readily prey switch depending on availability and opportunity.

ENERGETICS OF SWIMMING IN *LUTRA LUTRA*

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Using high speed cinematography (50 frames/s) the underwater swimming of a captive yearling otter (*Lutra lutra*) was filmed. With a Vanguard motion analyzer the swimming movements were analyzed frame by frame.
It was concluded that the otter propels itself by means of a simultaneous, strong and fast backward movement of both hind legs with spread webbed feet. Two kinds of strokes of the hind feet can be distinguished: 1. the power stroke with spread and extended webbed feet and 2. the recovery stroke with withdrawn and curved webbed feet. The frequency of the stroke cycle was 2.17 – 3.03 Hz. Stroke frequency is related to body size in free-ranging seabirds, pinnipeds and cetaceans. This relation is expressed as $F = 3.56\ mass^{-0.29}$.
From the analyses it appeared that the otter travels under water with undulating movements of the body. The amplitude of the undulation was smallest at the front of the head and highest at the tip of the tail. It was found however that neither the undulation of the trunk nor the tail contributed to the propulsive power as in fish swimming. The function of the undulation is merely the increase of the stride length of the power stroke to gain a maximized power output. There was no difference in the wave characteristics from the undulation of the trunk and tail. This suggests that the tail does not perform a separate muscular action and therefore just passively follows the movements of the trunk. The tail has however an important role in the maneuverability of the animal under water and preventing a pitch of the body during the vigorous backward strokes of the hind paws.
The high speed film analyses allowed for an estimation of the otter's power output by determining the forward directed propulsive force and backward directed drag. The drag could be estimated from the otter's morphology with the drag equation $F = ½\ \rho\ v^2\ Cd\ A$.
From the power output, the power input, metabolic rate and transport costs of the swimming behavior were determined using the mechanical efficiency of muscles and the locomotory efficiency of the hind feet propulsion. The results were compared with measured transport costs of underwater swimming in other aquatic mammals. The costs of transport (COT) in aquatic adapted species that swim in a horizontal path while submerged may be described by the relationship: $COT = 7.79\ mass^{-0.29}$. Based on this high speed cinematography study it appeared that fair estimates can be made of the necessary power input, metabolic rate and transport costs of underwater swimming otters.

OTTER OCCUPANCY AND RECOLONISATION EVENTS AT THE SOUTHERNMOST MARGIN OF THE ITALIAN RANGE (CALABRIA REGION)

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After a period of strong decline, the Eurasian otter (*Lutra lutra*) has re-expanded its area of distribution in Italy from 1984 to 2004, mainly toward the southern periphery of its range (Calabria region). In order to estimate site occupancy at the southern margin of otter range and to evaluate the potential of aquatic habitats of the Sila National Park for otter recolonization, we conducted repeated surveys at 81 stream sites in the Calabria region during spring-summer 2009. We used occupancy/detectability models to evaluate alternative hypotheses on the role of aquatic habitats (corridors or residence areas) of the Sila National Park and to assess the importance of human influences (population density, cattle density and the extent of agricultural land) on the probability of otter presence.

Presence of otters was confirmed in three river basins (Savuto, Neto and Crocchio) that have been previously surveyed and we found 12 new presence sites along 6 previously unoccupied streams. These records represent the first evidence of otter presence in the Sila area and National Park since the late 1970s, when it apparently became extinct. Because of low detection probabilities, the occupancy estimation was about twice the percentage of presence sites (19.8%). All three human-related covariates that were included in the models showed a negative effect on the probability of otter presence. A map of predicted probabilities of otter presence from the best occupancy model was created. For the watercourses flowing from the Sila high plain, it suggests an upstream-downstream gradient in the suitability for otters .

Results seem to indicate that the otter recolonization in the southern periphery of the Italian range is still in progress, but also suggest rapid changes in occupancy at distribution margins. We discuss old and new threats that may reverse the ongoing favourable occupancy dynamics and highlight management actions needed to favour the otter recolonization process at the southernmost margin of otter range and especially in the Sila National Park.

INTERSPECIFIC INTERACTIONS BETWEEN SOUTHERN RIVER OTTER AND ALIEN NORTH AMERICAN MINK

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We assessed interspecific interactions between the Southern river otter (*Lontra provocax*) and North American mink (*Neovison vison*) on a microscale of seashore sections. Southern river otter is an endangered species endemic to Patagonia, while the alien North American mink has invaded a large part of the mainland and southern archipelago since it was introduced in 1930. This otter has a body mass of up to 15 kg and, in riverine and lacustrine wetlands, mostly feeds on invertebrates, followed by fish, amphibians and rare birds, while in the marine environment, it feeds almost exclusively on fish. Although some studies have been carried out in freshwater habitats, competition with North American mink remains a question. Between 2006 and 2010, in the southwest Patagonian archipelago, Chile, seven surveys for otter spraints were carried out along five 3 km long stretches of seashore and one watercourse. One otter and seven mink were radiotracked. Otter diet included crustaceans (51%) and fish (46%), while mink diet included crustaceans (51%), rodents (16%) and fish (14%). In rivershore habitats mink diet was comprised of rodents (80%) and birds (12%). Diet data have not normal distribution even after transformation; therefore differences were assessed by Pearson chi square test, Kruskal-Wallis One-way Analysis of Variance and Mann-Whiyney *U* tests.Otter diet between habitats differed, but not by categories (Crustaceans, fish, terrestrial and birds). Mink diet did not differ between habitats, and among categories. Otter niche breadth (0.9) was larger than that of mink (0.4), while niche overlap was low (Levin's index, α=0.263)

The otter's home range was 6.4 km long, while the length of mink home range varied between 1.4 and 3.8 km. Where both species coexisted, the otter was more active at night, while mink during the day. Where mink range did not overlap that of the otter, no difference emerged between night and day activity. Thereafter, only in those sites where mink and otter field signs were found we performed a static interaction analysis in which the frequencies of presence of field signs per study site are compared without reference to the temporal sequence of frequencies. Thereafter, avoidance between otter and mink field signs was assessed by Spearman's coefficient of rank correlation where a positive *r* reflects a significant correlation and negative *r* indicates avoidance between otters and mink field sign presence. Results show that frequency of field signs of otters and mink was negatively correlated (-0.9), suggesting that mink habitat use was affected by interference competition with the otter. Thus, it appear that mink in the Patagonia coexists with southern river otter because of great availability of alternative preys not exploited by otters, as well as plenty availability of habitat not intensively used by otters, particularly because mink invasion has occurred mainly after southern river otter distribution declined because of hunting, habitat destruction, pollution and disturbance.

POPULATION VIABILITY MODEL FOR EURASIAN OTTER *LUTRA LUTRA* IN THE CZECH REPUBLIC

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Different data sources and several methods were used to collect demographic data about local Czech population of the Eurasian otter to evaluate potential risk factors and estimate current and future trends of the population. Presence/absence data from national surveys and snow tracking were used to calculate local densities and population size. Post mortem analyses of carcasses were used to get data about births and mortality. Radio-tracking and genetic samplings were used to reveal otter social structure. Based on different demographic parameters several models of growing of the population were built up and compared: quantitative descriptive model based on known otter numbers in several time periods, life tables based on data on births and mortality and PVA models. Finally when the definitive basic PVA model was set up, several management scenarios were also run up to point out the importance of different threats and management actions on population trend. The results of post mortem analysis showed that the main cause of death of otters in the Czech Republic is road casualty, followed by deliberate killing, especially by carbofuran, as a consequence of conflict with fishermen. The analysis of tooth sections allowed to assess that otter average age was 4,6 years and that mortality rate grew up with age till the age of seven years. Average size of litter was 1,69. Genetic analyses agreed with distribution data in showing three sub-populations in the Czech Republic. Comparing the estimated size of otter population in three successive periods (1992, 2001, 2006), the intrinsic rate of population increase was 0,05. Simulations of various scenarios showed no effect on long-term population survival when removing up to 2% of all individuals per year, whilst the annual removing of about 4% of the population would lead to its collapse.

PRELIMINARY REPORT ON THE BEHAVIOR OF SPOTTED-NECKED OTTERS (*LUTRA MACULICOLLIS*) ON RUBONDO ISLAND NATIONAL PARK, LAKE VICTORIA, TANZANIA

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Research on spotted-necked otter latrine placement and behavior was conducted on Rubondo Island National Park, located in the southwest corner of Lake Victoria (Latitude 2° 18' 10.3", Longitude 31° 51' 26.9") at intervals throughout the year between 2006 and 2009. Latrine surveys and observation sessions occurred during the dry, long-rain, and short-rain seasons. Latrine survey sessions consisted of walking the shorelines of 12 6-km shoreline sections. Five sections were surveyed 4 times, five were surveyed twice, and two were surveyed only once. Concentrated observation sessions were conducted by one observer hidden on the shore, in areas of known otter activity and at denning sites.. Observation sessions varied in length from 1 hour to 8 hours. The majority of otter sightings lasted ≤ 30 seconds (59%); the longest lasted 7 hours and 10 minutes. The UTM location of each otter sighting was obtained by a hand-held Garman® GPS unit. General habitat characteristics of the shoreline along which the sighting occurred were noted as well as the number of otters, sex if determined, and location of animals (approximate distance from shore, onshore, etc.) when first sighted.

Beginning and ending observation times were based on when the animals were first sighted and when animals were out of sight for longer than 5 minutes. Behaviors recorded were broken into mutually exclusive categories. Some categories included strings of physical actions (e.g. Head-up Swim defined as slowly paddling along shoreline) or association with other animals (e.g. Swim alone versus Group Swim defined as swimming within ≤ 10m of another animal). In group situations, behaviors were noted only once for each recorded observation regardless of the number of animals performing that behavior. Durations of behaviors were not noted. If animals joined or left a group this was recorded and their next behavior scored if not previously noted during that observation. Behavioral data were taken from all concentrated observations (n=741; 2,982 minutes).

The preliminary assessment of time otters were engaged in various activities represents the percentage of the total behaviors recorded during sightings of spotted-necked otters on RINP. All behaviors recorded including group structure, social and agonistic behavior, shoreline use, latrine placement in "sprainting zones", breeding, parent/young interaction, and maintenance behaviors will be reviewed to establish a behavioral catalogue for future ethogram creation.

HABITAT PREFERENCES OF OTTERS IN MALAYSIA AND SOUTHERN THAILAND

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In south-eastern Asia, four otter species have been reported: the Asian small-clawed otter (*Aonyx cinerea*), Eurasian otter (*Lutra lutra*), Hairy-nosed otter (*Lutra sumatrana*) and Smooth-coated otter (*Lutrogale perspicillata*), that are classified as Vulnerable, Near Threatened, Endangered, and Vulnerable, respectively, in the red list of IUCN. It is very difficult to identify otters at species level in the field, while their capture poses ethical and conservation problems. We developed a non-invasive method to identify otter species using fecal DNA analyses and then assess the habitat preferences of each species in Malaysia and southern Thailand. Surveys were conducted by foot, vehicle or boat, at 19 sites in Malaysia and 7 sites in Thailand, from April 2010 to March 2011. Faeces were collected from various habitats including main rivers and their tributaries, estuaries, mangroves, peat swamp forests, paddy fields and dam lakes. Totally 199 faeces were collected in Malaysia and 139 in Thailand. Faeces were preserved in 99.5% ethanol. DNA was extracted in the cytogenetic laboratory of Kebangsaan University in Malaysia and Forest Genetics and Biotechnology Division, National Park, Wildlife and Plant Conservation Department, in Thailand. Species identification was based on the amplification of mitochondrial D-loop sequences. In Malaysia, 144 feces were identified, including 120 Smooth-coated otters and 22 Asian small clawed otters. In Thailand, 66 faeces were identified, of which 32 were Smooth-coated otters, 23 Asian small clawed otters and 11 Hairy-nosed otters. Smooth-coated otter occurred mainly in mangroves, while Small clawed otter mainly used paddy fields. In Malaysia, where faeces of Hairy-nosed otters were not found, the occurrence of this species was confirmed at 7 locations by road-kills, 1 stuffed specimen and 1 photo in Kelantan, Terengganu, Perak, Pahang, Selangor and Johor. These otters were found near peat swamp forests, oil palm plantations and ponds.

THE INFLUENCE OF HABITAT QUALITY ON THE DETECTION OF RIVER OTTER LATRINES NEAR BRIDGES

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Several wildlife agencies in North America use riparian sign surveys near bridge crossings to detect the presence of river otters. However, the efficacy of using such surveys for determining if river otters occupy an area has not been evaluated relative to habitat conditions. We conducted surveys to detect latrines (locations where scats are deposited in riparian areas) from reintroduced populations of river otters at 26 bridge-suites in northern Pennsylvania. A bridge-suite consisted of a bridge site along with a random and a selected site (i.e. high quality site), neither of which were >2.5 km upstream or downstream from the bridge. Sites consisted of both shorelines along a 200 m section of stream or river. Site quality was determined by applying a modified Pattern Recognition model (PATREC) previously developed to provide a probabilistic assessment for predicting the occurrence of river otter latrines based on the presence or absence of certain riparian and riverine habitat features. Sites were surveyed in spring 2004 and fall 2003. Latrines were detected at 19 (73.1%) of the 26 bridge-suites. Of these 19 latrines, 17 (65.3%) were detected in spring, 15 (57.7%) in the fall, and 13 (50.0%) in both seasons. Among the 78 survey sites (3 sites per bridge-suite), 32 (41.0%) were positive for latrines (21 sites [26.9%] in spring and 22 sites (28.2%) sites in fall). Repeated measures logistic regression was used to assess the influence of the covariates season (spring or fall), type of site (i.e., site type: bridge, random, or select), and quality of site (site score) on the probability of detecting latrines. Two models were useful in describing the occurrence of a positive site (i.e., a site with >1 latrine), and both included site type as a variable. The odds of a selected site being positive ranged from 7.80 to 9.29 times the odds of random and bridge sites being positive. Monitoring the presence of river otters based on searching for latrines at bridge or random sites was considerably less effective than by using an a priori selection of surveys areas based on riparian habitat features.

ALIEN FISH IN OTTER *LUTRA LUTRA* DIET

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Fish introductions are believed to have occurred since Roman times, when carp *Cyprinus carpio* from River Danube were transferred to Mediterranean Europe. Nonetheless introductions peaked towards the end of the 19th century and again in the 1960s and 1970s, as a consequence of the development of more effective spawning techniques. Although the effects of introductions are not easy to quantify, the spreading of exotic freshwater fish is considered to be one of the main threats to the survival and genetic integrity of native fish around the world and evidence has been brought that taxonomic homogenisation is occurring in freshwater fish assemblages.

Among the six kinds of interactions that Ebenhard identified between alien species and native flora and fauna, "acting as a prey for native predators" has been the object of a few studies, although these "new" food resources may favour the populations of food-limited predators.

The Eurasian otter can be limited by food abundance, prey availability affecting otter numbers, breeding success and mortality and has been shown to promptly shift its diet where American red swamp crayfish have become available. To assess if alien fish species may play a beneficial role in otter conservation, we reviewed available information on their occurrence in otter diet throughout the European range of the species. The following criteria were used: studies had to cover at least one year, dietary composition had to be expressed as percent relative frequency (%RF), spraint sample size had to be >100, all recognizable fish species had to be reported and the timing (year) and location (mean latitude, longitude and height above sea level) of the studies had to be reported adequately. A total of 39 diet studies, carried out between the early 1970s and 2006, met these criteria, study areas covering the otter range from Portugal to Hungary and from Finland to southern Italy.

The %RF of alien fish in otter diet was then compared to alien fish availability in each country and period, as assessed on the basis of available literature. Spearman's rank correlation test and multiple regressions analysis were used to assess the influence of fish availability and environmental parameters on otter consumption of alien fish species.

On average alien fish %RF was 3.44 ± 8.8 (SD) (min - max: 0 – 49.81). Alien fish consumption was significantly correlated to the percentage of alien fish in each national freshwater assemblage and increased with time, *i.e.* was on average higher in recent than in old diet studies. Latitude was inversely correlated to both the total number of freshwater fish and the percentage of alien fish in the assemblages. Unexpectedly, mean height a.s.l. was positively correlated to both variables, but most study areas in the sample did not exceed 500 m a.s.l. The percentage of alien fish and latitude were the only variables retained by regression analysis in the final model.

Our results confirm the opportunistic feeding behaviour of the otter, the use of alien fish being related to their overall availability. Nonetheless the mean frequency of occurrence of this resource in otter diet seems negligible, suggesting that the enhancement of indigenous prey still represents a major tool for otter conservation.

USE OF NON-INVASIVE FECAL HORMONAL ANALYSIS TO DETERMINE GENDER IN NORTH AMERICAN RIVER AND ASIAN SMALL-CLAWED OTTERS

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Non-invasive hormonal analysis has been used previously to characterize reproductive traits such as estrus, seasonality and pregnancy in several otter species in captivity. For scientists who study otters in the wild, fecal samples are readily available but collection of serial samples from the same individual is difficult, limiting the use of fecal sampling primarily to census and diet content studies. To improve the amount of information gained from wild otter fecal collection, our objective in this study was to assess if otter gender could be determined through fecal hormonal analysis as an alternative to fecal genetic analysis. Fecal samples, previously collected and dried for an earlier study, from captive Asian small-clawed otters (ASCO) *Aonyx cinerea* and North American river otters (NARO) *Lontra canadensis* were used for this assessment. A total of 241 fecal samples (37 samples from 9 female ASCO and 33 samples from 4 male ASCO; 92 samples from 11 female NARO and 79 samples from 7 male NARO) were analyzed for estrogen, progesterone and testosterone metabolites using validated enzyme immunoassays. In ASCO, estrogens were higher ($P<0.0001$; Nonparametric ANOVA) in males (510.93 ± 27.81 ng/g dried feces) than in females (278.46 ± 12.08 ng/g dried feces); whereas progesterone was higher ($P<0.0001$) in females than in males: however, if samples from females during pregnancy or pseudopregnancy were removed from the data set, no significant difference in progesterone levels were observed. Testosterone in male ASCO was higher ($P<0.001$; 1051.05 ± 105.27 ng/g dried feces) compared to females (472.14 ± 46.38 ng/g dried feces). Because of the extreme seasonality of NARO, season was treated as a factor during analysis. Regardless of season, estrogen levels in female NARO samples (470.75 ± 13.85 ng/g dried feces) were higher ($P<0.0001$) than males (354.60 ± 13.95 ng/g dried feces). Females also had higher ($P<0.01$) progesterone levels, regardless of pregnancy status (pregnant/pseudopregnant females, 4627.02 ± 155.0; non-pregnant females, 1175.07 ± 134.81 ng/g dried feces) compared to males (762.41 ± 89.70 ng/g dried feces). Testosterone was higher ($P<0.001$) in males (1142.79 ± 68.0 ng/g dried feces) compared to females (646.95 ± 41.20 ng/g dried feces) only during the breeding season. These findings suggest that progesterone levels in NARO and testosterone and estrogen levels in ASCO may be the best predictors of gender. Because species-specific differences may occur, the most appropriate hormone metabolite for possible gender determination must be identified for each individual species. However, the range in values for all three hormones overlapped between males and females in both species. Due to this overlap in hormonal levels, gender determination based on a single fecal sample likely would be unreliable, suggesting that fecal hormone analysis of wild otter feces may not be a consistent method of gender determination in ASCO and NARO.

TROPHIC VARIABILITY OF *LONTRA FELINA* (CARNIVORA, MUSTELIDAE) IN TWO POPULATIONS IN TACNA, PERU

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The marine otter *Lontra felina* (Molina, 1782) is the only species of sea otter inhabiting the coast of South America. Its population has declined in the last decades, to the point that the species is considered to be in danger of extinction by the Peruvian government. Marine otters are top-predators in coastal ecosystems and can behave as "umbrella" species, owing to the large number of species they prey on. The objective of this study was to determine the composition of the Peruvian otter diet, for which we compared two populations. In addition, we investigated if there was a difference in the diet between winter (August – September) and spring (November – December). Faeces were collected between August and December 2006 in two study areas: Morro Sama and Quebrada Burros both located in southern Peru (Tacna). Sixty six samples were obtained, 36 from Morro Sama and 30 from Quebrada Burros. Jaccard (I_j), Sorensen (I_s), Sokal & Sneath (I_{ss}) and Ochiai-Barkman (I_{o-b}) indexes were used to measure similarity between populations and seasons. We determined a total of 22 prey – species, of which 59.1% were arthropods (n=13), 27.3% fish (n=6) and 13.6% molluscs (n=3). Otter diet in Morro Sama included 13 species, while Quebrada Burros's diet included 12 species. Only three species were found in both places (similarity <25%). Otter diet also varied seasonally (similarity < 15% in Morro Sama; < 17% in Quebrada Burros), suggesting that *L. felina* has a eurifagic – generalistic feeding behaviour. The data obtained in this study can be used for the future management of *L. felina* populations and the establishment of marine protected areas.

REPRODUCTIVE TIMING IN EURASIAN OTTER *LUTRA LUTRA* ALONG A CLIMATE GRADIENT

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Seasonal climatic differences result in variations in food resources. Breeding patterns in animal populations are usually synchronized with the period of maximum resource availability to optimize the survival of the offspring to independence, the adults' own survival and life-time reproductive success. In carnivore mammals the breeding is often timed so the lactation period coincides with the highest food availability.
The Eurasian otter (*Lutra lutra*) has a very adaptable breeding pattern across its distribution range. Breeding in otter populations varies from a seasonal pattern, e.g. in Finland and the Shetlands, to an unseasonal pattern, e.g. in the United Kingdom. Temporal and spatial fluctuations in the availability and predictability of food resources may determine these differences between populations in different areas and habitats.
We analysed reproductive organs in otter carcasses to determine the influence of climate conditions on the reproductive timing in three regions: northern Sweden (N-Sw: 60ºN-68ºN), southern Sweden (S-Sw: 56ºN-60ºN) and Denmark (DK: 55ºN-57ºN). The otters were found dead, mostly road-killed, and sent to the authorities in 1970-2008. Winter conditions , and consequently food availability, differed between the three regions with average temperatures below 0º C in 5 months, 3 months, and <1 month, respectively. Reproductive status in females was assessed from the presence of embryos, placental scars and/or lactation. Seasonal timing of births was assessed by correlating the dates which the individuals were killed.
In N-Sw (n=54 adult females examined) pregnancy was recorded only during spring and summer, and lactating females only during summer and autumn. Placental scars were found in all seasons but most frequently during summer and autumn. In adult females from s-Sw (n=56) and DK (n=68) reproduction signs were less seasonal. Litters were presumably born in all seasons, but more frequently during the summer and early autumn. Estimated birth months of juveniles indicated similar seasonal patterns and differences between the three regions. Body condition was low during the spring in otters from n-Sw, while no seasonal effects were observed in otters from s-Sw and DK indicating that food availability varies less in these two more temperate regions. Our results show that reproductive timing among otters is more specific in harsh climate and habitats as suggested from earlier studies in coastal otters. However, litters are produced successfully in all seasons even in strictly seasonal temperate climates. Otter cubs are relatively old before they are independent. This may reduce the selective force on adult females to synchronize births to seasonal variations in climate and food availability

ECOLOGY OF OTTERS IN THE ALPS AS INDICATED BY RADIO TELEMETRY: A PRELIMINARY REPORT OF AN ON-GOING PROJECT

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Otters (*Lutra lutra*) disappeared from the Alps during the second half of the 20[th] century and are now recolonizing the Alps both from the east (eastern Austria) and from the west (France). Due to the absence of otters in Alpine habitats in the last decades virtually no specific information is available about the ecology and biology of the species here. The only concrete data we have are distribution surveys based on spraints under bridges and snow surveys which give otter numbers. Due to an initiative of PRO LUTRA (http://www.prolutra.ch/), a Swiss foundation, we study now the ecology of otters in the Alpine habitats of Styria, Austria by means of radio telemetry. The study area is located along the lower Muerz river catchment. The river and streams drain from lime stone mountains of an altitude of up to 2.200 m a.s.l. The otter habitat expands between 900 and 500 m a.s.l. Some of the rivers and streams are still in some quite natural condition whereas most of them are highly modified in terms of hydro-morphology. This is both due to flood prevention measures, which date back up to the early 20[th] century, and due to hydro electro power plants, resulting in barriers (dams) and artificial ponds (reservoirs). Water is derogated for the power stations, leaving the natural river beds with little or no water and they create dams and reservoirs. These alterations of the rivers and their banks have direct influence on the ecology of otters, in particular on the abundance and availability of fish and other prey items. Up to now we have radio tagged seven otters, two adult males, two adult females and three subadult females. The first otter (A) was radio tagged in May 2010 in the upper part of the River Laming. It is a female. She gave birth in June 2010 but lost the litter by mid of August. In April 2011 she gave again birth to two cubs. Another three otters were trapped and radio tagged by early November 2010: an adult female (B) on the lower Laming, an adult male (D) on the Thoerlbach and a juvenile female (C) on Stuebmingbach; it was still accompanied by its mother and one sibling. In May 2011 another subadult female (F) was tagged with an implant on a tributary and one adult male (H) and one subadult female (G) were radio tagged on the River Muerz. The home range of female A comprises 12 km of main stream, female B of 10 km of stream. Male D has a home range of about 20 km whereas Male H on the River Muerz used in two months just about12 km. The three subadult females do not yet show any signs of dispersal, the home ranges of the two otters along the streams (C and F) comprise 7 km whereas the one (G) on the River Muerz is half as long. Analysis of habitat and home range use as well as resting site selection and behavior in context with rearing cubs will give detailed insights in the ecology of otters living in such highly modified Alpine river ecosystems.

OTTER NUMBERS IN 100 SQUARE KILOMETER SAMPLE AREAS IN THE ALPS AS INDICATED BY SNOW TRACKING

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In the winters 2008/2009 and 2010/2011 we carried out snow tracking in sixteen 10 x 10 km UTM squares in the Eastern Alps (Lower Austria and Styria). Snow tracking was conducted when snow fall on the day before the survey day was such that tracks of the last night could clearly be distinguished from older tracks; in most cases, older tracks were not visible at all because of excessive snow fall during the day before the survey. The survey was accomplished by up to seven experienced persons. All rivers and major streams within the square were searched continuously for tracks. Rivers which were too big or deep to cross were checked by two persons, each walking on one bank. Large single individuals were identified as male, medium tracks accompanied by other medium to small tracks were counted as females with cubs, single medium tracks were called unidentified medium animal; this could be either an adult female without cubs or subadult males or females. Due to a high number of weirs, which forced the otters to go over land, it was usually easy to distinguish between different individuals of the same track size in a square. The results gave an average of 2.9 adult otters plus 1.4 cubs per 100 km^2 (0.8 males, 1 female and 1.1 medium otter). These findings are up to now the first concrete otter numbers for Alpine habitats.

RESCUE, REHABILITATION, TAGGING AND RELEASE OF A NEOTROPICAL OTTER IN WESTERN BRAZILIAN AMAZON

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Neotropical otters (*Lontra longicaudis* Van Zyll de Jong 1972) are widely distributed within Brazil, from the Amazon and Pantanal to coastal rivers in the North and coastal and inland waters from Rio de Janeiro to Rio Grande do Sul.
The species was heavily hunted for its fur between 1950 and 1970, and is considered "data deficient" according to both IUCN criteria and the Brazilian Action Plan for Aquatic Mammals. Present population status is unknown, and the species is currently protected throughout most of its range.
In March 2009, a juvenile male Neotropical otter was confiscated by the Brazilian environmental law enforcement agency in the Amazonian town of Tefé, where it had been offered for sale in the local market. It had spent the previous month in a dwelling where it shared quarters with non-vaccinated domestic dogs. The animal was in general good nutritional status and aspect, with no apparent wounds or defects. It underwent a quarantine period in order to check for its condition and possibly release it back into the wild. Health evaluations and tests for parvovirus and canine distemper were performed, as well as a genetic check.
Prior to release, the animal underwent a surgical procedure for implantation of a intraperitoneal transmitter. The otter was released in the Mamirauá Sustainable Development Reserve and tracked for a few days before the signal was lost. This was the first attempt to follow and monitor a Neotropical otter through telemetry in the Amazon.

THE IMPORTANCE OF INSECTS IN OTTER DIET IN THE SOUTHERN RUSSIAN FAR EAST

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As throughout their wide range, in the southern Russian Far East otters mainly rely on fish, crayfish (Astacidae) and amphibians representing alternative food items. According to some researchers, otter eat insects indirectly, as prey, and then part of the stomach contents, of eaten fish . This is partially true and makes it difficult to assess the proportion of insects voluntary eaten by otters. Nevertheless, in the basin of the River Botchi Salmon (Botchinsky Reserve), located on the eastern slopes of the northern Sikhote-Alin Mountains (100 km to Sovetskaya Gavan), insects may be an important secondary resource for otters in winter.

In February – March, fish availability is limited because of the migration of anadromous and catadromous species and solid ice cover, especially in the upper reaches of rivers and streams. In this period the relative frequency of occurrence of insects in otter diet reached 45.1%, (frequency of occurrence = 90.7%). Moreover, 17.4% (N = 28) of spraints consisted only of insect chitin. The most frequent amphibiotic insects were larvae of stoneflies (Plecoptera: *Pteronarcys sachalina, P. reticulate, Megarcys ochracea*), and caddis flies (Trichoptera: *Stenopsyche* sp.), whose nymphs were eaten with their caps. The larvae of mayflies (Ephemeroptera) and chironomids (Chironomidae: *Diamisine*) were rarely consumed. Occasionally we found the larvae of dragonflies (Odonata), beetles (Coleoptera), weevils (Coleoptera *Curculionidae*), Schrenk's carabus *Carabus schrencki* Motschulsky, 1860, great diving beetle *Dytiscus marginalis* L., 1758, larvae of click beetles (*Elateridae*), ladybirds *Coccinella* sp., water creeper *Nepa cinerea* L, 1758, Hymenoptera, ants (*Formicidae*), caterpillars of butterflies (Lepidoptera). Terrestrial insects are mostly found in otter spraints in the warm season, particularly in June – September.

The stomach contents of dead otters found in the natural reserve in February consisted only of larvae of caddis fly *Stenopsyche* sp., confirming their active predation by otters. We also repeatedly observed otters eating insects: they feed usually in shallow ice hole (unfrozen areas), turning up stones and picking up the larvae.

Insects are high- calorie food items and in harsh climatic conditions may represent a profitable resource for many carnivores.

INSIGHTS GAINED FROM LONG TERM POST-MORTEM RESEARCH ON THE EURASIAN OTTER

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Over the last seventeen years Cardiff University Otter Project has carried out post-mortems on over 1750 otters (*Lutra lutra*) collected across England and Wales. With the aid of many collaborators, the resulting tissue and data archives have been utilised to address a range of questions about freshwater systems and population biology. Here we present four recent research highlights:

Otters as sentinels for emerging infectious diseases: Routine monitoring of infectious disease in otters is important from a conservation perspective, and because otters range over large distances they may act as sentinels of new infections. Abnormalities are recorded, and prevalence, intensity and geographic distribution of an array of parasites including blood borne pathogens, *Ixodid* ticks and digenean trematodes are monitored. Current interest focuses on two digeneans recently found in UK otters both of which significantly damage their biliary system.

Otters as bio-indicators of aquatic pollution: As a top predator the otter is a useful indicator of aquatic ecosystem health. Long term monitoring of organic and inorganic pollutants in otter tissues in the UK reveals considerable complexity in spatial, temporal and individual contaminant profiles. Lead levels, for example, show not only temporal change, but also interactions between environmental variables (such as weather and stream chemistry) that affect its sources, dispersal and bioavailability.

Genetic analysis reveals population structure and history: The reversal of otter declines in the UK has been assisted in some areas by translocations and population reinforcement, but this raises interesting questions regarding the genetic integrity of populations. Using DNA extracted from muscle tissues, Bayesian clustering and GIS have been used to identify the genetic structure of the UK otter population, revealing four distinct regional populations and a total of 11 smaller sub-groups. Dispersal between regions is shown to be limited, and further research focuses on how landscape limits genetic mixing.

Scent as a novel monitoring technique: Detailed monitoring of otters, particularly at the individual level, is a key aspect to their conservation, but presents many challenges. Chemical analysis of anal gland material has revealed scent differences based on age, sex and reproductive status. Further work investigating the presence of an individual scent "fingerprint" may provide a novel technique to monitor otters from spraint samples collected in the wild.

The achievements presented here highlight the range of research opportunities made available through biological specimen banks, particularly valuable for research on elusive species such as the otter.

SOCIAL INTERACTIONS OF THE EURASIAN OTTER (*LUTRA LUTRA*) IN A MEDITERRANEAN ENVIRONMENT

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Knowledge of the social system of a species is essential for a correct conservation and management of its populations. Mustelids are the most ecologically diverse carnivores and previous studies revealed high variability also in their sociality. Such variability has been documented and/or hypothesized also for the Lutrinae subfamily. In spite of being probably the most studied otter species, information available on the social system of the Eurasian otter (*Lutra lutra*) is scant and mostly limited to temperate areas, being almost absent for Mediterranean populations. Moreover, existing data are often biased by the adopted methodologies or the small sample of radio-tracked animals. We analysed the social interactions (static and dynamic) between individual otters radio-tracked during an extensive project on the behavioural ecology of this species in Alentejo (Southern Portugal). Non-related otter dyads of opposite sex showed high degree of home range and core area overlap, while dyads of the same sex showed almost no overlap. Such results are in accordance to the classic social system of intrasexual territoriality of Mustelids. Contrary to what is described in literature and expected for a solitary species, every otter dyad showed positive interactions, with individuals being associated to their related pairs more often than expected by chance. Cases of spatial and temporal overlap between adult males and females with cubs were documented, also when the former had no paternity. Our data provide the first statistically robust information available on the social interactions of the Eurasian otter by means of radiotracking, supporting the hypothesis of significant flexibility in the sociality of this species.

SESSION 4

Habitat assessment, potential distribution and dispersal

RAMSAR PROTECTED WETLANDS OF INTERNATIONAL IMPORTANCE AS HABITATS FOR OTTERS

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Wetlands of International Importance, as listed by the Ramsar Convention on Wetlands, can provide valuable opportunities to conserve otter species worldwide. Although initially focused on protecting waterfowls, listed wetlands now address numerous ecosystem services and a multitude of species. Currently, there are 1929 wetland sites from 160 Contracting Parties (primarily nations), protecting nearly 188 million hectares. The Ramsar Convention "is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources" (www.ramsar.org). Under this program, wetlands are broadly defined, and thus encompass the wide range of habitats on which all 13 species of otters depend. Lakes, rivers, swamps, marshes, mangroves and estuaries are included in Ramsar listed sites. Many sites consist of a mixture of wetland types, and some support significant human activities, such as fishing, agriculture, and ecotourism. A Memorandum of Understanding (MOU) between the International Union for Conservation of Nature (IUCN) and the Ramsar Convention was signed in 2003, to promote cooperation and collaboration. Of obvious interest is IUCN's commitment to conserve biodiversity, through efforts such as maintaining the Red List of Threatened Species, where selected otter species are listed. Yet, more can be done to promote awareness of otter reliance on wetland habitats with high ecological integrity. A stronger alliance between the Otter Specialist Group and the Ramsar Convention on Wetlands should be forged, because otters will benefit significantly. Examples are provided to demonstrate the value of such an alliance to both parties.

IDENTIFICATION OF INDIVIDUAL OTTERS *LUTRA LUTRA* BY THE ANALYSIS OF SINGLE FOOTPRINTS

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The individual identification of animals is crucial for the estimation of population size, animal density and other ecological investigations. If species are rare and cryptic or difficult to catch and observe, non invasive techniques are preferred. But genetic analyses can be very expensive if used at a landscape scale. Therefore a combination of several methods seems to be the most realistic approach.
Several attempts were carried out in the past to identify individual animals on the basis of single footprints, with promising results. However, those methods were seldom used and appear not very reliable. For this reason we have built a special equipment using paws from dead otters to make footprints under defined conditions.
The fore- and hind-paws from 25 Eurasian otters (*Lutra lutra*) of both sexes, aged from 1 to 10 years, were used to make 10 imprints per paw at different substrate depths. As substrate we used moulding quartz sand like common used in the foundry industry. All imprints were photographed (n= 960) by a digital single-lens reflex camera. The photographs were used to obtain the dimensional measurements, proportions and angles by an expressly developed software programme made.
The 131 resulting variables were reduced, by correlation analysis and Shapiro-Wilk-Test of normality, to 49 and 25 for the fore and hind foot, respectively. A last Student's *t*-test checking symmetry further reduced the set to 8 and 6 variables, respectively.
We used discriminant and cluster analysis in combination with a bootstrapping approach to test the reliability of the individual identification as well as the ability to identify unknown individuals. Individuals were recognized by one foot only in 27.69% (right hindpaw) to 49.38% (left forepaw) of trials. The chance to identify otters correctly increased up to 82.67% when combining two or more paws. This result is nearly comparable to the results of genetic fingerprinting.
But what happens with unknown individuals entering the population? For this case we have tested whether cluster analysis could be an appropriate method. Unfortunately, the results have shown patterns which are not useful for the identification of new or formerly unknown individuals. As a consequence, we can recommend the use of footprint analysis only in combination with genetic fingerprinting. The use of such a combination could save a lot of time and money in future monitoring programmes.

ASSESSING HABITAT CONNECTIVITY FOR EURASIAN OTTERS: WHICH PATCHES AND PATHS BETTER CONTRIBUTE TO DISPERSAL?

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Modelling habitat connectivity for semiaquatic species is a particularly challenging task, due to the fine-scale linearity of riverine habitats and the capacity of species to move on both freshwater and terrestrial realms. Semiaquatic species are mostly active along the hydrographical systems, but they also use the surrounding ground matrix to disperse across river catchments. Maintaining the functional connectivity within and among river basins is therefore critical to dispersal processes and population persistence. This is a crucial point for the survival of endangered species, such as the Eurasian otter (*Lutra lutra* L.) in Italy, consisting of two main isolated subpopulations in the southern part of the country. We analysed the connectivity of seven river catchments (dendritic networks) with different degrees of otter occupancy in the smallest and isolated portion of its Italian range, and evaluated their individual contribution to maintain or enhance otter movements and range expansion.

We developed a model of network connectivity based on suitable habitat availability and multiple minimum cost paths, analysed through a graph theory approach. We defined a graph composed of all the catchments containing suitable habitats for otters along rivers and streams (nodes), and all the multiple minimum cost paths between different catchments (links). The role of each catchment as a provider of habitat availability and connectivity for the otter was quantified by the Probability of Connectivity index (PC) and by the three fractions in which it can be partitioned: the available habitat area within each catchment (δPC_{intra}); the degree of connection with the other catchments (δPC_{flux}), and its contribution as a connecting element or stepping stone among the other catchments ($\delta PC_{connector}$). The PC indicates the overall probability that two otters randomly placed on two catchments meet into one or more areas that both can reach.

Results identified the Biferno as the most important river basin for the survival of the otter in the region, a vacant basin (Trigno) that could potentially be colonized by otters in the near future, and the connecting areas in the land matrix that might be preferentially used for dispersal movements in the region. To sustain the survival and long-term viability of the species in this portion of the otter range, these areas should deserve priority conservation actions.

ASSESSING THE POTENTIAL FOR OTTER RECOVERING IN SWITZERLAND BY AN INTEGRATIVE APPROACH

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Switzerland, where the otter is still absent, plays a main role in the reconnection of the western and eastern European nuclei. Considering that there are populations of otters near to the Swiss boundaries (France, Austria), otter natural recolonisation may occur. Given this situation, an assessment of habitat suitability is a necessary prerequisite for the establishment of management actions aimed to favour the recovering and persistence of the species in Switzerland. The Swiss landscape is man-dominated and suitable habitats for carnivore are heavily fragmented by both topography and human infrastructures. For those reasons it would be important to restore or preserve possible corridors and detect where conflicts with human activities might occur. Although the possible comeback of the otter has been controversially discussed in this country, no quantitative and holistic studies have been effectuated.

To assess the feasibility of otter recolonisation, our approach considered habitat suitability, connectivity, potential threats, and how local people perceive the comeback of the species, allowing us to identify critical areas and the priority activity that should be planned.

The natural recolonization of Switerland is more likely to occur from the Haute-Savoie. PCB contamination of freshwaters may still represent a major obstacle to otter persistence. Apparently, conflicts with human activities are not a problem, while people feel that river revitalisation is indispensable for favouring the comeback of the species in the country.

THE RECOVERY OF THE EURASIAN OTTER *LUTRA LUTRA* IN KOREA AND THE CHANGE OF PUBLIC ATTITUDE

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Since the 1970s, South Korea has attained unparalleled rapid economic growth. To analyze the impact of consequent habitat deterioration on the Eurasian otter (*Lutra lutra*), the distribution of otter spraints was surveyed at 47 points in 1982, 39 in 1991-94 and 48 in 2010, along both sea coasts and the banks of major rivers. Based on the density of spraints and questionnaire-based surveys to local residents, scores from 0 (no information and no spraints) to 3 (>1 spraint/500 m) were assigned to each point.

In 1982, when road improvement and river canalisation were still not intensive, average scores were 1.7 at coasts and 1.3 at rivers. In 1991-94 they were 1.4 at coasts and 1.0 at rivers, suggesting otter populations decline in both habitats. In 2010 they were 1.6 at coasts and 2.2 at rivers. While scores in coastal areas were rather constant, those at rivers clearly indicated the recovery of the species. In 2010, positive sites were also found in highly populated areas such as the coasts near Busan city (ca. 4 million inhabitants) and rivers flowing through other large cities. Although the number of otter researches at specific areas is rapidly increasing, long-term monitoring is still insufficient. This makes it difficult to analyze the causes of otter recovery.

Major otter protection tools in Korea were the species designation as a natural monument since 1982 and the establishment of several protected areas by the national government. Currently the otter is considered as a symbol of water quality improvement and healthy environments. For example the Korean Water Resources Authority has built an "otter ecological park. At Jingyang Reservoir, water level fluctuation has been restricted to enhance otter conservation and an artificial islet has been proposed as otter refuge. Notice board and road banners appealing the need for otter conservation have become popular at urban river parks, national parks and lakes and rivers throughout the country. On the web, otters are mainly thought as a favorable animal. As a consequence, man attitudes toward the otter do not seem to represent a threat to its conservation.

LANDSCAPE METRICS AND MULTITEMPORAL HABITAT SUITABILITY MODELS FOR THE CONSERVATION OF OTTERS IN THE ITALIAN CORE AREA

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In Italy the Eurasian otter (*Lutra lutra* L.) is an endangered species and the general deterioration of riverine habitats has heavily affected its populations. Currently, it survives only in the southern half of the peninsula, with an outlying area in Molise and a core area in Campania, Calabria, Apulia and Basilicata regions. Since core areas represent key source regions, to enhance the species conservation wide and well connected suitable habitats are needed in such areas.

A connectivity/fragmentation analysis among suitable habitat patches, a crucial factor rarely addressed in literature, can represent a precious support for an effective environmental management aiming to the survival of the otter. We examined the spatial characteristics and arrangement of suitable otter sites by integrating Landscape Metrics (LM) and Habitat Suitability (HS) analyses. The approach was implemented in a portion of the Italian otter core area, on a twenty years time step, corresponding to two otter surveys (1985 and 2006).

HS information was extracted by using the BIOMOD platform; the environmental variables included topographic (DEM, SLOPE, ASPECT) and land cover data; these last ones were obtained by Landsat-TM imagery acquired coherently with otter surveys. Landscape spatial characteristics (PLAND, NP, SHAPE_AM, ENN_AM, IJI, COHESION, DIVISION) were calculated on the derived HS maps categorized into three suitability levels (low, medium, high), providing also final user-friendly maps.

The analysis revealed that the structure of unsuitable/suitable areas heavily changed from 1985 to 2006. There was a general improvement of habitat quality, as the percentage of high suitable areas was, on the whole, reduplicated and their patches were more compact and naturally shaped; contextually the extension of low suitable areas is largely reduced (57% to 37%). Nonetheless, the territory does not reach yet a stable equilibrium and high dynamic transitions are still evident. From 1985 to 2006 about 14% of highly suitable areas downgraded to medium levels, 10% improved from low to medium levels, and about 19% shifted from medium to high suitable levels. The extension of highly suitable habitats likely reflects the positive effects of the environmental policies adopted in the last twenty years (e.g. the 1985 Galasso law that protects the areas close to the riverbanks). The obtained LM maps may be used to locate the most appropriate local restoration interventions aimed to enhance otter habitat quality and connectivity, guarantee the long term survival of otters in the area, and provide a powerful and clear management instrument for final non-expert stake-holders.

ROAD CASUALTY OTTERS ARE NOT A DEAD LOSS – MAKE FULL USE OF THEM!

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Hundreds of Eurasian otters (*Lutra lutra*) die in road traffic accidents every year. Although this loss is regrettable, for those studying the species the casualties represent one of the most valuable sources of data. However, in order to maximize this it is essential that basic facts, such as dates and locations of death, are recorded and that post-mortem examinations are performed in a detailed and systematic way. When using the data, the main objectives should be to determine the health and reproductive status of the population and to see if these relate to changes in abundance or distribution over time.

During a post-mortem examination it is important to be able to distinguish between normal and abnormal. In some disease conditions, such as pneumonia, the organs may be obviously abnormal. In others, particularly those caused by toxic agents, the changes may be subtle or only apparent microscopically. However, the weight, and in some cases the dimensions, of organs relative to body length are often affected by disease. For this reason these data should be routinely recorded.

Identification of a disease normally depends on samples being examined in a laboratory by a specialist. Where post-mortem examinations are performed by non pathologists and lesions are suspected it may be difficult to know what samples to take and what tests are required. In situations like this it is best to place samples of affected tissue in formalin for histological examination and to retain duplicate chilled and frozen samples whilst contacting a specialist for advice.

In addition to taking samples of apparently abnormal organs there is a strong case for routinely storing a standard set of frozen tissues for possible future studies. Those routinely archived by the author include liver, kidney, lung, adrenal and thyroid glands, stomach contents, bone and blood.

By following a consistent post-mortem protocol over a 20 year period a number of important facts have been discovered. The least expected, but possibly the most significant, is that intraspecific aggression is a major cause of mortality. Others include a decline in organochlorine pesticides and PCBs and a concurrent increase in liver vitamin A levels, lesions of retinal dysplasia in 30% of otters and of urate calculi in 10 %, and the emergence of a parasite (*Pseudamphistomum truncatum*) previously unrecorded in the UK. Collaborative studies with other laboratories have shown a decline in lead levels in bone after it was banned from petrol, the presence of polybrominated biphenyls in otters' livers and of non steroidal inflammatory compounds in their hair.

The challenge in the future will be to identify previously unrecognised threats before significant damage is done – and here road casualties will continue to be invaluable!

SESSION 5

Threats and conflicts

PROMOTING FRIENDLY MITIGATION STRATEGIES FOR THE MANAGEMENT OF HUMAN - OTTER CONFLICTS IN SOUTHERN BENIN

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Among the 13 species of otters in the world, four occur in Africa and their conservation is considered a top priority by the IUCN/SSC Otter Specialist Group. Although classified as vulnerable by the IUCN and on CITES appendix II, the spotted necked otter (*Lutra maculicollis*) is endangered in Benin, where its habitat has been restricted to the southern part of the country. A study carried out in 2004 showed that (1) human – otter conflicts can affect otter survival and (2) otters are highly endangered in Benin wetlands and extinction could occur if current threats are maintained. To avoid the disappearance of otters in Benin and manage them as flagship species, there is an urgent need for the development of sustainable conservation strategies. This study aimed to assess the costs of human-otter conflict and mitigate them by adopting and sharing the most effective friendly strategies. Sixty fish farmers were followed during 6 months to verify otter damages on fishery materials and harvests. Fishing materials were characterized according to their impact on otter survival to suggest those which may be prohibited. Both the age and sex of harvested fish was filed as to appreciate the impact of fishing techniques on food availability to otters. Ten potential mitigation techniques were tested with the collaboration of 30 fish farmers to identify the 3 most effective methods. The best friendly techniques were shared with fish farmers during local workshops. Finally, a strategic conservation plan for the species was elaborated by integrating all collected data.

LAUNCHING THE OSG OTTER MORTALITY WEB SITE

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At the last European Otter Workshop held in Slovenia in 2008 it was decided that it would be useful to have a platform where otter researchers and conservationists could exchange information on otter mortality.
Data on dead otters are valuable as they can give information on many aspects of otter biology and ecology, such as, for example, the state and distribution of the population or the presence and spread of diseases. Moreover dead specimens are often preserved in institutions and they can be a valuable source of tissues for genetic and other kind of analyses.
A European survey carried out in 2008 of how dead otters are reported, carcasses recovered and post-mortems carried out revealed that systems differ greatly amongst countries with some countries having implemented good systems of reporting, recovery and post-mortems while others lacking in one or more of these areas.
To facilitate the sharing of information on otter mortality and the improvement of systems of dead otter reporting, recovery and post-mortems a web site was created. This web site is part of the existing Otter Specialist Group web site and has been named the "OSG Otter Mortality" web site.
We present the web site with the main aims of seeking comments and suggestions to improve it and of soliciting content so that we can make it more useful. In particular, we hope to create a map of all the research groups interested in this topic and of the specimens and tissues available. We also hope that the international audience of the conference will contribute to improve the bibliography by pointing out grey literature on otter mortality, such as for example reports of mitigation projects, that is usually difficult to find otherwise.
The web site is being developed as a volunteer project.

LONG TERM MONITORING OF THE ENDANGERED EURASIAN OTTER POPULATION IN ISRAEL: IMPLICATION FOR CONSERVATION

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The Israeli otter (*Lutra lutra*) populations form the southern border of the species distribution and are potentially connected to northern populations by continues wetlands along the coastal regions of Syria and Lebanon. During the 20th century, the otter population in Israel experienced a dramatic decline due to anthropogenic habitat alterations. Currently, the otter population in Israel is estimated at no more than 100 individuals and defined as Critically Endangered. The reduction in wetland habitats has led to the extinction of the Mediterranean coastal subpopulation and overall fragmentation of the Israeli otter population.
The aim of this study was to investigate otter distribution trend as to plan effective conservation actions.
In 2000-2011, we monitored otter spraints once a year in winter, according to the standard method, along the valley of the River Jordan, the Sea of Galilee and coastal zone. Surveys for spraints included 59-100 sites each year. New activities of otters were detected in the northern coastal plains of Israel suggesting sporadic events of migration. We also recorded every known road-kill and direct observation and extracted DNAs from carcasses to analyze the genetic variance between local sub-populations.
Our results indicate that the Israeli otter population can be divided into two groups: (1) a stable population in the catchment of the River Jordan, where the percentage of sites positive for otters ranged between 47% and89%; (2) temporary subpopulations in the Golan Heights, the Jesrael valley and along the north-west Mediterranean coastline, where otter signs found only occasionally, as a result of random immigrations and repeated local extinctions. We believe that there is active otter immigration to the north-west coastline of Israel from Lebanon via the Mediterranean Sea. In addition, we found that otter population in dry regions, such as northern Israel, mostly depend on fish farming as fish ponds and canals act as a surrogate for natural wetlands and corridors, respectively. This situation emphasizes the dependence of the species survival on anthropogenic activities.

OTTER POST MORTEM MANAGEMENT AND RESEARCH IN ITALY. CURRENT SITUATION, LIMITS AND PERSPECTIVES

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In recent years, the expansion of otter (*Lutra lutra*) range has been recorded in a number of European countries. This positive trend has occurred also in Italy, although otter distribution is still limited to the southern regions and the species is considered as endangered. Increasing numbers of dead otters were reported during the last ten years in Italy, likely due to increasing population size.

Carcass reports usually provide spatial data (the location where the otter was found) that enable the investigation of the scene of death. In case of road traffic casualties (RTC) or human-related mortality (e.g., fyke-net accidents), this is considered of primary importance in order to identify and mitigate risks for individual otters. However, such approach assumes RTCs or any human-related mortality to be a threat, even in the absence of any attempt to quantify the relative influence of each cause-specific mortality on population survival.

To properly evaluate threats, a first requirement is to collect detailed mortality and pathology data. This, in turn, requires that the reported carcasses are timely recovered and submitted for necropsy. Post-mortem (PM) examination of otters provides evidence of diseases and causes of death, and data on the age, sex and reproductive status of dead individuals. This information, coupled with the estimation of population sizes or adequate surrogates, may be used in population modelling and assessment. However, such important data need to be recorded by (preferably one or a few) experienced teams based on agreed protocols. In February 2010 a workshop arranged by the IUCN Otter Specialist Group – Europe has been held in Denmark to discuss PM procedures in Europe and practice necropsies. The workshop highlighted a great variation in schemes for 'reporting-recovering-PM analysis' of otters among European countries and stressed the importance of common standards and collaboration.

Here we describe the current situation and limits of post-mortem management of otters in Italy in relation to the key points outlined above and in the light of national laws and indications provided by the national action plan for otters. We discuss future perspectives and possible improvements of PM procedures focusing on systematic collection of otter corps and standardized, high-quality PM analyses. In particular, we present an ongoing research project intended to contribute to fill major gaps in otter PM management and research: the RECAL project. A multi-disciplinary team, with otter ecologists and pathologists has begun to work on carcasses collected in the core area of otter distribution in Italy (Cilento and Vallo di Diano National Park), by applying standardized protocols discussed in Denmark in 2010, attempting to create an effective organization for carcass recovering and developing tools for data recording. At present the RECAL research group is the only specialist team that have practiced multiple necropsies of otters in Italy.

CURRENT STATUS AND THREATS AFFECTING OTTER (*LUTRA LUTRA*) POPULATION IN THE SOUTH CAUCASUS

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The otter was once widespread throughout the south Caucasus region (Georgia, Armenia and Azerbaijan), occurring on almost every river and lake up to 2800 m a.s.l. Commercial trapping of otters started during the soviet period and stopped at the end of last century, as over-exploited otter populations had rapidly declined. By the end of the 1980s, otter populations in all three countries had become fragmented. Since that time there has been little in the way of research in the region.

A brief assessment was done in Armenia in 2010, showing that the population had greatly reduced due to pollution, construction of hydro technical facilities and overfishing. Although the Eurasian otter is listed in the Red Book of Armenia and hunting is prohibited, otters are still poached for furs, which are usually seen at the black market during the cold season.

The Eurasian otter is not included in the Red List of Azerbaijan. In 2000, the estimated number of otters in Azerbaijan was 1500, while surveys carried out in 2005-2007 showed that the species is primarily found in the south, northeast and northwest of the country. Population densities also seem to be quite low with, on average, 0.2-0.5 individuals/10 km of riverbank. According to data obtained in 2009, a total population of 108 individuals has been assessed in the country. The main threats to the otter in Azerbaijan include the destruction of riparian habitats, decreasing fish stocks and still widespread poaching. Levels of pollution in some areas of the country are also high.

The species is fully protected in Georgia. However, based on surveys conducted by NACRES in 2003, 2007 and 2010, otter population is declining. The development of various sectors of the economy has caused the destruction/degradation of habitats and environmental pollution. Recently, the government has decided to build additional dams for hydroelectric purposes, which will involve the major rivers of Georgia. The unsustainable use of forest resources has increased dramatically over the last decade. Drainage of flooded forest along the rivers has become common practice in recent years, causing the degradation of large plots of otter habitat. Fish farmers see otters as competitors, resulting in their persecution through illegal leg-hold traps set on rivers, streams and especially near fishponds. Vegetation is cleared to deprive wildlife of any shelter.

DISTRIBUTION AND MAJOR THREATS TO OTTER ON RIVER KARNALI, BARDIA NATIONAL PARK, NEPAL

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Three species of otter have been reported in Nepal: the Eurasian otter, smooth-coated otter and Asian small-clawed otter. They are top-predators and important biological indicators of the health of river and wetland ecosystems. The status, distribution and habitat use of otters have never been systematically studied in Nepal. Nevertheless, smooth coated otters are considered to be rare on the River Kamali outside the border of Bardia National Park (Nepal), while, inside the protected area, a minimum number of 35 smooth coated otters had been estimated for the River Geruwa. The overall goal of this study was to collect necessary baseline information on otters, as to contribute to otter conservation in Bardia National Park.

The specific aims of the study were to prepare a GIS based distribution map and assess the major threats to otters in the area. The study was carried out in the basin of River Karnali. Primary data were collected through transect surveys for spraints and tracks, key informants surveys, questionnaires and interviews with local people. Secondary information was mainly collected from Bardia National Park, the Department of National Parks and Wildlife Conservation (DNPWC), the Institute of Forestry, Pokhara Campus, and public libraries. GPS locations of otter signs of presence were interred in a digitizing Topo-map of the study area and the otter distribution map was prepared using GIS software such as cartalinx, Arc View 3.2 (a) and DNR Garmin software. Otters were distributed along the banks of the rivers Geruwa, Khaura and Batahani. Otters were mostly sighted at Patkanua, Banjaria ghat, Gaida machan, Lamak Tal, Bagaura Phanta and the helipad area.

According to 55% of key informants, otters are decreasing in number. Thirty percent of respondents had no idea about the status of otters, while 15% of respondents argued that, otters are increasing in numbers. Otters should be declining mostly because of the loss of riparian habitat, lack of fish, illegal hunting and human disturbance. According to 70% of the respondents, the main cause of decline in the numbers of otters is both legal (licenses are given to Sona community for fishing inside the protected area) and illegal fishing. Outside the protected area poisoning and electro-fishing are still often used for fishing.

According to 40% of respondents fishing is also the main threat to otters on the River Kamali. Thirty-five percent of respondents believed that otters are disturbed by washing and bathing activities performed by local people, while 25% replied that firewood collection and transportation by local people disturbs the habitat of otters.

OTTERS (*LUTRA LUTRA*) IN SWEDEN: BODY CONDITION, REPRODUCTION AND POPULATION BETWEEN 1970 AND 2010

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The aim of this study was to evaluate the general health status of wild Swedish otters (*Lutra lutra*) found dead over a period of four decades (1970-2010). Body condition was calculated and used as a measure of heath status. Also traces of recent reproduction among adult females were studied. During this period, the concentration of contaminants, such as PCB and DDT, have decreased in both the environment and otters, whereas the otter population has increased.

In Sweden, dead otter should be notified to the authorities and sent to the Swedish Museum of Natural History (SMNH). During 1970-2010, altogether 658 otters were sent to SMNH for necropsy and sampling for the Environmental Specimen Bank. The major cause of death was traffic (n=514) and drowning in fishing geer (n=45). The remaining otters were found dead in traps, starved or diseased (n=62).

The otters were measured, sampled and a detailed inspection of the carcass was made. Some road-killed animals were not measured, because of severe damage to the carcasses. Weight and length were recorded for 486 animals. Body condition index was calculated for males and females separately, and a linear regression analysis was calculated using body condition index *vs*. year of collection.

Moreover, the over time frequency of reproductive signs on adult females (implantation scars, pregnancy and/or lactation) was calculated.

During the study period, a strong increase in the number of dead otters was noted. In the 1970s, 57 otters were sent to the authorities, in the 1980s only 26 animals, in the 1990s 124 animals and in 2000-2009 385 animals. This indicates the sharp recovery of the species, as confirmed by several otter surveys.

Both the frequency of adult female otters with signs of reproduction and the body condition index have increased over time. The largest otters are now found in southern Sweden, probably as a consequence of milder winter climate and higher foraging opportunities compared to northern regions. A correlation between milder winters and increasing body size has been reported, but naturally a decreasing contaminant load in the otter feed might also have something to do with this.

RECENT ARRIVALS: PARASITES OF THE EURASIAN OTTER

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Invasive species have a major influence on the health and stability of ecosystems. Non-native taxa are increasingly identified in aquatic ecosystems and are often pathogenic. A lack of baseline data on native parasites hinders the identification of introduced parasites - an essential step for the protection of habitats. In many taxa (plants, freshwater fish, birds and mammals), the ability to tolerate a broad range of environmental conditions is considered a main factor influencing the success of invading species. We hypothesised that successful parasitic invaders also show broad tolerance. We examined the macroparasites of the Eurasian otter, *Lutra lutra,* in England and Wales: two trematode (Opisthorchiida) species, *Pseudamphistomum truncatum* and *Metorchis albidus*, have been recently reported as novel parasites of otters in the UK. Prevalence of *M. albidus* was strongly associated with rainfall, North Atlantic Oscillation (NAO) and temperature, whilst only temperature was important in predicting the prevalence of *P. truncatum*. Evidence of clustering in the *P. truncatum* population agreed with the recent introduction of this species, whereas no significant clustering for *M. albidus* was identified. We highlighted life history traits of these parasites, namely rapid generation times, asexual and sexual reproduction and dormant encysted periods, that are particularly beneficial for their invasion success. In conclusion, *M. albidus* is now considered to have occurred in the UK for a much longer period than previously thought. Further, a broad tolerance to environmental variables aids the establishment of parasites in novel regions.

ECOLOGICAL, SOCIO-ECONOMIC DETERMINANTS OF THE SPOTTED NECKED OTTER (*LUTRA MACULICOLLIS*) – FISH FARMERS CONFLICT IN SOUTHERN BENIN: IMPLICATIONS FOR CONSERVATION

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In Benin, most fish populations have been overexploited and many fisheries have collapsed with direct consequences for wetlands wildlife. The spotted-necked otter (*Lutra maculicollis*) is poorly known and currently threatened by permanent conflict with fishermen. They are blamed to destroy fish traps and gears and reduce quantitatively and qualitatively fishermen's harvest. This study was designed to evaluate the ecological, socio-economic determinants of the conflict and identify mitigation methods. A survey based on questionnaires and group discussions was conducted in 35 villages and 5 animal-based medicine markets, involving 204 people belonging to different socio-professional groups. We also conducted *in-situ* surveys to map the focal areas for the conservation of the species.

Otters destroy from 40 to 200 gears/fishermen/year. The perpetual research of food explains the migration of *L. maculicollis* towards shallows during the dry season where they suffer human pressure. We recorded direct persecution on otters by man (e.g. accidental catching, poisoned bait. The analysis of both historical and recent observations show a reduction in the distribution area of otters which are currently highly endangered in Benin' wetlands.

Strategic and sustainable management programs must be developed for the safeguard of the species and its habitat. Accordingly, it is important to develop mitigation/compensation strategies to reduce the conflict between human activities and the conservation of otters.

OTTERS AND RAILWAYS – AN ASSESSMENT OF TRAINS AS A THREAT TO THE OTTER POPULATION IN SWEDEN

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The otter *(Lutra lutra)* is a threatened species and traffic is one of the modern threats. The proportion of otters killed by traffic in Sweden is increasing and one possible reason is the increasing amount of traffic. The number of otters found train-killed is very small, compared to road-killed ones, possibly due to the lower probability of finding train-killed otters. However, to assess the need of mitigations at railways, it is important to find out how many otters are actually killed by trains.

We assessed the number of otters that are train-killed each year by comparing data on road-kills and train-kills from otter, lynx and moose. For the two latter species more reliable data were available on train-kills and these data were used to solve for the unknown number of train-killed otters.

The number of otters killed per kilometer of railway per year is twice as large as that of otters killed per kilometer of road. To avoid the problem from increasing furthermore in the future (with increasing number of trains, higher velocities and a larger railway network) it is important to build fauna passages where needed, both at new and existing railways. These passages can also be used by other species. Compared to traffic on roads, trains constitute an unpredictable, fast and relatively quiet hazard to otters. It seems like otters pass over railways at the same situations as by roads.

THE "OTTER BOX", A USEFUL TOOL TO WORK WITH EDUCATION ABOUT OTTERS, MINK AND BEAVER

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For many years, most of the Swedish County Administration Boards has worked with an information box for large carnivores as an effective education tool. These information boxes have been a big success especially to inform schoolchildren about Swedish carnivores. Only in one county more than 25 schools including more than 5 000 children have been educated using the information box during 2010.
"Föreningen Rädda UtterniSmåland" (the organisation Save the Otters in Småland) has taken the initiative to make a similar information box for otters e g "the otter box". The box includes skin, skull reconstructions (made by Arizona Dry Bones), faeces and paw prints (in natural size) from otter, mink (*Mustela vison*) and beaver (*Castor fiber*). The box also includes a CD with otter sound and films as well as information about otters. Together with these items there are instructions and examples for how to continue to work with issues concerning otters. The aim is to achieve a broad public awareness for an endangered species like the otter.

OTTERS CAUGHT IN TRAPS: A MINOR PROBLEM OR THE TIP OF AN ICEBERG?

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During otter surveys a large amount of illegal traps have been registered in Sweden since the late 1980s. In a northern county a total of 71 traps were found during a survey conducted in 2007. Out of these 71 traps, 24% had an entrance hole that was larger than recommended by the government. Only four traps were marked with the owners' name and telephone number, which is obligatory.

Even though regulations were set by the government in 1908s to decrease the entrance hole for both live box traps (10x12 cm) and body grip traps (7 cm in diameter) in order to prevent catching otters, several "home made traps" were found as well as non-selective traps with unknown target. Some of the traps that were found are normally used for catching other species, e.g. pine marten (*Martesmartes*). This type of trap should normally be placed up on a tree, whilst sometimes they are placed on the ground next to riverbanks (entrance hole 19x12 cm).

Sometimes even legally sold mink traps do not follow governmental recommendations. For example a mink trap (live box) called "Östgötafällan" had a entrance hole (12x16 cm) larger than recommended. The manufactories reduced the size to 10x12cm only in 2005 although the trap had frequently been used since the 1990s. The Canadian so called Conibear beaver and otter trap is used in Sweden under supervision and a proper education provided by the County Administration Board (to our knowledge till now only one otter has been killed in a Conibear trap in Sweden).

The Swedish Museum of Natural History has only four otters registered as killed in traps. Three of them were juvenile otters killed in mink traps. The high number of illegal traps found during otter surveys suggest that these figures are underestimated, also because illegally caught otter probably are not delivered to the authorities. These results suggest that there is a need for both a change in regulations and better information about trap selectivity.

LOCAL KNOWLEDGE AND CONFLICTS WITH OTTERS IN THE CENTRAL AMAZON – PRELIMINARY INFORMATION

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Traditional knowledge constitutes an alternative source of information on animal biology and ecology, complementing scientific information. This is especially important when research projects are undertaken in straight collaboration with local populations living inside the area of interest. We aimed to characterize and summarize ethnobiological information on two species: the Neotropical otter (*Lontra longicaudis*, NOs hereafter) and the Giant otter (*Pteronura brasiliensis*, GOs hereafter), and assess their possible interactions with fishing activities. Understanding people's perceptions and attitudes towards the species should help providing a basis for community-based conflict mitigation.
The study area was located inside the Amanã Sustainable Development Reserve, comprising the Amanã Lake and associated watercourses. Five riverine communities have been visited since December 2010. Anecdotal information was obtained from fishermen through informal conversations, during monthly field campaigns of an ongoing project on otter-fisheries conflicts. Currently, the method of participant observation is being used for obtaining preliminary information and familiarization with the research subjects.
Classification: besides *ariranhas* (GOs), there are 3 kinds of *lontrinha* (NO) recognized by local people: the common *lontrinha*, the *meiona*, and the *mucurinha.* The common kind has the characteristics usually known for the species and occurs in all kinds of aquatic habitats (lakes, flooded forests and watercourses). The *meiona* is described as the largest kind, with white stripes coming from each side of the chin to the throat region; apparently, it is seen in the same habitats of *lontrinha*. *Mucurinha* is the smallest kind, with a dark, black fur and mainly occurring in the main channel of watercourses.
Behaviour: GOs are seen as "rowdy, intrepid" animals that make a lot of noise and can swim "faster than fish". It is frequent the idea that their latrines are the places where they eat, due to the fish remains found in these marking places. NOs are more elusive and usually only a single individual can be observed for a short time.
Uses and conflicts: both species are said to have had a high economic importance in the past, but since the prohibition of fur trade in the last century, are not hunted anymore. There was one narration of a medicinal use of NO's skin, as an infusion to heal asthma and shortness of breath. GOs are currently perceived as a menace for fishing activity (mainly subsistence), being associated with gillnet damages and scaring fish away. Some locals fear the animals and think they could get inside their boats to attack. In December 2010, one case of intentional killing of a GO was documented. NOs are not usually mentioned in the conflict context; so far we heard only one resident that complained that NOs occasionally destroy fishing gillnets.

ROAD COLLISION RISK EVALUATION FOR THE OTTER IN ITALY

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Road casualties represent a major threat to otters in Europe, accounting for 30%-80% of accidental deaths of otters. Road mortality might be especially critical for small and isolated populations, as increase of mortality rate might trigger irreversible extinction vortex. The risk of collisions is related to traffic flow and both the distance and orientation of the road network with respect to the watercourse. Identifying the portions of the road network at high risk of collision allows to optimize interventions aimed to reduce otter accidental mortality. We realized a map of road fatalities risk for otter in its Italian range The map was realized through GIS using ArcMap 10. A buffer of 250 m was created around the road network map at scale 1:250.000 (provided by Italian Environmental Agency, ISPRA). The buffer width corresponds to the maximum distance from the watercourse at which otters fatalities usually occur. Buffers were classified in three categories, i.e. low, medium and high risk, based on traffic flow and the presence of barriers to animal crossing. The values of overlapping road buffers were summed, , obtaining a total of five risk categories (low, medium, high, very high, extremely high). The road buffer map was then overlapped with the buffered hydrographic network map at 300 m (150 m from each river side). This corresponds to the maximum width of riverine habitat used by otters . The non overlapping portions of the buffers were then downgraded to null risk. Finally, the resulting map was filtered considering the lateral connectivity, i.e the probability of otters to move across river stretches. Lateral connectivity was assessed by evaluating the resistance of the land matrix between neighbouring catchments. Layers included slope, land cover, altitude, human density and road networks. A logical overlay of layers allowed the identification of areas permeable to otter movements between catchments. Portions of the risk map falling within impermeable areas were then downgraded to low or no risk. As expected, the occurrence of the three highest categories of risk (high, very high and extremely high) was proportional to the percent extension of otter range in the different regions, i.e. Basilicata (36%), Campania (26%), Molise (17%), Calabria (14%) and Puglia (7%). The final map was tested by mapping otter road casualties in Italy derived from the website managed by Laura Bonesi and available at http://www.units.it/lontra/. Otter fatalities were not proportionally distributed, as 67% of all known road-killed otters came from Basilicata region.

DAMAGES CAUSED BY THE EURASIAN OTTER IN FISHPONDS AND IMPACT OF OTTER DISTURBANCE ON CONDITION AND GROWTH RATE OF COMMON CARPS IN FISHPONDS

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In fishpond areas, where otter density is high, deep conflict between otter protection and fishermen is common. Besides primary damages, e.g. direct consumption of fish, according to fishermen in the over-wintering period (November – March) otter disturbance result in fish higher predisposition to diseases, higher mortality and lower market value. To ascertain the effect of otter disturbance on fish, a survey was carried out in the fish-pond area located in south-western Czech-Moravian Highlands (Czech Republic).

In autumn 2007, 1000 individually PIT-tagged common carps (*Cyprinus carpio*) were stocked into five different fishponds, with area ranging from 0.4 ha to 0.6 ha, for over-wintering. The condition and growth rate of all fish was assessed before stocking. Visiting rate (proportion of nights when at least one otter visits the site) by otters was estimated based on the weekly surveying for spraints or other signs of otter presence at ponds. After over-wintering the condition and growth rate of survived fish was estimated and related to the visiting rate (ranging from 0.06 to 0.52, i.e. otters visited ponds from 6% to 52% of nights). During the vegetation period (April -October) all survived fish were stocked into one fishpond and in autumn 2008 the condition and growth rate of fish was assessed. Our preliminary results show that otter disturbance affected the condition of over-wintered carps (those from fishponds with higher visiting rates had significantly lower spring condition). Highly disturbed carps showed significantly slower growth rate in the subsequent vegetation period.

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MÜLLERIAN DUCT CYSTS ON THE VAS DEFERENS IN SWEDISH WILD OTTERS (*LUTRA LUTRA*)

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Otters (*Lutra lutra*) are aquatic top predator and as such they are exposed to elevated concentrations of environmental contaminants in their feed. It is believed that PCB was responsible for the dramatic decline of otters occurred after the 1950s in Sweden. However, few pathological effects on otters that can be correlated to contaminants have been reported.

Between 2005 and 2010, we investigated the reproductive organs from 135 dead adult or subadult male otters for the presence of cysts on the vas deference. Most otters were accidently road-killed (n=105), eight were drowned in fishing geer, one in a mink trap, and the rest were found dead for starvation or undetermined causes. The otters originated from various locations in Sweden. The vas deferens and testes were sampled and evaluated separately. The number of cysts on each deferens was recorded and measured. After that they were fixed in10% buffered formalin, trimmed, and processed for light microscopy of the cysts.

At least one cyst was seen in 70% of the male otters. Otters with cysts were found in all areas of Sweden. Comparison of prevalence between more and less polluted areas is being verified. Unfortunately there is no reference material from earlier periods to evaluate if the cyst prevalence is increasing or decreasing. The number or cysts varied from zero to more than ten, always in very close proximity to the vas deferens, and could be either unilateral or bilateral. The cysts were of variable size and measured from approximately one to ten mm in length and contained a clear watery fluid. At microscopy the cysts had a fibrous capsule blending with the surrounding common ligament containing the vas deferens. The internal side of the capsule was lined with a single layer of flat to cuboidal eptithelial cells. Occasionally, these cells had some remnant cilia-like structures on the luminal surface. The otters were most likely not sterile as the cysts did not connect to or interfere with the vas deferens. These cysts are suggested to be vestigial remnants from the fetal female Müllerian ducts that normally regress under the influence of anti-müllerian hormone when the gonads develop during embryogenesis. The cysts may be a result from fetal exposure to elevated concentrations of estrogen or estrogenic compounds and further studies of the origin and cause of the cysts are ongoing.

ANTIMICROBIAL RESISTANT AEROMONAS ISOLATED FROM EURASIAN OTTERS IN PORTUGAL

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Antimicrobial resistant bacteria represent a worldwide problem for human and animal health, but little is known about their role in wildlife health. Wild animals' role as vectors of pathogenic and resistant bacteria to the environment and vice-versa should be determined, to monitor selective pressure from drug use and misuse. As Eurasian otters (*Lutra lutra* Linnaeus, 1758), are widespread throughout Portugal and occur in a wide diversity of aquatic environments, they represent an ideal model for this analysis. *Aeromonas* are ubiquitous Gram-negative bacteria found in a broad range of aquatic environments. They are able to invade host cells and express several virulence factors, being associated with human and animal diseases, such as gastroenteritis and wound infections. Antimicrobial resistant *Aeromonas* were isolated from otter fecal samples collected in 2006 in the basin of the River Sado, Alentejo, south Portugal. For each scat sample (n=31), an AMIES swab was performed. Bacteria isolation was carried out in Columbia agar supplemented with 5% sheep blood. Isolates were identified by their morphologic characteristics and biochemical profiles as *A. hydrophila* (n=4), *A. hydrophila*/*caviae* (n=10) and *A. sobria* (n=4).

Antimicrobial susceptibility was evaluated by the disk diffusion method according to the Clinical Laboratory Standards Institute guidelines, using the following drugs: amoxicillin/clavulanic acid (AMC), ampicillin (AMP), chloranfenicol (C), cephalexin (CL), cephotaxim (CTX), clindamycin (CLI), erythromycin (E), enrofloxacin (ENR), gentamicin (GEN), nalidixic acid (NA), penicillin G (P), streptomycin (S), sulphametoxazole/ trimethroprim (SXT), tetracycline (TE) and vancomycin (VAN).

Low resistance levels were expected, since these animals have not been subject to antibiotherapy, but no isolate was susceptible to all antimicrobials tested. High levels of resistance were observed for P, CLI, E, VAN and AMP; intermediate levels were observed for CL and AMC; and low levels were observed for S, NA, CTX, ENR and SXT. All isolates were susceptible to C, GEN and TE.

Multiresistant profiles were observed in 4 isolates. Comparison of these profiles may differentiate between strain populations and/or identify the resistance source. Similar patterns observed in 2 isolates from one sampling site suggest they may be from the same individual, probably representing the same strain. The same pattern was also observed in an isolate from a different sampling site, suggesting the occurrence of resistance dissemination between animals and/or a common source.

Results confirm otter role as potential carrier of resistant *Aeromonas*. The antimicrobial resistance profile of otter fecal bacteria may provide useful information to assess the potential transmission of resistance from the man-contaminated environment.

SESSION 6

Otters in captivity and rehabilitation centres

ASSESSING THE EFFICACY OF A GnRH AGONIST IMPLANT (DESLORELIN) TO REDUCE REPRODUCTIVE AND STRESS HORMONE LEVELS AND BEHAVIORAL AGGRESSION IN SINGLE-SEX GROUPS OF CAPTIVE ASIAN SMALL-CLAWED OTTERS

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Asian small-clawed otters (ASCO) *Aonyx cinerea* naturally live in large family groups. Due to lack of space, zoological institutions often need to house animals of low genetic or reproductive value in single-sex groups. However, these single-sex groups frequently require separation at unpredictable times due to aggressive interactions of undefined etiology. To decrease or prevent aggressions, the Association of Zoo & Aquarium's ASCO Species Survival Plan has recommended the use of Deslorelin, a Gonadotropin Releasing Hormone (GnRH) agonist. Deslorelin, typically used as a contraceptive, is theorized to reduce levels of androgens (males) and estrogen/progesterone (females) through gonadal down-regulation and, consequently, to decrease aggression while otherwise having little adverse impact on social structure or dynamics. However, there have been no systematic assessments of Deslorelin efficacy and its behavioral and endocrine influences in otter species.

For this study, fecal samples and behavioral observations (using an ethogram; 30 min sessions, 4 sessions/wk) were collected from seven single sex ASCO groups (2 to 6 animals/group) for four months. Prior to the start of the study, all individuals in four of the seven groups were implanted with Deslorelin. Fecal samples were dried, extracted and analyzed for reproductive (androgens, estrogens and progestins) and stress (corticoids) hormones using validated enzyme immunoassays. Prelimary Aggression was observed in five groups, regardless of Deslorelin treatment. Male ASCO groups treated with Deslorelin had lower ($P < 0.0001$; Single Factor ANOVA) testosterone levels compared to non-treated groups, yet cortisol levels were higher ($P < 0.0001$) in Deslorelin treated animals. However, these results may be skewed by observations in one group of six Deslorelin-treated males in which several aggressive events requiring separation occurred during the study period. Within this group, the most aggressive male had the highest ($P < 0.0001$) cortisol levels whereas the individual subjected to aggression exhibited the highest ($P < 0.0001$) testosterone. Among females, hormonal analysis of two ASCO housed together showed a reduction in both progesterone and cortisol levels when comparing pre- and post-Deslorelin implantation. In conclusion, while Deslorelin treatment in ASCO appears to be effective in reducing levels of reproductive hormones, a corresponding reduction in cortisol levels, as an indirect measure of stress and aggression is less certain, especially in males. Further assessment of normal behavior in this species as well as the efficacy of GnRH agonists in down-regulating reproduction and minimizing aggression will be needed to improve management of ASCO single sex groups. (Funding: AZA Conservation Endowment Fund).

CONSERVATION OF RIPARIAN MAMMALS IN HUMAN-MODIFIED LANDSCAPES: THE ASIAN SMALL-CLAWED OTTER (*AONYX CINEREUS)* IN THE WESTERN GHATS, INDIA

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Research on the persistence of species in human-modified landscapes has focused on terrestrial fauna. Animals confined to riparian ecosystems often occur in human-modified landscapes since their habitats extend beyond the adjoining protected areas.

We examined occupancy and intensity of habitat use by Asian small-clawed otters in three land-use types – a protected area and neighbouring tea and coffee plantations -, in the Anamalai Hills, Western Ghats, using spraints, i.e. marking intensity, as the indicator. We sampled 66 500 m long stream segments by employing an occupancy framework. All streams were sampled in the dry season and were mostly of order 3 or higher. Several habitat variables were also measured on the streams and their banks.

Occupancy was high in all three land use types (>0.75), indicating that otters use riparian ecosystems also in human-modified landscapes. Marking intensity was, however, much lower in tea (4.16 spraints/km) and coffee (4.87) plantations than in the protected area (7.75). Using GLMs, we identified the abundance of potential refuges (such as rocks and fallen trees), shoreline diversity and land-use type as having independent influence on habitat use.

The widespread use of tea and coffee plantations was due to the retention of much of the riparian vegetation and presence of forest fragments. Human disturbance such as sand mining, pollution, fishing and infrequent poaching might be the reasons for the relatively low marking intensity.

Our study highlights the need to retain remnant forests to enhance small-clawed otter conservation in human-modified habitats.

OTTER CAPTIVITY CENTRES: THEIR ROLE IN CONSERVATION

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In Abruzzo (central Italy) there are 3 captivity centres where otters have been hosted since the 1990s. In December 2010 an agreement among the 3 centres has been signed with the main goal of coordinating their efforts relating to only one composite captive population of otters.

The aims of the agreement were:

1. to increase the number of individuals and their fitness in the otter captive population in order to:
   a) enhance our knowledge on the species' biology;
   b) promote communication and educational activities
2. to develop a recovery and rehabilitation centre, while drafting and promoting guidelines for the recovery of injured wild otters, their maintenance in captivity and their successive release.

To achieve the above goals the following activities have been planned:

- to exchange individuals otters among the 3 captive centres;
- to facilitate two reproductive events in 2011;
- to collect information on otter reproductive behaviour by using infrared cameras located into the dens and around the enclosures;
- to draft and share targeted educational programs for primary and high schools;
- to develop a specific research program on otter vocalization to evaluate the potential of this tool for the study of otters in the wild.

Thanks to the exchange of reproductive otters, two breeding couples have been established and four pups were born between the end of January and the beginning of February 2011. In turn, this allowed us to:

1. record both vocalisations and images. Preliminary analyses seem to show that otters have a tendency to reply to some specific recorded voices;
2. enhance our educational activities; the otter is re-colonizing some areas of southern of Abruzzo from where the species has vanished in the early 1990s, and it is now important to build on the attitude of human local populations and increase their acceptance for the species. For this reason we devoted our material to develop a specific museum exhibit structure ("The otter den").

Finally the projected recovery and rehabilitation centre has been realised as part of the existing otter captive centre of Caramanico Terme. The expansion of the range of the otter population in Italy will likely correspond to an increase in the recovery rate of injured otters. Our experience in handling otter individuals will be applied to recover, maintain and release injured otters in nature and develop guidelines for best practices.

SESSION 7

Marine living otters

STATUS REVIEW: SEA OTTER (*ENHYDRA LUTRIS*) POPULATION STATUS AND TREND

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The world-wide population of sea otters (*Enhydra lutris*) is currently estimated to be 108,479 and is dispersed from eastern Hokkaido, Japan, through Russia, the United States, and Canada. Sea otters are not uniformly distributed throughout their range and the major concentration areas are Russia (24%) and the United States (69%, predominantly in southwest Alaska); Canada has about 4% of the world population and Japan has <1%. In 2009, researchers in Russia reported numbers to be reduced from 2007 estimates due to resource (food) limitations. Japan currently has regular sea otter sightings and has emerging concerns with competition with local fisheries. In Alaska, the southwest population stock remains listed as threatened under the Endangered Species Act; 15,164 km^2 was designated as critical habitat to the recovery of the population in 2009. The south-central and south-eastern population stocks in Alaska are considered stable or increasing. In BC Canada, the northern sea otter was down- listed from threatened to a Species of Concern under the Species at Risk Act due recent population surveys and to steady population increase. In Washington State, the population is increasing but a recent of study of free-ranging sea otters indicated 80% and 60% have been exposed to phocine distemper and toxoplasmosis, respectively. In California, population trends have declined since 2007 and of particular concern is a reduction in the number of breeding age female otters.

COMMANDER ISLANDS PHENOMENA: SEA OTTER POPULATION REMAINED STABLE

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Since 1991, after a dramatic mortality event, the sea otter population of Commander Islands (CI) has demonstrated a trend of stable growth up to 2007. A total of 7,010 sea otters were counted in 2007 on Bering and Medny Islands (compared with 6,109 in 2005). We suggest that the 2007 estimate represents a historical maximum of sea otter abundance on CI since at least 1756, when sea otters on Bering Island were exterminated, leaving only a small sea otter colony on Medny Island.

During the last decade, sea otter numbers on Bering Island have been stable ranging between 3500 and 3700 individuals. The last complete survey (by small boats) was carried out in 2008, when 3712 sea otters were counted (4197 in 2007) and otter distribution pattern was similar to those of previous years. On Medny Island, a boat-based survey was conducted in summer 2010, when 2554 sea otters were counted (2813 in 2007).

Partial sea otters counts in part of Bering Islands in summer 2009 and 2010, recorded high numbers of females with dependent pups. We suggest that (1) high birth rates (20-26%), (2) high survival rates and (3) low mortality of all age classes are the most important factors influencing the stability of sea otter abundance on CI during the past 10 years.

In contrast, despite the small distance between CI and Aleutians Islands the sea otter population of the latter archipelago has progressively declined. Investigating sea otter population stability on CI can be helpful for understanding the causal mechanisms of sea otter decline on the Aleutian Islands. Some hypotheses are discussed.

RECENT STATUS OF SEA OTTERS IN HOKKAIDO ISLANDS, JAPAN

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The range of the Asian sea otter (*Enhydra lutris lutris*) extends from Kuril Islands to Commander Islands, Russia. In the southern portion of their range, such as Habomai and Hokkaido region, sea otters have become extinct in the second half of the 20th century, as in the 1960s one or two otters per year were had still been recorded. In 2001, however, skiff-based population surveys were conducted in the Habomai Islands and sea otters were found to have expanded their range and have established a growing population. Range expansion probably took place in the late 1990s. Recently, sightings of sea otters around Hokkaido have increased remarkably, further range expansion is likely in progress, involving the southern and eastern part of Hokkaido Islands.

In February 2009, one young male otter became very popular in Hokkaido, because he occupied the river crossing Kushiro City for about three months. After he moved to Nosappu Cape, which is located next to the southern Kuril Islands several otters (up to six) are observed frequently and some of them seem to inhabit around the Cape.

At first, people were positively disposed towards the presence of sea otters. However, otters consumed a lot of sea urchin which local fishermen stocked in the coastal area, and now there is serious conflict between sea otters and the sea urchin fishery. In 2010, the estimated damage to the sea urchin fisheries amounted to 30 million yen. On the other hand, sea otters risk to be killed by net fisheries. The best available information concerning sea otters distribution and abundance in the southern Kuril Islands comes from surveys carried out more than ten years ago. To identify potential solutions to management problems and conflicts we need to provide up-to-date information by conducting further population surveys.

ASSESSMENT OF TEMPORAL PATTERNS IN WINTER DIET OF SEA OTTERS (*ENHYDRA LUTRIS*) BY SCAT ANALYSIS IN KACHEMAK BAY, ALASKA (2008-2009)

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Long-term monitoring of a keystone species' diet is valuable and contributes to our understanding of shifts in the structure of an ecosystem. In Alaska, scat collection is feasible in winter months when sea otters haul out in greater concentrations. In this study, we evaluate scat analysis as a low-cost tool to monitor long-term trends in the winter diet for sea otters in Kachemak Bay. During the spring of 2008, we collected 142 scat samples from 10 locations throughout the Bay. During October 2008 – May 2009, we collected 97 scat samples systematically at 3 female/pup haul out locations. Dominant prey types at all sites were mussel (41%), and crab (31%), and clam (12%). During 2008-09, there was an inverse relationship between proportion of mussel (dominant late fall and spring) and crab (dominant winter and early spring) in the diet. Proportions of other prey remained at low levels throughout the sampling period. Scat analysis is biased toward species where hard parts of prey are ingested. During summer 2008, we conducted visual observations in a female/pup area adjacent to all winter haul out sites (n=322 successful dives); the dominant prey type was clam (38%). Kachemak Bay is a soft-sediment habitat and has the potential to support high-calorie sea otter prey, such as large clams and crabs. Scat analysis will be a useful tool in identifying general trends in winter consumption of crab and relatively low-calorie hard-shell invertebrates but will exclude the larger bivalve and soft-bodied prey.

SESSION 8

Habitat improvement, compensation and mitigation

LONG TERM MONITORING OF THE EURASIAN OTTER IN THE ALQUEVA DAM (SE PORTUGAL)

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There are few examples of long term monitoring studies involving otters and dams, although the number of these infrastructures is progressively increasing. We monitored Eurasian otter *Lutra lutra* responses to the construction of the Alqueva dam (250 km^2, SE Portugal) during: pre deforestation/flooding (1999-2000); deforestation (2001); flooding (2002-2003); and post flooding (2004-2006). In each phase, 600m long transects were surveyed for otter presence every three months in forty-eight $1km^2$ wide cells selected within the flooding area. Each survey site was characterised in terms of otter habitat (e.g. resting sites, water, corridors) and related with otter presence. In eight survey sites, we collected otter scats to assess diet and compare it with prey availability using electrofishing, nets and traps. Otter presence was widespread prior to dam construction (88.2% of the surveyed area), slightly decreasing during deforestation (74.9%), and exhibiting a major decrease during the flooding phase (43.8%). Recovery occurred in the post flooding period (71.7%). Seasonal effects on otter presence were detected at the end of the post-flooding phase, with higher otter presence in the dry season than in the wet one. Otter diet was dominated by fish and American crayfish *Procambarus clarkii* both in pre-deforestation/flooding phase (56.7% and 35.3% of occurrences, respectively; N=1921) and at the end of the post-flooding phase (60.7% and 33.2%; N=658). Richness of preyed fish decreased with flooding (16 to 8) as well as the ratio of native/non-native fish species (1.7 to 0.3). In 2000, otter diet was dominated by pumpkinseed *Lepomis gibbosus*, barbels *Barbus* sp. and chubs *Squalius* sp. By 2006 otter fish diet was dominated by *L. gibbosus*, mosquitofish *Gambusia holbrooki* and largemouth bass *Micropterus salmoides*, all non-native species. Black bullhead *Ameiurus melas*, a species with previous residual presence in streams that increased in numbers with the flooding also became an important item in otter diet. Prey and cover were determinant factors for otter presence in the streams prior to the construction of the dam. Post flooding, the number of streams flowing into the reservoir became more important, since the high vegetation cover provided by their banks offered shelter and resting sites, a resource that was scarce in the reservoir margins. Otters also responded positively to the presence of islands within the reservoir, which maintained a good vegetation cover and may act as safe haven. Otter presence showed a recovery in the post flooding phase although not to the level prior to dam construction. These results emphasize how long term monitoring is important to truly evaluate a species response to impacts and allow compensation measures.

RESTORATION OF THE OTTER HABITATS IN LUXEMBOURG AND BELGIUM: 5-YEAR ACTIONS IN FAVOUR OF AN EMBLEMATIC SPECIES OF OUR WATERCOURSES, THE EUROPEAN OTTER (*LUTRA LUTRA*)

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In 2005, 7 partners (Nature Parks of the Haute-Sûre, Haute Sûre Forêt d'Anlier, Our, Hautes Fagnes-Eifel, 2 Ourthes, the Hëllef fir d´Natur foundation and the Centre de Recherche Public – Gabriel Lippmann) proposed a LIFE-Nature Project to preserve the habitats of the last otters in Luxembourg and Belgium.
The main objective of this wide and cross-border project was to improve the otter habitats and try to build or rebuild corridors between the two important otter populations located in France and Germany in order to facilitate the migration of the species and contribute to re-establish stable otter populations in our countries.
To reach these objectives, we tried to improve the natural fish productivity (by the restoration of 6 spawning grounds and the removal of 21 obstacles TO fish migration), decrease the impacts related to the presence of cattle alongside rivers (installation of 262 drinking troughs, 61 km of fences, 23 footbridges), promote autochthonous riparian tree species by the early cutting of spruce forests in floodplains (150 ha), regulate the exploitation of riparian woods, connect catchment areas by planting the riverbanks with indigenous trees and shrubs (23 km) and digging ponds (178), manage secure passageways under bridges for both otter and small mammals (N = 9), create nature reserves (105 ha) and otter havens (31) and manage invasive plants (189 ha) in the Natura 2000 areas.
The raising of people awareness was an important element of the project, which included a travelling exhibition and an educational file: "on the tracks of the otter". A network of volunteers allowed to survey a wide area for otter footprints and spraints between 2007 and 2010.

A VALUATION OF DIFFERENT TYPES OF FAUNA PASSAGES FOR OTTERS IN NORTHERN SWEDEN USING CAMERAS

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Traffic is one of the major threats to the future reestablishment of the Swedish otter population. There are 2000-3000 otters in Sweden today, whilst, as a touchstone, in the 1950s 1500 animals were hunted each year for pelts.
Between 70% and 80% of the dead otters that every year are sent to the Natural History Museum in Stockholm are killed by traffic. To address this problem the Swedish Traffic Administration has started to predispose different types of fauna passages. As weather conditions changes drastically between regions, the various kind of passages are not expected to be efficient throughout the country.
The otter movements in northern Sweden vary seasonally, due to variation in feeding opportunities and reproduction status. Food resources are scarce and there are limited areas with winter open water streams. The aim of this project is to better understand how, and if, otters use the different types of passages during extreme weather conditions. This knowledge will hopefully help us to use the best passages with respect to weather conditions.
To study how the animals use the passages, several cameras will be strategically placed on different passages (shelves, floating shelves, culverts etc) and brought into operation in northern parts of Sweden. The cameras will record images throughout four seasons. During winter supplementary snow tracking can be carried out to record the movements of the animals outside the camera range.
The results may also be of interest, thru an international perspective, to compare experience with alternative types of passages. Due to global climate changes the conditions for fauna passages might alter and there will be a need for passages that function during more extreme weather conditions.

SESSION 9

Phylogeography, population and landscape genetics

FINE-SCALE SPATIAL GENETIC STRUCTURE AND DISPERSAL OF THE EURASIAN OTTER (*LUTRA LUTRA*) IN A MEDITERRANEAN ENVIRONMENT

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The fine-scale genetic structure of animal populations is influenced, among other factors, by dispersal. This process is often male-biased in mammals, with females remaining closer to their birth places; such a pattern can lead to a higher structuring of relatedness in females compared to males. Limited dispersal may cause spatial restrictions in gene flow, which can have important consequences in the management and conservation of the involved populations.
Restricted gene flow in Eurasian otters (*Lutra lutra*) has been documented only at global or regional level, whilst it has not been investigated at finer levels. Dispersal in this species is thought to be male-biased, although evidence in wild resident populations is lacking.
In the present work, radiotracking and molecular data were used to verify the existence of a spatial structure in the relatedness of a single otter population at a local scale and to test the hypothesis that dispersal is male-biased. Genetic samples (N = 65) were obtained from carcasses, hair plucked in traps, fresh spraints and individuals captured within the framework of an ecological project on Eurasian otters developed in the Alentejo region (Sotuhern Portugal). Moreover, young otters (in pre-dispersal phase) were radiotracked, in order to verify dispersal events and compute dispersal distances.
Fifty-one individual genotypes were obtained (28 ♀, 23 ♂) and six young otters (2 ♀, 4 ♂) were captured and monitored for a time period judged to be enough for detecting the potential occurrence of dispersal. An overall pattern of genetic structuring was found up to a scale of 30-40 km, suggesting isolation by distance within the population, despite no putative landscape barriers were present. Relatedness estimates (obtained through 19 microsatellite *loci*) were inversely related to geographic distances in females, while males did not show any pattern. Among the tracked animals, only males dispersed, covering on average a maximum distance of 17 km (range: 4 – 27 km). These findings, based on both molecular and field data, provide the first robust evidence of male-biased dispersal in wild resident Eurasian otter populations and the first report of a locally restricted gene flow, providing new elements for the conservation of the species.

GENETIC CONSEQUENCES OF POPULATION DECLINE IN EURASIAN OTTER (*LUTRA LUTRA*) POPULATIONS IN THE CZECH AND SLOVAK REPUBLICS

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During the last century, human-caused habitat fragmentation contributed significantly to the reduction in population size of many species, including the Eurasian otter (*Lutra lutra*). In the Czech and Slovak Republics, the Eurasian otter was common in the past, but declined during the last century, the most significant population bottleneck occurring in the late 20[th] century. Small population size and isolation caused by population bottlenecks can result in substantial loss of genetic variability, which is important for the species viability. The aim of our study was to compare the genetic variability and structure of contemporary populations with those of historical populations. Recent population bottlenecks can mask the signs of ancient bottlenecks, as found out in some other European populations, therefore we tried to infer the demographic history of both contemporary and historical populations using nuclear markers. Overall 19 microsatellite loci were analysed and DNA was extracted from museum specimens from the 1970s, representing historical populations, and carcasses from 1996 to 2010. Preliminary results show slightly higher values of genetic variability in both Czech and Slovak historical samples in comparison with contemporary populations. A relatively high level of genetic differentiation between Czech and Slovak populations has been found in contemporary populations (F_{st} = 0.147, $P < 0.05$). A low but statistically significant level of genetic differentiation has also been found in historical populations (F_{st} = 0.066, $P < 0.05$). Evidence of a recent bottleneck has been detected in contemporary populations. A bottleneck has been detected even in historical populations, corresponding to the first half of the 20[th] century. Lack of samples originating from the period before this bottleneck did not allow us to outline possible older bottlenecks. According to genetic analyses, contemporary Czech and Slovak populations, which were separated at the turn of this century, have reconnected. Nonetheless, the Eurasian otter in the Czech and Slovak Republics must still be considered a vulnerable species. Although the conflict between the otter and the fishermen is growing nowadays, it is still necessary to protect this species as to favour the natural reconnection of fragmented populations. The project is supported through grant no. KJB600930804 of the Grant Agency of the Academy of Sciences of the Czech Republic.

ANALYSING POPULATION DYNAMICS OF EURASIAN OTTERS (*LUTRA LUTRA*) USING NON-INVASIVE GENETIC CAPTURE-MARK-RECAPTURE (CMR): PITFALLS AND SOLUTIONS

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Populations of the Eurasian otter (*Lutra lutra*) were tremendously depleted in Central Europe since the end of the 19th century. As a consequence, populations in Germany decreased heavily and in Western Germany otters even disappeared. This led to a gap in distribution that disconnects Eastern and Western European populations. But, since the 1990s otters are recovering in regions where they were absent for decades and otters of northeast Germany expanded their range towards west, closing the gap this way. To comprehend the current spread of the otter, we are studying the population dynamic of a wild otter population by using non-invasive microsatellite genotyping and genetic capture-mark-recapture (genetic CMR) over a sampling period of six years (2006-2012). Each year we collected between 200–460 fresh faecal samples on five consecutive days in an area of approximately 40km² that comprises seven groups of ponds. The study area is located in one of the distribution core areas in Germany, in the "heath and pond landscape Upper Lusatia", in Eastern Saxony.

The otter faeces serve as a non-invasive DNA source to generate an individual DNA-profile for individual identification by using microsatellite genotyping. Once individual DNA-profiles are revealed, the data can be applied to capture-mark-recapture models (CMR) to gain a reliable estimate of the population size and related quantities. Seven microsatellite markers and a sex marker were used to identify each individual and to estimate the population size by applying initially standard CMR models like the ones in programme CAPTURE or CAPWIRE.

Despite using rigorous and accepted approaches to minimise genotyping errors like the creation of a consensus genotype through various repetitions and a screening approach to detect and discard low quality samples, we found that our data set still contained errors leading to an overestimation of two-fold. The reason for that is the comparably high, although conservatively calculated, genotyping error rate of 44.9%. In general, faecal samples contain low quantities of target DNA in a bacterial-enriched environment that includes PCR-inhibitors, as well as exo- and endogenous nucleases. Furthermore, DNA in faeces is likely exposed to hydrolytic, oxidative and enzymatic degradation. This applies even more for otter faeces. They are notorious for low DNA quality and quantity, resulting in high error rates and low genotyping success. Fortunately, methods were developed recently to overcome the error-proneness of faecal samples by incorporating genotyping errors into the analysis.

We will present these methods and discuss what happens if genotyping errors are neglected. Furthermore, we have applied these methods to the data of the first three sampling years (2006-2008) and will discuss the precision of the population size estimations and provide insights into the dynamics of the population within these three years.

MOLECULAR DIVERSITY AND POPULATION STRUCTURE OF THE NEOTROPICAL OTTER (*LONTRA LONGICAUDIS*) IN NORTHWESTERN SOUTH AMERICA

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In spite of recent efforts, still little is known about the evolutionary history of the Neotropical otter (*Lontra longicaudis*). We obtained 32 biological samples from otter individuals collected in a broad portion of northwestern South America, and used them to analyze a set of molecular markers representing both the mitochondrial and nuclear genome. These markers include four mitochondrial DNA (mtDNA) fragments (segments of the *ATP8*, *ATP6,* and *ND5* genes and the 5' portion of the control region, totaling 1468 bp) as well as 10 microsatellite loci previously described for two other otter species (*Lutra lutra* and *Lontra canadensis*). High levels of genetic variability were observed in the mtDNA segments, as illustrated by the presence of 28 distinct haplotypes, with a resulting haplotype diversity of 0.9919 (SE: 0.0017). Moderate to high levels of polymorphism were also observed at the microsatellite loci, which presented a mean of 7.7 alleles per locus and an observed heterozygozity ranging from 0.3 to 0.8. No signal of genetic structuring was observed with the microsatellite data set, suggesting all collected samples might belong to the same population. In contrast, some phylogenetic structure was recovered with the mtDNA, in some cases suggesting a geographic pattern of haplotype clustering. The deepest divergence was observed with a sample from the Magdalena river valley in Colombia, which may represent a distinct population isolated from the remaining areas by the Andean Eastern Cordillera. The results indicate that Neotropical otter populations from northwestern South America maintain high levels of genetic diversity, and suggest the absence of a marked phylogeographic structure in this region may be due to the region's large and complex hydrological network, which likely favours high levels of gene flow for aquatic and semi-aquatic organisms.

INDIVIDUAL IDENTIFICATION AND DISTRIBUTION ASSESSMENT OF OTTERS (*LUTRA LUTRA*) THROUGH NON-INVASIVE GENETIC SAMPLING: RECOVERY OF AN ENDANGERED SPECIES IN THE BASQUE COUNTRY (NORTHEN SPAIN)

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Non-invasive genetic techniques have proven to be an adequate methodology for the monitoring and study of otter populations largely due to the linearity of the territories and the marking behaviour of the species. The otter is included in the Basque Catalogue of Endangered Species under the "Endangered" category and currently a Management Plan has been implemented in Alava, the only province among the three provinces within the Basque Autonomous Region with a permanent otter population. During the 2008-2010 period, a systematic sampling was carried out by looking for otter faeces in different water bodies (rivers, streams and wetlands) of Alava and surrounding areas. Samples were identified to species level by means of the PCR-RFLP technique prior to genotyping. Among the 132 analysed samples, 127 (98.4%) belonged to the study species, one to a European mink (*Mustela lutreola*), and one to an American mink (*Neovison vison*) providing new and accurate data of species distribution. All samples corresponding to otter were subsequently individually genotyped using a multiplex panel of 11 microsatellite markers and sexed by typing the sex-chromosome-related gene ZFX/ZFY. We obtained a complete individual genetic profile for 55 samples (genotyping success 43%). After a rejoining process we identified 20 different individuals: 11 females, 6 males, and 3 individuals of unknown gender. The frequency of detection of each individual varied between 1 and 10. Mean otter density in permanent areas was set at 0.09 (0.06-0.12) individuals per kilometre. The present study has established a useful methodology protocol for long-term monitoring of otter populations in order 1) to develop effective research and management programs and 2) to reach sound conclusions for the conservation of the species in the study area.

EVOLUTIONARY HISTORY AND CONSERVATION GENETICS OF SOUTH AMERICAN OTTERS

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Four otter species are distributed in South America: the neotropical otter (*Lontra longicaudis*), the southern river otter or huillín (*Lontra provocax*), the marine otter or chungungo (*Lontra felina*) and the giant otter (*Pteronura brasiliensis*). The *Lontra* genus colonized the South American continent from North America, whereas *P. brasiliensis* was already present in the region.

To understand the phylogeographic pattern of the four otter species and to reconstruct the *Lontra* genus evolutionary history we used approximately 2000 bp of mitochondrial DNA from otter samples (Faeces, blood samples from captured animals, and muscle tissue from otters found dead) collected along South America. Sequences were analyzed on eastern Andes along the Amazonian and Paraná-Paraguay basin (*P. brasiliensis* and *L. longicaudis*), on western Andes from Peru to southern Chile for *L. felina*, and along the Patagonian rivers and lakes across Andes in Chile and Argentina as well the southern fjords and channels in Chile for *L. provocax*.

The phylogenetic reconstruction indicate *L. longicaudis* as the basal species, the peripatric speciation of the huillín across Andes, and the recent parapatric speciation of *L. felina* from *L. provocax* distributed in Patagonia along southern fjords and channels.

Although the neutrality test, Tajima *D* and Fu's *Fs*, were not significant, the Median Joining Network topology suggested a signature of bottleneck for giant otter populations and huillín populations distributed along rivers and lakes. We found a strong population genetic structure for *L. felina* and a pattern of isolation by distance along the Peruvian and Chilean coast. Moreover, our results support the subspecies division of *L. felina* (*L. f. felina* and *L. f. peruviensis*) which should be considered for future conservation actions.

OTTERS IN SWEDEN: A POPULATION STUDY USING FAECAL DNA

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The aim of the study was to examine the genetic variation, differentiation and approximate number of individuals present in two different populations of the Eurasian otter (*Lutra lutra*) in Sweden. Analysed samples consisted of recent tissue-samples (from deceased otters sent to the Swedish Museum of Natural History between 2000 and 2010, n = 42) and faecal samples collected during autumn 2010 (n = 48). All tissue and faecal samples originate from the same two areas in Sweden; Småland in the south and Västernorrland in the northern part of the country.

DNA was extracted from all the samples using GeneMole. The tissue samples were genotyped for 8 different microsatellite loci after multiplex PCR. Amplification of the faecal samples started with a PCR of a part of the mtDNA. This DNA-fragment was then used to check if the sample could be confirmed to originate from an otter or not. Only the samples that could positively be identified as otter were thereafter amplified using the same microsatellite-primers as for tissue samples.

Preliminary data suggest a high success rate of the collectors, who mainly gathered otter faeces (and not mink) and that there is a relevant genetic separation between the two populations. A rough estimation of the number of otters in each area will hopefully be extrapolateable from the data.

THE USE OF GENETIC METHODS TO STUDY EURASIAN OTTERS

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In the last decade, genetic methods have become available also for wildlife and conservation studies. Application of genetic analyses can provide many important and interesting data, such as on population numbers and structure, relatedness, population history, genetic viability and conservation status, etc.

We present a review of genetic methods used by our research group to study Eurasian otters (*Lutra lutra*) in Central Europe: (1) noninvasive genetic sampling; (2) population genetic analysis; (3) analysis of historical DNA; (4) forensic genetic analysis. We used microsatellite DNA markers for individual identification and assessment of population size, genetic structure and demographic history of populations, and SRY marker (located on Y chromosome) for sex identification.

To assess otter population size and structure, DNA was extracted from fresh spraints and shed hairs collected in cold months. The success rate of analysis ranged between 50% and 70 % and individual otters were identified at three different sites: eutrophic river with large fishponds; lowland river with streams and small fishponds; and oligotrophic mountain streams. Partial information was obtained also on relatedness between some individuals, especially when combined with data from telemetry.

To study genetic variability, genetic structure and demographic history of otters in the Czech and Slovak Republics, tissue samples from carcasses and, more recently, materials from museum collections were used. In the latter case, DNA was extracted from teeth (usually canines), skulls, skins and mounted specimens. The success rate of historical DNA analysis ranged between 50% and 80 %. Using contemporary samples, the reconnection of Czech and Slovak populations, which had been separated in the last century, was confirmed.

Genetic analysis of blood remains collected from the ground allowed to confirm that an Austrian hunter had killed illegally a male otter, providing evidence for the disciplinary hunting board and the court.

These examples show the considerable potential of genetic methods in otter research and conservation, and we argue that genetic studies should be included in all otter action plans.

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NON-INVASIVE GENETIC SAMPLING OF THE EURASIAN OTTER IN ITS ITALIAN NORTHERN RANGE

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Information on population density and structure of the highly endangered otter populations in Italy are still very scanty, especially those regarding the small isolated subpopulation which currently is the northernmost one in this country. In this portion of the range, the recently colonized basin of the River Sangro plays a strategic role for the future expansion of the species northward. In 2010, we started a pilot Non Invasive Genetic Sampling (NIG) along the River Sangro in order to 1) refine the DNA extraction and sequencing protocols to increase the rate of genotyping success; 2) estimate the minimum number of individuals living in the river basin; 3) evaluate the genetic flow with neighboring rivers 4) describe the otter spatial distribution, its population structure and density. We analyzed 22 samples of spraints and jellies, collected in 2010, with a panel of 12 microsatellite loci (Lut435, Lut604, Lut701, Lut715, Lut832, Lut833, Lut453, Ot04, Ot05, Ot07, Ot17, Ot22) and ZFX/ZFY sequences for sex identification. Ten sampling stations were checked daily; fresh samples were collected within 24 hours from deposition and preserved in ethanol at -20°C until DNA extraction. We run nested PCR that allowed to improve success rate in DNA amplification and sequencing. We also attempted to increase whole DNA contents by Whole Genome Amplification protocol but we did not obtain significant results. The 22 samples were initially screened with three microsatellite loci, amplification of all samples was repeated four times for every locus (multi-tube protocol) and negative controls were always included in the analysis. Only samples amplified with success in at least 50% of replicates were analyzed at all loci. Only 10 of 22 samples were analyzed with all microsatellite loci and with ZFX/ZFY sequences. Despite the low number of genotyped samples, we recognized the presence of at least 2 individuals, one male and one female on 60 km of river stretch. Moreover, the retention of more samples than usually after the preliminary screening could allow to refine the population profile. The low rate of success suggests that future sampling efforts should be improved to allow individual detection and the estimate of population density.

INDIVIDUAL IDENTIFICATION AND SEX DETERMINATION OF EURASIAN OTTERS (*LUTRA LUTRA*) IN DAEGU CITY BY GENETIC ANALYSIS OF SPRAINTS

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Eurasian otter *Lutra lutra* is one of the most well known threatened species in South Korea. Since the 1980s, it has experienced rapid population decline, as a consequence of overhunting, pollution and habitat loss. However, due to the improvement of aquatic environments, Eurasian otter populations have recently recovered in some areas of South Corea, where traces of otters have been discovered even on watercourses flowing through several big cities, such as Daegu. With the aim of investigating otter distribution in Daegu, we analyzed 20 faecal DNA samples by using nucleic genetic markers.
Faecal samples were collected on River Gumho and Shincheon stream. DNA was extracted by QIAamp DNA Stool Mini Kit (Qiagen^{TM}). Individual identification and relatedness were investigated by genotyping all DNA samples using a panel of 12 microsatellite loci; the sex was assessed based on sequence variation of Zinc Finger protein gene on sex chromosomes. Ten fecal samples were successfully genotyped, while the gender of nine samples was successfully identified. At least seven individuals were distinguished, four males and three females. High levels of kinship were verified by the analysis of genotypic data using GenAlEx6.1.
Non-invasive genetic analysis proved to be a useful tool for the study of Eurasian otters.

GEOGRAPHIC VARIATION IN EURASIAN OTTER (*LUTRA LUTRA*) MORPHOLOGY AND MARKINGS – A REFLECTION OF GENETIC STRUCTURE?

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Patterns of phenotypic variation within a species, for example in morphology or colouration, frequently mirror the genetic structure of populations. Studying this variation can provide insights into population origins and selection pressures, which may have important implications for the conservation management of a species. Recently published evidence shows that the recovering Eurasian otter (*Lutra lutra*) population in England and Wales can be divided into 4 regional populations, reflecting known population history; further sub-structuring suggests 11 smaller groups. Using multivariate analysis of markings, skeletal measurements and body size we investigate the extent to which this genetic structure and sub-structuring is reflected in the phenotypic variation of *L. lutra* and whether the degree of differentiation between populations also reflects population origins.

MONITORING AN OTTER POPULATION IN NORTHERN GERMANY BY DNA TYPING OF SPRAINTS

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Knowledge of the number and the distribution of an animal species is an important precondition for its management. After a dramatic decline in the Eurasian otter (*Lutra lutra*) population in Europe during the first half of the 20[th] century a remarkable expansion of the distribution range became obvious. Such an expansion is well documented for more than a decade by systematic sample surveys for field signs of otters for an area of 1200 km^2 in the northern part of Lower Saxony, Germany. To get more and better data about the population size, population structure and genetic diversity in this area we started a monitoring in the year 2009 by genetic typing of DNA extracted from spraints. Spraint samples were collected from 27 sampling sites for a period of 10 weeks. Only freshly deposited spraints from the previous night were used. Spraints were stored in vials containing a 99% ethanol solution. After extraction and pre-selection DNA amplification was applied, seven microsatellite loci were used for individual typing. Sex was determined using the DBY7Ggu primer in combination with microsatellite locus 04-OT-04 as the internal control. Allowing one missing locus, 53 out of 107 samples could be assigned. So we obtained a DNA typing success rate of 49%. A total of 15 individuals (8 males, 6 females and 1 unknown sex) could be distinguished. That means a low density of otters, one animal per 86 km^2. The spatial distribution of the identified otters suggest that most of the males and females live in more or less exclusive areas with little overlap.

WORKSHOP

Biology and conservation of the giant otter

GIANT OTTER (*PTERONURA BRASILIENSIS*) VOCALIZATIONS AS A BASIS FOR ACOUSTIC MONITORING

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Acoustic monitoring is a non-invasive method that facilitates monitoring in areas which are difficult to access and is of special importance during sensitive phases of the animals' life cycle, such as rearing offspring. One of the most important prerequisites for acoustic monitoring is vocal individuality and the possibility to identify unknown individuals by vocal cues. Acoustic monitoring should be well-suited for giant otters as they possess a highly developed acoustic communication system. We hypothesized that giant otter vocalizations differ between groups and between individuals, allowing the acoustic monitoring of this endangered species. We obtained recordings from wild and captive giant otters. Acoustic parameters of the recorded vocalizations were measured, classified and statistically analyzed. We combined acoustic parameters into principal components. The principal components were used in subsequent discriminant function analyses in order to test for individual- and group-specific characteristics. Preliminary results indicate that some vocalizations differ between social groups as well as between individuals. Currently we are studying vocal group recognition in captive giant otters using playback calls from group members and unknown conspecifics. Individual recognition is tested with a habituation - dishabituation paradigm. Preliminary data suggests that giant otters are capable of recognizing conspecifics by vocal cues alone. This indicates vocal individuality in giant otter calls, a crucial prerequisite for successful acoustic monitoring. Thus, we are confident that acoustic monitoring is going to become a powerful tool for the study and protection of this endangered species.

A GIANT OTTER DISTRIBUTION SURVEY IN THE LOWER RIO BRANCO REGION, AMAZONAS AND RORAIMA STATES, BRAZIL

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Distribution and population data are critical for establishing effective conservation strategies. Brazil, in spite of covering more than three quarters of the giant otter (*Pteronura brasiliensis*) range, still possesses very limited information on the species distribution. According to the OSG Range-Wide Distribution Survey Strategy (RDSS-GO), surveys should concentrate in large transects over the Brazilian Amazon basin and in existing work areas. Both the criteria were met in the Lower Rio Branco, between the Brazilian states of Amazonas and Roraima.

The region, which is part of the Central Amazon Corridor, has recently been recognised as conservation unit and giant otter distribution had never been investigated before. With the aim of contributing to the protected area management plan, a first distribution survey was carried out at end of the dry season (February - March 2011). The survey also aimed to evaluate the Standard Distribution Survey Method (SDSM-GO) and gather data for the Information System for Otter Surveys – ISOS.

On the UTM grid base, the survey covered 2 100x100 km squares , redefined to 3 50x50 km quadrants and 6 25x25 km sub-quadrants. Two black-water rivers (Jauaperi, Negro), one white-water river (Branco) and 6 creeks were investigated with a total distance travelled of 380 km, using the stop-at-first-sign method. The survey was conducted with a regional boat and two wooden paddle canoes, maintaining a travelling speed consistently below 10 km/hour.

All the sub-quadrants were identified as positive for the presence of the giant otter, 50% of the recorded signs being sightings of individuals and 50% being indirect signs such as campsites, dens and tracks. The presence of cubs, about 5 months old, was recorded once. All the surveyed sites were selected on the basis of interview with local people, with a stop-at-first-sign maximum distance of 5 km. While travelling towards the selected sites no indirect signs and only one otter group were recorded.

We conclude that the SDSM-GO is appropriate to the conditions in which we have tested it, although the survey distance of 20 km proved to be unnecessarily long and could be reduced without affecting the observation probability. We confirm the appropriateness of using a 100x100 km grid in the RDSS-GO but strongly suggest the selection of the sites on the basis of the traditional local knowledge in order to avoid wrong conclusions, which would lead to equivocal conservation and policy decisions. Further field testing is required to confirm whether this methodology can be recommended for monitoring populations with a lower density. The Columbus Zoological Park Association supported the survey.

DEMOGRAPHY AND CONSERVATION OF THE GIANT OTTER (*PTERONURA BRASILIENSIS*) IN THE RIVER MANU FLOODPLAIN, PERU

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The giant otter is one of the most social of the world's 13 otter species, and is a top carnivore of the lowland rainforests and wetlands of South America. Following intensive hunting pressure for pelt trade between the 1940s and mid 1970s, it is now extinct, or virtually so, in Argentina, Uruguay and Paraguay and its range elsewhere has been much reduced or fragmented.

To inform conservation management decisions, it is important to understand the demography of a species. We present demographic data from the first 14 years of a long-term giant otter population study conducted in Manu National Park, Peru. A total of 14 dry season surveys were carried out between 1991 and 2006. Each annual census covered 230 kilometres of the River Manu and a core group of 20 oxbow lakes (n=31). By cataloguing throat patterns and compiling data accompanying each sighting, individuals could be recognized and their life histories followed over successive years (285 different individuals, 866 annual dry season data points, 3.04 data points per otter).

Baseline demographic and reproductive variables, including age at independence, age at first reproduction, average litter size at independence and longevity were documented. Estimates of net reproductive rate, generation time and intrinsic rate of increase were obtained; dispersal and philopatry were found to be sex-biased. Moreover, we examined the factors that may affect the reproductive success of giant otters.

The Manu floodplain population is increasing due to the combined effect of higher cub productivity, greater number of transients and the founding of new resident groups (from 8 to 12). These findings will be useful in formulating recommendations for the conservation and management of giant otter populations in Peru.

THE NATIONAL ACTION PLAN FOR GIANT RIVER OTTERS IN BRAZIL

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The giant river otter (*Pteronura brasiliensis*) is included in the Brazilian Threatened Species List as "vulnerable". Historically spread throughout the country, from the Amazon to the southernmost state, the species is now represented by small populations, some of those isolated or in decline. The species is considered as endangered in two Brazilian states and likely extinct in other four states. Stable or recovering populations occur only in Amazonia and Pantanal.

Current threats to the species in Brazil include habitat alteration due to mining and logging, conflicts with fishermen, removal of cubs for illegal pet trade, oil spills during exploration and transport activities and badly-managed tourism activities.

The Giant River Otter National Action Plan was constructed in April 2010 by a team of experts under the coordination of the Brazilian Institute for Conservation of Biodiversity. Its objective is to conserve the giant river otter populations in the current distribution areas and start the recovery process in the original distribution range. Conservation strategies include actions for the protection and recovery of habitats, law enforcement and environmental education, management and monitoring of natural habitats and scientific research, including a nationwide distribution survey.

Forty-two actions are split among 6 goals: 1. Minimize conflicts between humans and giant river otters; 2. Improve the knowledge on population biology, distribution, taxonomy, health status and genetics; 3. Establish the Captive Conservation Program; 4. Evaluate and regulate tourist activities in areas of giant river otter presence; 5. Improve protection and connectivity between giant otter populations in critical areas; and 6. Evaluate and test the viability of natural recolonization of part of their historical distribution range.

The National Plan has been officially approved and shall be implemented within a 5-year period.

ARTIFICIAL FEEDING OF AN UNWEANED GIANT OTTER (*PTERONURA BRASILIENSIS*) CUB

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Giant otters are classified as "Endangered" and today their populations in Brazil are basically restricted to the Amazonia and Pantanal biomes. To this moment, there is no information available on both the nutritional content of giant otter milk and the amount of milk consumed by cubs. Here, we describe the food offered to an orphan giant otter cub, which on 15/06/2007 was brought from the River Negro (Amazonas, Brazil) to the Lab. of Aquatic Mammals at INPA (Manaus, Brazil). This cub, a female called Nyryny, weighed 1.9kg and was 65cm long. The eyes were just opened and the animal was crawling with little coordination. Only the extremity of the canines, of yellowish color, and the tips of 2 lower molar teeth were present. At the beginning we offered about 40ml of NAN® milk without lactose every 40 minutes. After the fourth day we added 2g of Aminomix®, and on the fifth day 2ml of canola oil was added. On the following days, we also added 20ml of Babydrax®, coconut water and egg mixed with milk and 0.15ml of Poliplex®. Nevertheless, the cub did not gain weight and sometimes it did not accept the milk bottle. As a result, it became severely dehydrated, and it was necessary to apply three subcutaneous injections of physiological saline solution (a total of 20ml). The cub also caught a cold, diagnosed by nasal secretion and loss of voice. On 01/07/2007, the NAN® milk, which has low protein, carbohydrates and fat content, was substituted by UHT whole milk. We also introduced 2 tea spoons of "Farinha Láctea"® together with 0.3ml of Poliplex® to each 120ml of whole milk. Successively, we added honey, "propolis", 0.2ml Glicopan® and Scott® emulsion on alternating bottles. Simultaneously, we bathed it in "andiroba" oil to treat skin sores caused by dehydration. In 18 days the cub gained 1.5kg and all dehydration and cold signs disappeared. At that time, the cub was consuming about 130ml each time, totalling approximately 1L/day. After the 30[th] day we started offering small pieces of catfish, which were held by Nyryny with the forepaws. From 20[th] to 30[th] July, the animal reached 4.2kg and the average milk consumed was about 200ml per feeding session. Fish was offered more frequently until the animal reached 6kg, which happened 2 months and 12 days after its arrival. On the 28/08/2007, Nyryny was sent by plane to a Zoo in southern Brazil by IBAMA (the wildlife "fiscalization" institute in Brazil), but the animal did not resist the long trip and arrived dead at its destination. However, we are quite confident that if the cub had remained in Manaus, it would have survived. The information here presented has the purpose to help the institutions to raise and rehabilitate *P. brasiliensis* orphan cubs and also to help the management of the species in captivity. This study had the financial support of the Programa Petrobras Ambiental and Philadelphia Zoo.

COMBINING GENETICS AND DIGITAL VIDEO TO INVESTIGATE THE SOCIAL BIOLOGY OF THE LARGEST EXTANT OTTER (*PTERONURA BRASILIENSIS*)

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Studies focusing on the social system of giant otters established that groups are formed by a dominant reproductive pair and their offspring of previous years, which do not breed. This reproductive suppression reduces the number of individuals contributing to gene pool, therefore decreasing genetic variation. Since 2002, we have used digital video to monitor the ecology and social relations of a giant otter population from the Southern Pantanal wetlands, Brazil (UTM- 21K 502060, 7831592). In 2008, we began a semi-invasive genetic sampling using three different CO2 biopsy dart projectors: Zootech 35N pistol, Pneu-Dart 176b rifle, and Pneu-Dart X-Calibur gauged rifle. Having the greatest range and being virtually silent, the last dart projector had the best overall performance, allowing for multiple attempts in the same event. A system of line and reel ensured dart recovery. We stalked the otters mainly in their den entrances and latrines. For a first period otter were boat-chased, successively the field researcher and the shooter hid in the bank vegetation, 5-10m away from the den. Such proximity reduced the chance of hitting the animal in undesired body sections, and maximized the collection of behavioral data, since the animals were oblivious to our presence. Normally, after being hit by a dart, the animal was startled by the sting, but the group returned to its activities a few seconds later. In 107 days of fieldwork we obtained 50 samples. Samples were stored in 95% ethanol. DNA was extracted using the DNeasy Blood & Tissue Kit (Qiagen). We isolated 14 polymorphic microsatellite loci for *P. brasiliensis.* All individuals were genotyped for the twelve markers that conformed to Hardy-Weinberg and linkage equilibrium. Number of alleles per locus ranged from 3 to 7, and average observed heterozygosity was 0.633. Since samples were collected in two areas approximately 52 Km apart, we used a Bayesian clustering analysis to investigate the existence of fine-scale geographic population structure. The most likely scenario was of a single population of giant otters in the studied area. Relatedness and parentage analysis are currently underway, in order to verify if long-held views about the species social system will be confirmed by genetic data. We estimated the relatedness coefficient (r) between all pairs of individuals ("dyads"), and the most likely relationship between them (classified as unrelated, half-siblings, full-siblings or parent-offspring). Preliminary analyses showed that 1156 of all 1224 dyads (94.4%) represent individuals related to some degree. The coupling of photo-identification and behavioral data with genetic techniques represent a new approach to the study of giant otters. We believe it will provide a clearer picture of the giant otters social system.

INTERACTION BETWEEN GIANT OTTER (*PTERONURA BRASILIENSIS*) AND FRESH-WATER AMAZON DOLPHIN (*INIA GEOFFRENSIS*)

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The giant otter (*Pteronura brasiliensis*) is sympatric with a number of potential competitors. The species feeds mainly on fish, as do numerous birds, reptiles, other fishes and mammals in the species distribution area. Nevertheless the giant otter is believed to occupy a high-specialized trophic niche and avoid competition. Interaction with the river dolphin (*Inia geoffrensis*) has been reported only once in El Tuparro, Colombia in 1983, and described as commensalism rather than competition. During our study of giant otter at the Xixuaú Reserve, in the Brazilian state of Roraima (2002 - 2011), we saw 5 interactions in which the two species were hunting in close proximity (1.5 – 5 m), during the low water and the flooded seasons. When approached by dolphins, the otters were hunting both along the shoreline and in open water. The two species are common in the region and the local people report this behaviour as a frequent association that would benefit *Inia*, which catches the preys fleeing from otters.

We received personal communications reporting the same association in Santos Luzardo, Venezuela in 1994, during the flooded season and in the Orinoco, Colombia in 2003, during the low water season. In total, only one of 16 reported observations was of an otter approaching a group of dolphins.

Niche partitioning is an important mechanism that organisms use to reduce exploitative competition. It mitigates the overlap in resource use through a number of strategies including differences in periods of activity, dietary requirement and preferred habitat. *Pteronura* and *Inia* are diurnal and more active in early morning and in the afternoon. Both species tend to be opportunistic during the flooded season, when preferred preys are difficult to locate, and selective foragers during the low water season. The comparison of data available in literature on both predators diet reveals that 50% of their fish prey belongs to the same families. Dolphin prey has an average total length of 200 mm, comparable to the otter prey size. On the other hand, at the Xixuaú Reserve, the species show a certain degree of microhabitat differentiation use, the giant otter mostly occurring in secondary channels and tributaries not accessible to dolphins during the low water period. Furthermore, a mitigation of potential competition is also possible due to differences in competitive ability in different habitats.

In summary, though this interaction has been recorded only a few times and could be occasional, the few data available allow us to interrogate on the existence of some potential interference for food between these predators in our area. The effects of interference interactions among carnivores need to be considered when planning multi-species conservation. Future more exhaustive research on feeding ecology, temporal and spatial aspects of *Pteronura* and *Inia* coexistence and its effect on their fitness are required to elucidate the interactions between these species.

RELATIVE ABUNDANCE OF THE GIANT OTTER (*PTERONURA BRASILIENSIS*) IN THE BLANCO AND SAN MARTIN RIVERS (ITÉNEZ RIVER BASIN, BOLIVIA)

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The giant otter (*Pteronura brasiliensis*), commonly known in Bolivia as "londra", was recently categorized as "Endangered" by the Red Book of Vertebrates of Bolivia. This species was believed to be extinct in the 1980s in Bolivia but recently populations have begun to show signs of recovery.
In this study we estimate the relative abundance and the population growth rates of the giant otter populations in the San Martin and Blanco rivers between 2004 and 2007. The relative abundance was calculated using standardized annual surveys in which incomplete counts were made along 186 km in Rio San Martin and 240 km in Rio Blanco. Population change was calculated using dN/dt=rN, where N=number of individuals in the population and r=intrinsic rate of natural increase. The Rio Blanco is a river without important backwaters and with turbid water, whereas the Rio San Martin is characterized by its high habitat heterogeneity, wide floodplains, and clear waters. The relative abundance of giant otters in the San Martin and Blanco rivers increased between 2004 and 2007 from 0.20 to 0.31 ind./km and from 0.00 to 0.06 ind./km, respectively. The number of individuals in the Rio San Martin increased from 34 to 55, distributed amongst 16 and 22 family groups respectively. The growth rate in Rio San Martin was 6.33 individuals per year and the intrinsic rate of natural increase was 0.11, showing a high level of recovery of these populations compared with the situation of other giant otter populations across their distribution range. We consider that the giant otter populations in rio san Martin may be close to carrying capacity, as the levels of intra-specific competition between groups (2.1 groups per 30 km of river) reach their maximum level. This may explain the recolonization of the nearby Rio Blanco. After almost a 30-year ban on the legal trade of their skins by CITES, *P. brasiliensis* is starting a slow process of recovery and recolonization in Bolivia. This is particularly happening in remotes areas of difficult access for hunters such as Rio San Martin and Rio Blanco; however, due to the high fragility of these systems the process of recovery of these populations should be accompanied by well-targeted conservation strategies for the species and their habitat. In general, the populations of giant otters in Bolivia remain isolated and degradation of riparian habitats and competition with the fishermen for resources continue to be the main threats for the survival of this species.

IUCN'S BIOLOGY-BASED APPROACH TO ASSESSING SPECIES' VULNERABILITY TO CLIMATE CHANGE

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There is growing evidence that climate change will become one of the major drivers of shifts in species dominance and geographic range, and even species extinctions, in the 21st century. How might we begin to predict which species will be more vulnerable to climate change effects than others? The prediction of these relative vulnerabilities has most commonly been carried out using models of geographic range change, which have many well-known limitations, particularly for freshwater ecosystems. I present a collaborative IUCN-led study that introduces an alternative approach based on species' traits. The approach provides an opportunity to take into account species biology (e.g. demographic, physiological and ecological traits) and experts' knowledge. Based on assessments of individual species' biological sensitivity, their predicted climate change exposure (derived from General Circulation Model projections), as well as their anticipated adaptability to climatic change, the study has assessed relative climate change susceptibility of global birds, amphibians and corals. I will highlight some of the species groups predicted to be at greatest risk from climate change and identify the regions of their greatest concentrations. Exploring the relationship between pilot species' predicted climate change vulnerability and existing Red List status allows an assessment of future threats in terms of this measure. These results present a new kind of assessment for climate change impacts on species dominance shifts and potential extinctions. I will explore possibilities for extending this approach to freshwater ecosystems and discuss implications of our findings for adapting conservation approaches, including those for otters, to climate change.

RETURN OF THE OTTER IN SOUTH TYROL (NE ITALY)

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The distribution of Italian otter (*Lutra lutra*, L., 1758) population, up until 70's, is very difficult to understand historically because available documents and otter references are incomplete, not very punctual, not regularly distributed and often inexact. Actually the Italian otter populations are fragmented and totally disconnected from other European populations and they are concentrated in six regions of central and southern Italy: Abruzzo, Basilicata, Calabria, Campania, Molise and Puglia. In the Bolzano Province (NE Italy) the latest presence of the otter was registered about 54 years ago (1956/1957) only in two rivers: Rio Gadera and Rio Sesto (two otters death by hunting). In South Tyrol the presence of otters was assessed by Andreas Kranz in 2008. From May 2010 to April 2011 a survey was promoted by the Department for Nature and Landscape of the Autonomous Province of Bolzano-South Tyrol and WWF Bolzano. This involved the search for otter's signs (spraints, footprints and observations by camera trapping) along three rivers, in order to confirm the stable presence of otter in the area. We monitored 52,97 Km of river stretches, recorded 51 spraints sites (1 site/1.04 km), and localized (through GPS) 88 spraints. Camera traps recorded four pictures of otters and an interesting movie of sprainting activity. Both survey and genetic characterization of spraints made by I.S.P.R.A. (Italy) confirmed the stable presence of otters in the area. Sampling efforts will be extended in the future to understand the real distribution and the future prospective of South Tyrol otter population. In order to assure the stable presence of otter population in Bolzano Province and neighbouring areas, conservation actions and management of the river habitat should to be planned. The return of otter in South Tyrol opens new prespective for Italian otter conservation and new hopes for natural recolonization in suitable habitat areas of northern Italy.