N O T E   F R O M   T H E   E D I T O R

NOTE FROM THE EDITOR

Dear Friends, Colleagues and Otter Enthusiasts!

The last months have been quite hectic as work with articles for the open issues with the Proceedings from Frostburg, HwaCheon and Pavia was ongoing in parallel with those for the issue 28/2. The latter one was closed recently finally finishing the issues for 2011. Please keep an eye on the special issues with the Proceedings as not all articles have gone online yet and there are still some very interesting manuscripts in the pipeline.

In 2010 and 2011 Hermann Ansorge, Jennifer Balke, Michael Belanger, Mia Bisther, Laura Bonesi, Robert Brooks, Eduardo Carillo-Rubio, Paul Chanin, Claudio Chehebar, Pablo García Díaz, Morten Elmeros, Vania Carolina Fonseca da Silva, Daniel Gallant, Dilian Georgiev, Silva Lopez Gilberto, Syed Ainul Hussain, Hugh Jansman, Ghandiv Kafle, Waseem Ahmad Khan, Rachel Khun, Andreas Kranz, Joszef Lanski, Dusty Lombardy, Myriam Marmontel, Fernanda Michalski, Darren Norris, Zachary Olson, Nuno Pedroso, Paul Polechla, Juan Pablo Gallo Reynoso, Daniel Scognamillo, Andy Sheldon, Vic Simpson, Lorenzo Quaglietta and Peter Urban assisted me with reviews. To be honest I hope I did not forget anybody as the list became so long. The quality of the published articles and reports is not only depending on the authors work but is also improved by the reviewers whom I want to thank for their very valuable input.

Dr. Alexander Burdin, USA; Prof. Robert P. Brooks, USA; Dr. Will Duckworth, United Kingdom, Prof. James Estes, USA, Prof. Syed Ainul Hussain, India, Dr. Hélène Jacques, France, Dr. Hans Kruuk, Scotland, Prof. David Macdonald, UK, Dr. Aksel Bo Madsen Denmark, Dr. Gonzalo Medina-Vogel, Chile; Prof. Claudio Prigioni, Italy; Ms. Janice Reed-Smith, USA; Prof. Tom Serfass, USA; Dr. Sadie Stevens, USA and Dr. Vic Simpson, United Kingdom have all accepted to be in the Editorial Board for the IUCN OSG Bulletin. I am sure their dedication will further support the quality of the journal.

Lesley what would I do without you? Thanks a lot for all your dedication to the IUCN OSG Bulletin.

R E P O R T

DATA ON *Lontra longicaudis* (CARNIVORA: MUSTELIDAE) MORTALITY IN SOUTHEAST AND SOUTHERN BRAZIL

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Abstract: Herein we present data on *Lontra longicaudis* mortality in Minas Gerais (n=12) and Rio Grande do Sul (n=14) states, Southeastern and Southern Brazil, respectively. In Minas Gerais most deaths were caused by entanglement and drowning in fishing gear (n=5; 42%), followed by roadkill (n=3; 25%), dog attack (n=2; 17%), hunting and undetermined cause (n=1; 8% each). In Rio Grande do Sul, the major cause of death was roadkill (n=10; 72%), followed by hunting (n=2; 14%), dog attack and undetermined cause (n=1; 7% each). The habitats associated with the highest number of deaths were reservoirs in Minas Gerais (n=8, 67%) and pluvial channels in Rio Grande do Sul (n=7, 50%).

Keyword: Neotropical otter; deaths; roadkill; fishing gear

The neotropical otter *Lontra longicaudis* Olfers, 1818 is a semi-aquatic mustelid, reaching up to 1.4 m in length and 14 kg of body weight (Emmons and Feer, 1997) and distributed from northeastern Mexico south to Uruguay, Paraguay and across the northern part of Argentina to Buenos Aires province (Larivière, 1999). In the 20th century, hunting for fur caused local extinctions of *L. longicaudis* populations (Waldemarin and Alvarez, 2008). Loss and fragmentation of habitats, water pollution and conflicts with fisheries also contributed to the species decline and still represent

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current threats to the remaining populations (Indrusiak and Eizirik, 2003; Waldemarin and Alvarez, 2008; González and Lanfranco, 2010). The species is listed in the IUCN 2011 World Red List as Data Deficient, with a decreasing population trend (Waldemarin and Alvarez, 2008). It is considered Endangered in Argentina (Diaz and Ojeda, 2000), Susceptible in Uruguay (González and Lanfranco, 2010) and Vulnerable in the Brazilian states of São Paulo (PROBIO/SP, 1998), Minas Gerais (Machado et al., 1998), Paraná (Mikich and Bérnils, 2004) and Rio Grande do Sul (Indrusiak and Eizirik, 2003).

In Brazil, most of the studies on *L. longicaudis* were focused on feeding habits (Passamani and Camargo, 1995; Helder-José and De Andrade, 1997; Pardini, 1998; Colares and Waldemarin, 2000; Quadros and Monteiro-Filho, 2001; Kasper et al., 2004; 2008; Alarcon and Simões-Lopes, 2004; Quintela et al., 2008; Carvalho-Junior et al., 2010) and use of latrines and shelters (Soldateli and Blacher, 1996; Pardini and Trajano, 1999; Waldemarin and Colares, 2000; Quadros and Monteiro-Filho, 2002; Alarcon and Simões-Lopes, 2003; Kasper et al., 2004, 2008; Carvalho-Junior, 2007; Quintela et al., 2011), while data on mortality causes are scarce. Thus, herein we present data on mortality of *L. longicaudis* in Southeastern and Southern Brazil, aiming to contribute to the species' conservation.

This study was conducted in the States of Minas Gerais and Rio Grande do Sul, Southeastern and Southern Brazil respectively. In Minas Gerais the study area contains rivers and streams of the Paraíba do Sul basin and associated reservoirs, between the counties of Muriaé (21°10'S, 42°22'W) and São João Nepomuceno (21°31'S, 42°54'W), Atlantic Forest biome (Fig. 1). In Rio Grande do Sul, the study area comprises the Internal and External coastal plain geomorphological units, between the counties of Eldorado do Sul (30°01'S, 30°19'W) and Rio Grande (32°15'S, 52°27'W) (Fig. 1).

Data on *L. longicaudis* mortality were obtained from March 2008 to August 2011 through field observation and reports from three locals and two collaborating researchers. Well preserved individuals were collected and deposited in mammalian collections of Museu de Ciências Naturais of Universidade Luterana do Brasil, Canoas, Rio Grande do Sul and Museu de Zoologia João Moojen, Viçosa, Minas Gerais.

A total of 26 otter deaths were recorded in the study period, 12 in Minas Gerais and 14 in Rio Grande do Sul. In Minas Gerais the highest number of deaths comprised entanglement and drowning in fishing nets (n=5; 42%), followed by road kill (n=3; 25%) (Fig. 2), dog attack (n=2; 17%), hunting and undetermined cause (n=1; 8% each). In Rio Grande do Sul, the highest number of deaths comprised road kill (n=10; 72%) (Fig. 3), followed by hunting (n=2; 14%), dog attack and undetermined cause (n=1; 7% each) (Table 1).

The habitats associated with the highest number of deaths in Minas Gerais were reservoirs (n=8, 67%), followed by rivers (n=3, 25%) and streams (n=1, 8%). In Rio Grande do Sul the highest number of deaths were associated with pluvial channels (n=7, 50%), followed by coastal streams (n=4; 29%), marshes (n=2; 14%) and estuary (n=1; 7%) (Table 1).

Despite the small sample size, we observed differences in major causes of death between the two investigated areas. While roadkill represented the major cause of otter death in Rio Grande do Sul, most of the mortality records in Minas Gerais were related to entanglement and drowning in fishing gear. Absence of records of deaths by accidental captures in fishing nets in Rio Grande do Sul may be related to low density of otters in Patos Lagoon estuary, the system where most of the fishery activity is concentrated in the region.

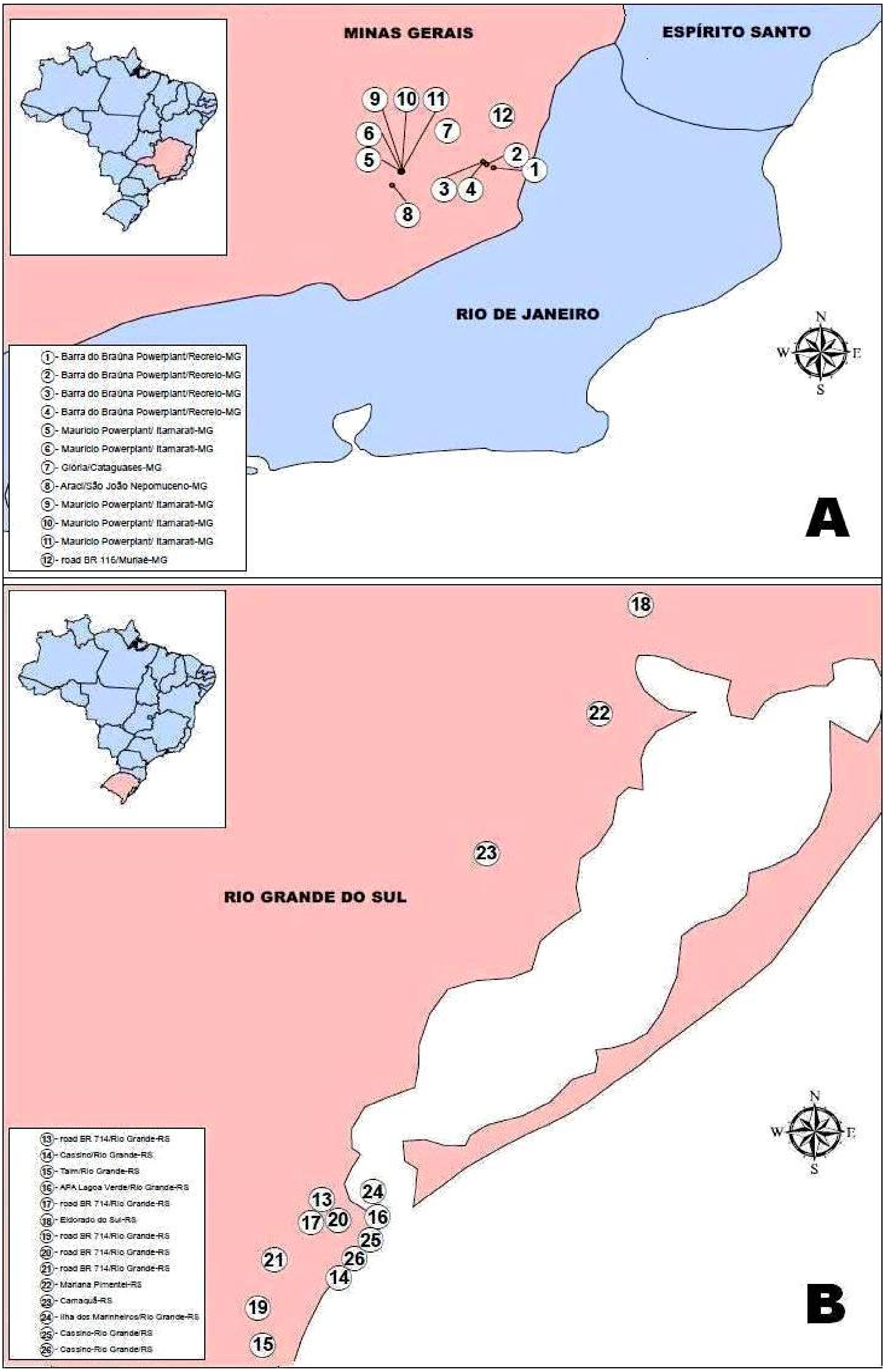

Figure 1. Study area: A) Minas Gerais, B) Rio Grande do Sul. Numbers correspond to deaths shown in Table 1.

In coastal streams environments, where otters are more commonly observed, gillnet and fyke net fishery is impractical. On the other hand, gillnet and fyke net fishery activities in Minas Gerais sampled areas are conducted mainly in reservoirs, where otters are commonly observed. Carvalho (2007) considers man to be the otter's main competitor for food; they have the same preferences for fish species, which results in direct conflict with fishermen as well as deaths by entanglement. Death by entanglement in fishing gear is also documented for *Lutra lutra* (van Moll, 1988; Foster-Turley et al., 1990; Lodé, 1993; Poole et al., 2007; Hauer et al., 2002; Georgiev, 2007) and *Lontra felina* (Pizarro Neyra 2008). In western France, Lodé (1993) considered accidental drowning in fyke nets to be the major cause of *L. lutra* deaths.

Lontra longicaudis roadkill have been observed in the states of São Paulo (Freitas et al., 2009), Mato Grosso do Sul (Cáceres et al., 2010), Santa Catarina (Cherem et al., 2007) and Rio Grande do Sul (Hengemühle and Cadermatori, 2008; Bager and Rosa, 2010) and represent the only documented mortality data on the species in Brazil. In Rio Grande do Sul Coastal Plain most federal and state highways and even local roads are bordered by pluvial channels, which are suitable habitats for otter occurrence. The movement of otters between pluvial channels by crossing highways and roads is the main cause of otter road kill. Hauer et al. (2002) found traffic accidents to be the major cause of mortality of *L. lutra* in eastern Germany. Philcox et al. (1999) also observed that 91% of 673 *L. lutra* roadkills occurred at points where roads cross watercourses.

Hunting and dog attacks represented minor causes of death in the present study. *Lontra longicaudis* was hunted excessively for the pelt trade in the period 1950-1970 and illegal hunting is still practiced (Waldemarin and Alvarez, 2008). It is important to note that hunting in the studied areas is related to fishery conflicts, with the justification that they are competitors for fish and damage fishing gear. The meat was not consumed from any of the three killed individuals while the pelt was removed from only one. Domestic and feral dogs are a potential threat to wild mammals, especially when organized in packs (Galetti and Sazima, 2006). Deaths by dog attacks were also reported in low proportions for *L. lutra* in Central Finland (Skarén, 1992) and southern Bulgaria (Georgiev, 2007) and for *Lontra felina* in southern Peru (Pizarro Neyra, 2008).

In the present study we did not detect and investigate deaths caused by diseases, intoxication or poisoning. In our informal interviews with local people no one admitted to using poisoned carcasses aimed at killing otters. However, incidental otter deaths may occur due to poisoning campaigns targeting pests of crops or livestock, such as rodents, canids and felids, and these should also be investigated. Lodé (1993) found that reduction in *L. lutra* distribution in western France coincided with poisoning campaigns against muskrats and coypus.

Organochlorine compounds have often been found in *L. lutra* (Mason et al., 1986; 1992), *Lontra canadensis* (Stansley et al., 2010) and *Enhydra lutris* samples (Nakata et al., 1998; Bacon et al., 1999). In southern Rio Grande do Sul there are extensive rice crops adjacent to swamps, shallow lakes, pluvial channels and other otter habitats. Rice crops receive large pesticide applications, and bioaccumulation in adjacent otter habitats represents a poisoning risk (Pastor et al. 2004).

Table 1. Deaths of *Lontra longicaudis* in Rio Grande do Sul and Minas Gerais states, Brazil

Locality/County	Coordinates	Associated habitat	Data	Cause of Death
Barra do Braúna Powerplant/Recreio-MG	21º27’27“S, 42º24’31”W	reservoir	July-2008	Roadkill
Barra do Braúna Powerplant/Recreio-MG	21º26’24“S, 42º26’30”W	reservoir	November-2008	entangled in fishnet
Barra do Braúna Powerplant/Recreio-MG	21º25’36“S, 42º27’33”W	reservoir	March-2009	entangled in fishnet
Barra do Braúna Powerplant/Recreio-MG	21º25’36“S, 42º27’33”W	reservoir	March-2009	entangled in fishnet
Maurício Powerplant/ Itamarati-MG	21º28’37“S, 42º52’11”W	reservoir	August-2009	killed by dog
Maurício Powerplant/ Itamarati-MG	21º28’37“S, 42º52’11”W	reservoir	August-2009	killed by dog
Glória/Cataguases-MG	21º16’15“S, 42º38’41”W	stream	October-2009	Roadkill
Araci/São João Nepomuceno-MG	21º32’56“S, 42º54’56”W	river	November-2009	entangled in fishnet
Maurício Powerplant/ Itamarati-MG	21º28’37“S, 42º52’11”W	river	November-2009	undetermined
Maurício Powerplant/ Itamarati-MG	21º28’35“S, 42º51’54”W	reservoir	February-2010	entangled in fishnet
Maurício Powerplant/ Itamarati-MG	21º28’40“S, 42º52’34”W	reservoir	July-2010	Hunted
road BR 116/Muriaé-MG	21º10’56“S, 42º22’15”W	river	September-2010	Roadkill
road BR 714/Rio Grande-RS	32º06’29“S, 52º20’38”W	pluvial channel	March-2008	Roadkill

Cassino/Rio Grande-RS	32º17’30“S, 52º16’15”W	coastal stream	July-2008	undetermined
Taim/Rio Grande-RS	32º33’03“S, 52º32’49”W	marsh	December-2008	Roadkill
APA Lagoa Verde/Rio Grande-RS	32º07’10“S, 52º10’17”W	coastal stream	August-2009	Roadkill
road BR 714/Rio Grande-RS	32º07’59“S, 52º22’22”W	pluvial channel	September-2009	Roadkill
Eldorado do Sul-RS	30º01’09“S, 51º19’09”W	pluvial channel	June-2011	Roadkill
road BR 714/Rio Grande-RS	32º25’27“S, 52º33’50”W	pluvial channel	June-2011	Roadkill
road BR 714/Rio Grande-RS	32º06’32“S, 52º20’41”W	pluvial channel	September-2011	Roadkill
road BR 714/Rio Grande-RS	32º15’42“S, 52º30’32”W	pluvial channel	September-2011	Roadkill
Mariana Pimentel-RS	30º24’19“S, 51º27’19”W	marsh	September-2011	Roadkill
Camaquã-RS	30º52’44“S, 51º49’14”W	pluvial channel	September-2011	Roadkill
Ilha dos Marinheiros/Rio Grande-RS	32º01’40“S, 52º10’80”W	estuary	undetermined	Hunted
Cassino-Rio Grande/RS	32º12’24“S, 52º10’50”W	coastal stream	undetermined	killed by dog
Cassino-Rio Grande/RS	32º13’24“S, 52º11’50”W	coastal stream	undetermined	Hunted

Figure 2. Roadkilled otter in Cataguases Minas Gerais, Southeastern Brazil.

Figure 3. Roadkilled otter in Eldorado do Sul, Rio Grande do Sul, Southern Brazil.

The present study contributes to knowledge on *L. longicaudis* mortality in South and South-eastern Brazil. Considering the observed results, we recommend: assessment of locations where multiple otter road kill have occurred and evaluation of possible mitigation measures (i.e. underground passages); implementation of environmental education activities emphasizing the ecological importance of otter and modifications to fishing gears to prevent accidental deaths; control of domestic and feral dogs in otter habitats. It is also recommended that ecotoxicological studies of aquatic systems adjacent to intensive rice farming be conducted.

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RÉSUMÉ

DONNEES DE MORTALITE SUR *Lontra longicaudis* (CARNIVORE: MUSTELIDES) DANS LE SUD-EST ET LE SUD DU BRESIL

Ici, nous présentons des données sur la mortalité de *Lontra longicaudis* dans l'état fédéral de Minas Gerais (n=12) et de Rio Grande do Sul (n=14) respectivement au sud-est et sud du Brésil. Dans l'état de Minas Gerais, la plupart des décès ont été causés par la prise accidentelle et la noyade dans les filets (n=5; 42%), suivis par les collisions routières (n=3; 25%), les attaques de chiens (n=2; 17%), la chasse et les causes indéterminées (n=1, 8% chacun). Dans le Rio Grande do Sul, la cause majeure de décès a été Roadkill (n=10; 72%), suivie par la chasse (n=2; 14%), attaque de chien et de cause indéterminée (n = 1 chacun, 7%). Les habitats associés au plus grand nombre de décès sont les retenues d'eau dans l'état de Minas Gerais (n=8, 67%) et les canaux pluviaux dans l'état du Rio Grande do Sul (n=7, 50%).

RESUMEN

DADOS SOBRE MORTALIDADE DE *Lontra longicaudis* (CARNIVORA: MUSTELIDAE) NO SUDESTE E SUL DO BRASIL

Apresentamos dados sobre a mortalidade de *Lontra longicaudis* nos estados de Minas Gerais (n=12) e Rio Grande do Sul (n=14), Sudeste e Sul do Brasil, respectivamente. Em Minas Gerais a maioria das mortes foi causada por enredamento e afogamento em redes de pesca (n=5; 42%), seguido por atropelamento (n=3; 25%), ataque de cães (n=2; 17%), caça e causa indeterminada (n=1; 8% each). No Rio Grande do Sul, a maior causa de morte foi atropelamento (n=10; 72%), seguido por caça (n=2; 14%), ataque de cães e causa indeterminada (n=1; 7% each). Os habitats associados ao maior número de mortes foram reservatórios em Minas Gerais (n=8, 67%) e canais pluviais no Rio Grande do Sul (n=7, 50%).

A R T I C L E

ASSESSMENT OF SEA OTTER (*Enhydra lutris kenyoni*) DIET IN KACHEMAK BAY, ALASKA (2008-2010)

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Abstract: Long-term monitoring of a keystone species' diet contributes to our understanding of shifts in the structure of an ecosystem. Sea otters were extirpated from Kachemak Bay, Alaska by 1911 and returned to the region through natural recolonization beginning in the 1970s. The sea otter population increased from <1,000 in the 1990s to 3,600 in 2008. In Kachemak Bay we describe the diet based on results from scat analyses and visual observation. Scat collection is only feasible in winter months and analysis is biased toward species where hard parts of prey are ingested. Scats were collected over a one-week period October - May during 2008-10. Dominant prey types for all samples combined were mussel (41%), crab (32%), and clam (12%). The combined proportion of these prey observed visually were clam (38%), mussel (14%) and crab (2%). Scat analysis will be a useful tool in identifying trends in winter consumption of crab and mussel, but will exclude identification of larger bivalve and soft-bodied prey. Kachemak Bay is primarily a soft-sediment benthic habitat, which is suitable habitat for clams and crabs. In the 1970s, commercially valuable crab and clam species were abundant in this area. We evaluate scat analysis as a low-cost tool to monitor long-term trends in the winter diet for sea otters in Kachemak Bay.

Keywords: Alaska; *Enhydra lutris*; habitat; prey choice; scat

INTRODUCTION

Sea otters eat a wide range of marine invertebrates and their diet varies by the type of forage habitat available to them. The relationship between sea otter foraging and ecosystem structure has been best studied in habitats, which are urchin and kelp dominated (Estes and Palmisano, 1974; Simenstad et al., 1978; Duggins, 1980). Less is understood about prey and ecosystem dynamics in soft-sediment habitats where dominant prey tend to be clams and crab (Kvitek and Oliver, 1988; Kvitek et al., 1992; Doroff and DeGange, 1994). Sea otters were extirpated from Kachemak Bay, Alaska by the 1900s and were naturally recolonizing the area by the mid 1970s (Schneider, 1976). Kachemak Bay is primarily a soft-sediment basin with extreme tidal ranges (8.7m) in south central Alaska (KBNERR, 2001). By 2008, the sea otter population in Kachemak Bay increased from <1,000 in the 1990s to 3,600 (Gill et al., 2009). Methods for assessing sea otter diet include visual observation (Doroff and DeGange, 1994), scat analysis (Doroff and Bodkin 1994; Watt et al., 2000), and recently emerging techniques in whisker isotope analysis (Newsome et al., 2009; Newsome et al., 2010). All methods have some biases in identification of sea otter prey. In this pilot study we assess sea otter prey types through scat analyses and visual observations and evaluate scat analysis as a low-cost tool to monitor long-term trends in the winter diet for sea otters in Kachemak Bay.

MATERIALS AND METHODS

Scat Collection

Scat collection is limited in our study area to the winter months when sea otters haul-out more frequently and in greater concentrations (Doroff and Badajos, 2010; Doroff, pers. obs.). In March 2008, we began a pilot study to assess the feasibility of determining sea otter diet by scat collection in Kachemak Bay. Nine locations were assessed, and of those, a site in Little Tutka Bay where sea otters (females, females with pups, and an occasionally territorial male, Christen pers.com) haul-out on floating docks was selected as a long-term monitoring location (Fig. 1).

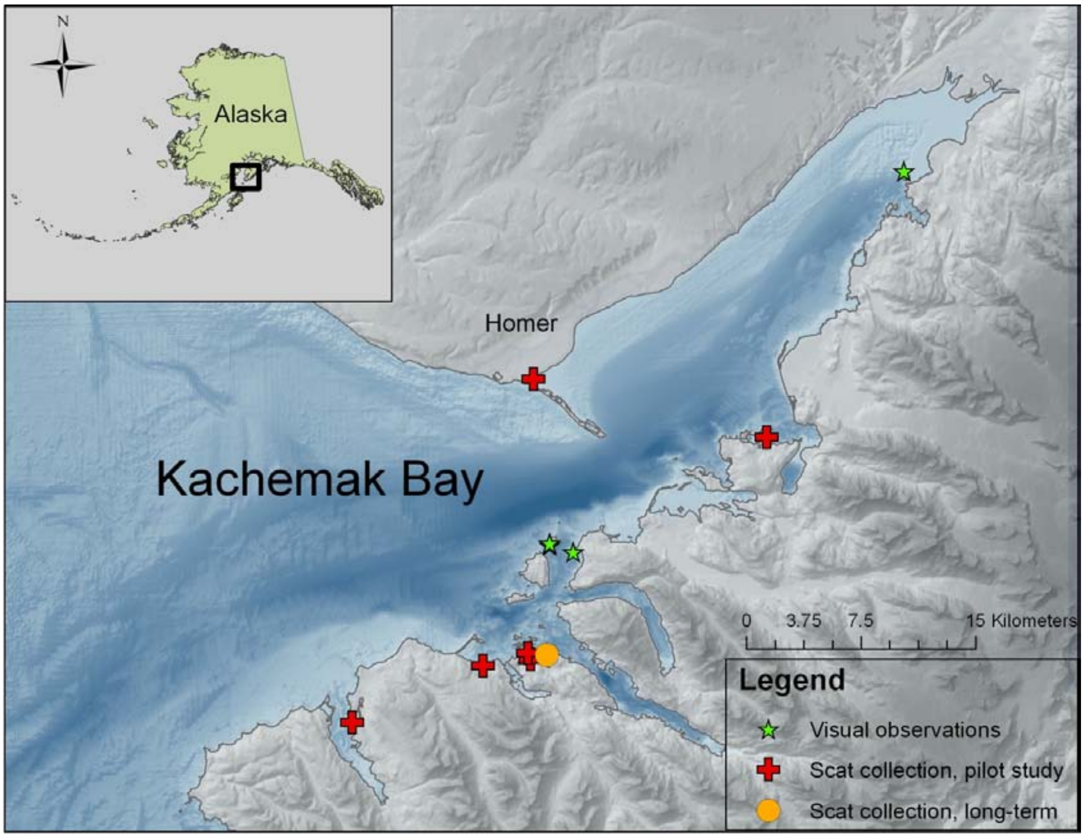

Figure 1. The study area is located in Kachemak Bay, Southcentral Alaska. In March 2008 we began a pilot study to assess the feasibility of determining sea otter diet by scat collection in Kachemak Bay (red). Nine locations were assessed, and of those, a site in Little Tutka Bay where sea otters haul-out on floating docks was selected as a long-term monitoring location (orange). Diet was assessed by visual observation in 2008 at three locations (green).

The site in Little Tutka Bay was chosen because we could reliably visit the site throughout the winter months on a weekly basis. In Little Tutka Bay, both sea otter and river otter (*Lontra canadensis*) scats were collected (Fig. 2). River otter scats were easily distinguished from sea otter scats by content (95-100% fish bones versus primarily invertebrate remains) and location (river otter scat tended to be, but not exclusively, on the highest point on the floating platform (such as rope coils)). During August – May 2008, 2009, and 2010, we searched for and collected scat samples from one-week accumulations at approximately monthly intervals (Table 1). All scats were collected, labeled with the date and location, and frozen until processing.

Figure 2. Washed, dried, and sorted sea otter and river otter scats collected in Kachemak Bay, Alaska.

Scat Sample Processing

Methods followed Watt et al. (2000). Scat samples were washed with fresh water through a high-pressure hose using one large mesh (2mm) and one fine screen (≤1mm) sieve. Air-dried samples were sorted by hand to the nearest discernable taxonomic level and placed in Ziploc baggies for analysis (Fig. 2). The relative importance of each prey type was determined by the frequency of occurrence and the percent volume for each sample. The frequency of occurrence was expressed as the presence of a prey type in a scat. The percent volume of each prey type was estimated and ranked as follows, using a 1-6 index method where: 1=<5%, 2=5-25%, 3=26-50%, 4=51-75%, 5=76-95%, 6=>95%. We ranked each prey type, which occurred in the scat. To summarize mean percent volume, we used the median value of each category.

Table 1. Sample sizes for scat collected from sea otter and river otter in Kachemak Bay, Alaska. Typically, sea otters only haul out at these sites during the winter months. A dashed line indicates that the study site was not checked during that month.

	2008		2009		2010	
Month	Sea Otter	River Otter	Sea Otter	River Otter	Sea Otter	River Otter
Jan	--	--	--	--	6	0
Feb	--	--	9	0	3	0
Mar	24	0	8	0	2	0
Apr	55	5	10	0	1	0
May[1]	68	3	32	0	0	0
Jun	--	--	0	0	0	0
Jul	--	--	0	0	0	0
Aug	0	9	0	0		
Sept	0	4	0	0		
Oct	18	9	0	0		
Nov	--	--	--	--		
Dec	20	1	8	0		

[1]sample size in May 2008 reflects an increased effort across multiple sites in Kachemak Bay. This was done as a pilot to assess the feasibility of the project.

Visual Observations

We conducted visual observations in a female/pup area in proximity to the long-term monitoring site for scat collection during summer 2008 (Fig. 1). Lack of funding precluded the collection of visual observations of foraging sea otters during the winter months. Focal animal sampling was used to select study animals and all visual observations were conducted with a high-power telescope (Questar field model 50x). Methods followed previously established protocols for visually identifying prey and estimating prey size (Doroff and DeGange, 1994; Doroff and Bodkin, 1994).

RESULTS AND DISCUSSION

During 2008 (March, April, and May), we collected 147 sea otter scat samples from 9 locations throughout the Bay. During October 2008 - May 2009 and December 2009 - April 2010, we collected 97 and 20 scat samples, respectively, at our long-term monitoring site in Little Tutka Bay (Fig. 1).

Dominant prey types in the scat samples at all sites were mussel (*Mytilus trossulus*) (41%), crab (32%) (including: *Cancer* spp., *Telmessus cheiragonus*, *Pagurus* spp. and probable *Chionoecetes bairdi*), and clam (12%) (including: *Saxidomus giganteus*, *Mya* spp., and *Leucoma staminea*). Other species present throughout the sampling period included urchins (*Strongylocentrotus* spp.), chitons, limpets (*Tectura* spp.), and snails (Table 2). In most cases, the prey was well masticated and we were not able to identify the remains to species. Though not previously known to be sea otter prey in Kachemak Bay, we found fish bones in scat collected during the winter sampling periods in 2008 and 2009. Fish bones were usually only one or two rib bones and never a whole fish; fish bones comprised <1% of the total volume of any single scat (Table 2). Sea otter haul-out sites in our study area were shared with river otters (*Lontra canadensis*), so it is possible that the fish bones could have been originally part of the river otter scat. Regardless of species, scat samples on the surface of the dock tended to be discrete samples. However, with multiple sea otters and other species using the dock space, cross contamination of scat is possible. The river otter scat collected has not been analyzed for species content to date. We also collected 10 scats that were of unknown origin and we were not able to identify species by visual assessment; possible species include American mink (*Neovison vison*) and bear (*Ursus americanus*). River otter and unidentified scats were omitted from summaries of sea otter prey.

Table 2. Frequency of occurrence and the mean percent volume of prey types in sea otter scat samples collected at haul-out sites in Kachemak Bay, Alaska 2008-2010

Prey Type	% Freq Occurrence			Mean % Volume		
	Spring 2008 (n=147)	Fall 2008-Spring 2009 (n=97)	Fall 2009-Spring 2010 (n=20)	Spring 2008 (n=147)	Fall 2008-Spring 2009 (n=97)	Fall 2009-Spring 2010 (n=20)
Mussel	94	93	70	41	42	33
Crab	80	80	85	31	29	52
Clam	59	61	40	12	12	8
Barnacle	39	37	0	2	2	0
Urchin	38	42	25	6	11	6
Snail	20	26	0	1	2	0
Limpet	18	15	0	1	1	0
Chiton	13	8	5	1	0	0
Unid. Bivalve	5	11	0	1	0	0
Scallop	5	9	0	0	0	0
Unid. Prey	4	11	15	0	0	0
Fish	3	10	0	0	0	0
Horse mussel	3	2	0	0	0	0
Shrimp	1	0	0	0	0	0
Worm	0	1	0	0	0	0
Cockle	0	5	0	0	0	0
Sand dollar	0	1	0	0	0	0

The mean number of prey types per scat sample across all locations and sample periods was 4 (n= 264; range 1-10). Trends in relative composition and prey diversity (number of taxon per scat) were similar among sites sampled in spring 2008 and the long-term monitoring site sampled in winters 2008-2009 and 2009-2010. In general, there was an inverse relationship between proportion of mussel and crab in the diet. There could be multiple reasons for the observed pattern. Contributing factors include small sample sizes (especially in 2010), the seasonality of rough water and its effect on sea otter forage patterns (confining foraging to more protected near-shore waters where mussels are found), and the age of the animals using the haul out site (independent young of the year may forage on mussels more often than adults). To better document the sex-age classes of sea otters using the haul out site, we place a low-coast Plant-Cam ™ on the dock during the spring 2010 monitoring period. We had no luck in capturing images of sea otters on the dock and it appeared all haul out activity occurred only at night during that time period. Proportions of clam, urchin, and other prey in the scat samples fluctuated but remained at low levels (≤ 20%) throughout the sampling period (Fig. 3).

We assessed prey by visual observation in 2008 (n=322 successful dives) and the dominant prey types identified in sea otter diet were clam (38%), mussel (14%), and crab (2%). Size classes were estimated visually for 230 clams retrieved as sea otter prey and the median size class consumed ranged between 3 and 5cm; shells were discarded rather than ingested. Based on visual observation, shells from most clams consumed would not have been in the scat record for foraging sea otters. Mussels were a much smaller part of the diet and were consumed by all sex and age classes of sea otters. In general, mussels are easy for sea otters to capture but are a lower-calorie prey per food item than larger bivalves. As a result, young-of-the-year tend to have a higher portion of mussels in their diet than adults (Doroff and Bodkin, 1994). From a scat analysis viewpoint, mussel shells are ingested every time they are foraged on and will be identifiable in the scat sample whereas clams will only be detected when the smallest size classes or clam species with soft shells (such as *Mya* spp.) are consumed.

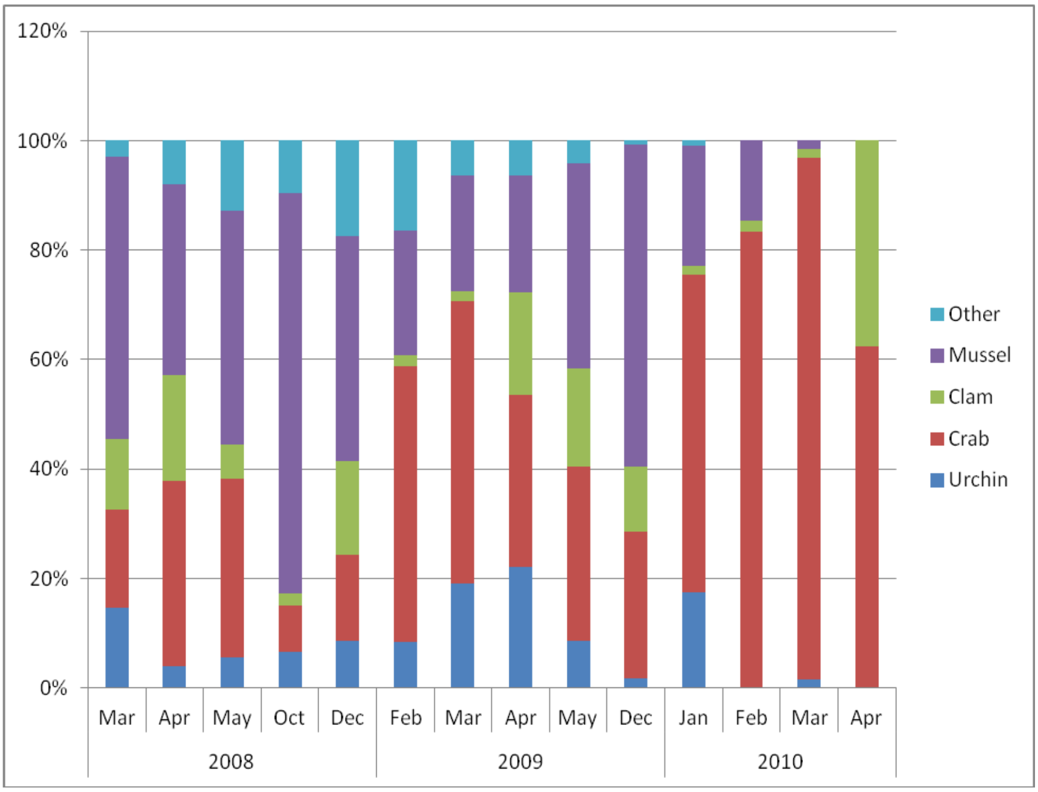

Figure 3. Mean percent volume of prey in sea otter scats collected in Kachemak Bay, Alaska for all sites combined across all years (spring 2008, fall 2008-spring 2009, and fall 2009-spring 2010).

Kachemak Bay is a large fjord estuary and supports the only significant commercial and recreational clam fisheries in Southcentral Alaska, as well as a personal-use Tanner crab (*Chionoecetes bairdi*) fishery. The habitat is largely soft-sediment and has the potential to support large populations of high-calorie sea otter prey, such as clams and crabs (KBNERR 2001). During 2007-2010, the U. S. Fish and Wildlife Service and the Kachemak Bay Research Reserve conducted a study of survival, movements, and habitat use of 44 radio-marked sea otters in Kachemak Bay (Doroff and Badajos 2010). Figure 4 illustrates the cumulative distribution of winter (Oct-Apr) foraging locations for all sex and age classes of study animals. We assumed that marked animals were representative of the whole population and foraging occurred near haul-out sites as well as in open water during our scat-sampling period. To begin to understand relationships between sea otter foraging and the benthic ecosystem in Kachemak Bay, multiple methods will need to be employed. Scat analysis is strongly biased toward ingested hard parts of prey and, in the case of clams, understates the contribution of larger sized clams in the diet. In contrast, visual observations are limited to the near-shore foraging habitat and are biased against prey consumed >1km from shore, which may include larger species of crab. Because of biases in both visual observation methods and in scat analyses to accurately determine sea otter diet, emerging techniques in isotope studies of sea otter whiskers will likely be an important tool in understanding diet in habitats like Kachemak Bay (Newsome et al. 2009, Newsome et al. 2010).

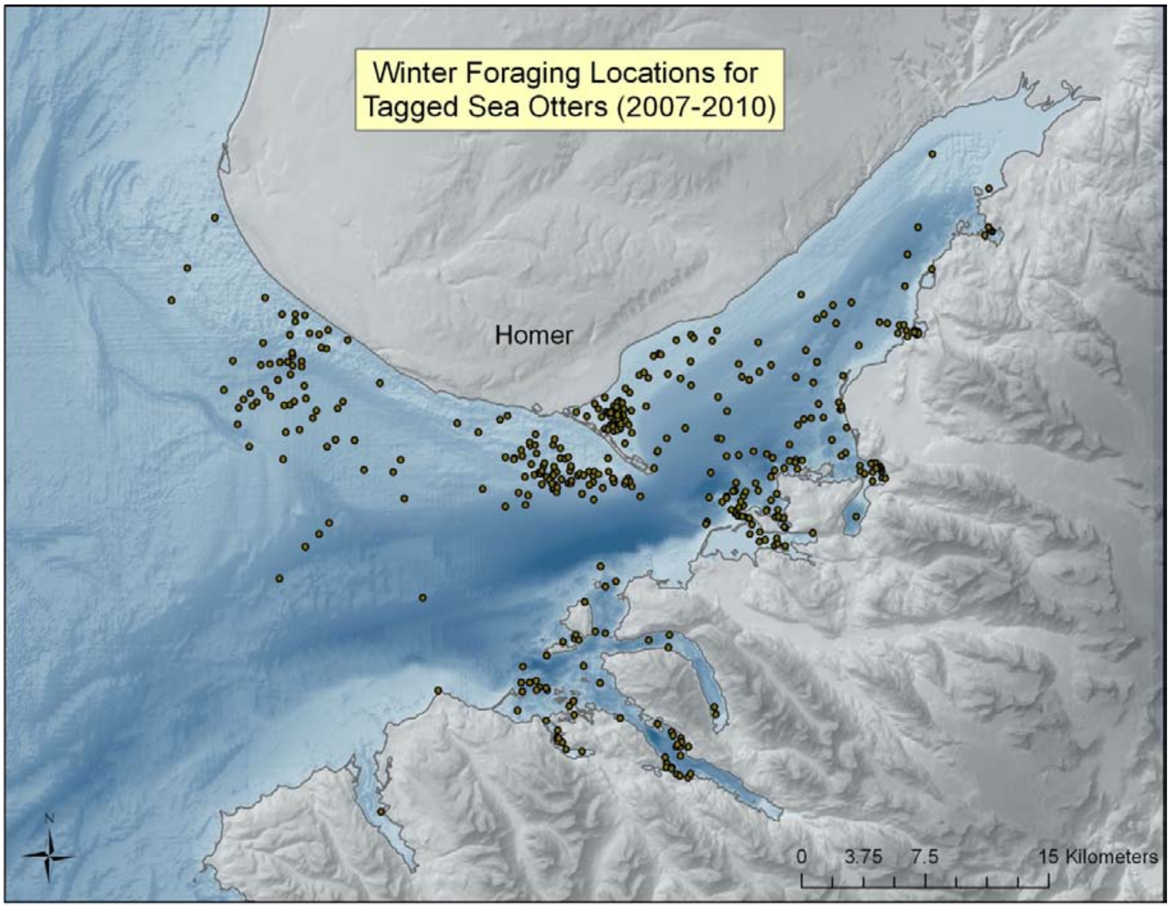

Figure 4. Cumulative distribution of winter foraging locations (October – April) of 44 tagged sea otters in Kachemak Bay, Alaska during 2007- 2010 (n=414) from Doroff and Badajos (2010).

Evaluation of scat analysis

Scat analysis will be a useful tool to identify trends in specific prey, such as crab, in Kachemak Bay over time. Crab parts, even those that are well-masticated, are identifiable in the scat samples and include a range of species from small intertidal and subtidal species to larger Tanner crabs. We are developing an identification manual for the crab species, which occur in Kachemak Bay sea otter scats collected during the winter months. Identifying crab to species in sea otter scat would allow students to monitor trends in crab species consumed over time, both within a season and among years. Human use of crab in the study area is managed by the Alaska Department of Fish and Game. A better understanding of the effects of both human use and of a keystone species foraging on crab populations will facilitate comprehensive management of harvestable crab species.

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RÉSUMÉ

BILAN DU REGIME ALIMENTAIRE DE LA LOUTRE DE MER (*Enhydra lutris kenyoni*) DANS LA BAIE DE KACHEMAK, ALASKA (2008-2010)

Le suivi à long terme de l'alimentation d’une espèce clé contribue à notre compréhension des changements dans la structure d'un écosystème. Les loutres de mer ont disparu de la Baie de Kachemak en Alaska en 1911 et sont revenues grâce à un début de recolonisation naturelle dans les années 1970. La population de loutres est passée de moins de 1000 individus dans les années 1990 à 3600 en 2008. Dans la Baie de Kachemak nous avons décrit le régime alimentaire des loutres en analysant les épreintes et en cumulant les observations visuelles. La collecte des épreintes n'est possible qu’en hiver et l'analyse est biaisée en faveur des proies dont les parties dures sont ingérées. Les épreintes déposées durant une semaine ont été collectées et ce chaque mois entre octobre et mai pendant la période 2008-2010. Sur l’ensemble des échantillons prélevés, les proies dominantes sont les moules (41%), les crabes (32%), et les palourdes (12%). Pour les observations visuelles, voici l’ordre de consommation: palourdes (38%), moules (14%) et crabes (2%). L'analyse des épreintes est un outil utile pour identifier les tendances hivernales de consommation de crabes et de moules, mais excluent la possibilité d'identifier de grands bivalves et d’autres proies au corps mou. La Baie de Kachemak présente principalement un habitat de sédiments benthiques mous favorable aux palourdes et aux crabes. Dans les années 1970, les crabes et les palourdes de valeur commerciale étaient abondants dans cette région. Nous estimons enfin que l'analyse des épreintes est un outil à faible coût pour surveiller les tendances à long terme de l'alimentation hivernale des loutres de mer dans la Baie de Kachemak.

RESUMEN

EVALUACIÓN DE LA DIETA DE NUTRIA DE MAR (*Enhydra lutris kenyoni*) EN LA BAHÍA DE KACHEMAK, ALASKA (2008-2010)

Los monitoreos de largo plazo de dieta de especies clave contribuyen al entendimiento de los cambios de estructura de un ecosistema. Las nutrias de mar fueron extirpadas de la bahía de Kachemak, Alaska en 1911 y volvieron a la región a través de recolonización natural en 1970. La nutria de mar incrementó su población de < 1.000 individuos en 1990 a 3.600 en el 2008. Nosotros describimos la dieta de la bahía de Kachemak basado en los resultados a partir de análisis de heces y observación directa. La colección de heces es únicamente factible en los meses de invierno y su análisis es sesgado hacia especies donde sus partes duras son ingeridas. Las heces se colectaron durante un periodo de una semana durante Octubre a Mayo durante 2008-2010. Los tipos de presas dominantes para todas las muestras combinadas fueron mejillones (41%), cangrejos (32%) y almejas (2%). El análisis de heces sería una herramienta útil para la identificación de tendencias en el consumo de invierno de cangrejos y mejillones, pero excluiría la identificación de grandes bivalvos y presas de cuerpo blando. La bahía de Kachemak es primariamente un hábitat bentónico de sedimento blando, el cual es hábitat disponible para almejas y cangrejos. En 1970, especies de cangrejos y almejas de interés comercias fueron abundantes. Nosotros evaluamos el análisis de heces como una herramienta de bajo costo para el monitoreo a largo plazo de tendencias en la dieta de invierno para las nutrias de mar en la bahía de Kachemak.

A R T I C L E

FACTORS INFLUENCING DISTRIBUTION OF EURASIAN OTTER (*Lutra lutra*) IN SWAT AND DIR DISTRICTS, PAKISTAN

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Abstract: This study assessed the distribution of Eurasian otters (*Lutra lutra*) through community-based survey followed by their potential habitat investigation in two districts of Khyber Pukhtoon-khwa (KPK), Pakistan. Results of the study indicated that Sheer Palam, Tormang, Patrak, Kalkot and Tal (Upper Dir), Madyan, Baronial, Mankial and Peshmal (Swat) are the key habitats to host Eurasian otters. Secondary data (community questionnaires) indicated 79% people consider that Eurasian otters are permanent residents in the study area, 12.5% thought otters were seasonal migrants while 8.5% people were not able to report otter status. Of the 31 sites surveyed, only nine sites were found to be positive for otter presence. The results indicated that the distribution range of the otter covers some potential areas of Swat and Upper Dir in Pakistan. This study concludes that otter population is more vulnerable in areas of dense human population. Anthropogenic activities are greatly influencing the presence of otters in the region and thus need an immediate action for the recovery of this declining population.
Keywords: Eurasian otter; distribution; population status; community based surveys; Pakistan

INTRODUCTION

Otters belong to the mammalian family Mustelidae (Subfamily Lutrinae), and are adapted to semi-aquatic life (Hussain, 1999; Macdonald and Duplaix, 1983). Among several otter species, the Eurasian otter (*Lutra lutra*) has the widest distribution with a range covering parts of three continents; Europe, Asia and Africa (Reuther et al., 1993). The Eurasian otter's geographical range is enormous, larger than the remaining other 13 species. It inhabits Europe, North Africa, Russia, China, Japan, Indonesia, Malaysia and parts of India and Pakistan (Mason and MacDonald, 1986), although it has disappeared from several areas of its historical range due to anthropogenic activities as competition for fish, fur trade, killing and habitat loss etc. (Saavedra, 2002). Otters are semi-aquatic mammals because they carry out most of their activities in water, but reproduction and resting happen on land like other terrestrial mammals (Chanin, 1985, Hussain et al., 2008; Mason and Macdonald, 1986). They are also recognised as one of the top predators of freshwater ecosystem (Kruuk et al., 1994; Lekagul and McNeely 1977; Ottino and Giller, 2004) and key species in the wetland ecosystem (Mason and MacDonald, 1986).

Distribution status of Eurasian otter in Pakistan

Pakistan hosts two species of otters: the Eurasian otter (*Lutra lutra*) and the Smooth coated otter (*Lutrogale perspicillata*). The Eurasian otter is distributed in the northern mountainous region of Khyber-Pukhtoonkhwa (KPK) province while the Smooth coated otter occurs in the Sindh and Punjab provinces of Pakistan (Khan et al., 2009). The wetlands and rivers of Pakistan provide suitable habitat for the Eurasian otter. It is known to be found in rivers and streams of the Himalayan mountain range in KPK-Pakistan (Khan et al., 2009). The Eurasian otter is distributed in the northern valleys of Swat, Chitral, Kohistan and Gilgit Baltistan in accessible river areas (Roberts, 2005). Otter tracks have been seen along the Shyok River in Baltistan, Ghizer River in Gilgit, Kunhar River in Chitral and on the banks of the Hunza River (Roberts, 2005; Hess, 1993). Fur trade of the Eurasian otter is common in northern regions of Pakistan and thus skins of Eurasian otters reach as far as Peshawar and Rawalpindi from the Jhelum and Neelum valleys of Azad Kashmir and the Hunza District of Gilgit Baltistan. The main aim of this study was to build baseline information on the otters' past and current status, to map the distribution range and potential habitats and to evaluate the factors influencing their distribution.

MATERIALS AND METHODS

Study Area

The study area in the Swat and Dir Districts are situated in Khyber-Pukhtoonkhwa (KPK) Province of Pakistan. This region represents diverse habitats and geographic features from rivers and streams to cultivated and uncultivated lands, to forested and semi-forested areas and mountain ranges. These are contiguous valleys in KPK (Figure 1). These districts are naturally gifted areas of fascinating landscapes and clear healthy climate located in the middle of foothills of the Hindu Kush mountain range. The climate of KPK varies enormously for a region of its size, covering most of the many climate types found in Pakistan. In the districts of Dir and Swat, the climate becomes more typical of Pakistan as a whole, although a significant amount of the annual precipitation still comes from anterior clouds through the winter months. Dir is one of the wettest places in Pakistan: annual rainfall at Dir averages 1475 mm (58 inches), of which 400 mm (15.75 inches) falls during the summer monsoon from July to September and twice that amount during the winter rainy season from December to April. Swat, which is rather more sheltered, has an average annual rainfall of around 840 mm (33 inches), with about 430 mm (17 inches) expected between June and September.

Evaluation techniques

Indirect evaluation techniques were used to assess the distribution of Eurasian otter by following the standard guidelines for otter distribution surveys (Reuther et al., 2000). The sites were considered “positive” when at least a single otter sign was recorded and “negative” when no otter sign found. The percentage of these positive and negative sites was considered on the basis of total sites visited. During the current study, indirect methods were categorized into two broad categories which include interviews with local community and field observations.

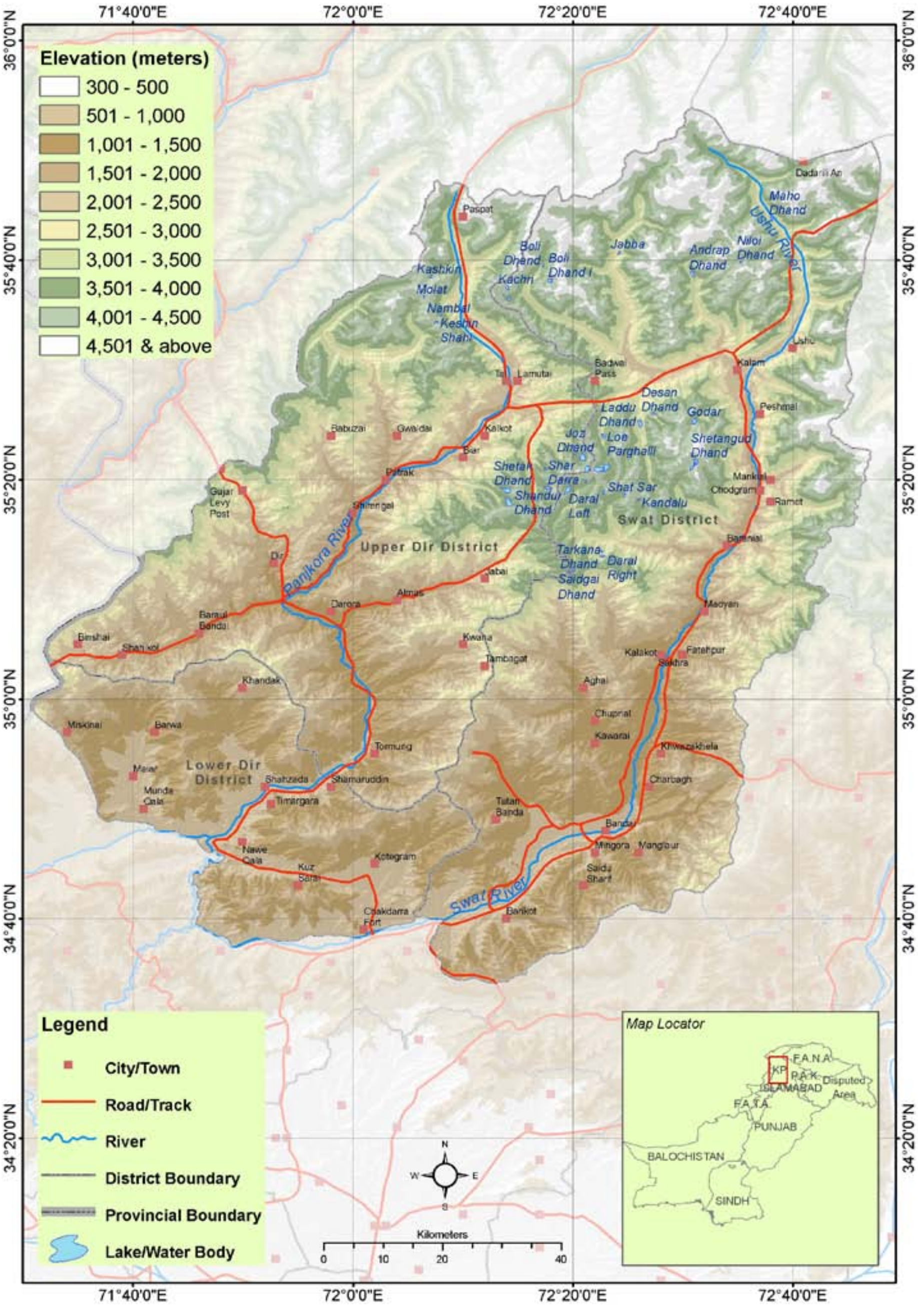

Figure 1. Map of the study area of (Swat and Dir) in Khyber-Pukhtoonkhwa (KPK), Province of Pakistan

Community-based assessment of Eurasian otter

A survey questionnaire was developed and meetings were arranged with different professionals including fishermen, hunters, fish traders, fish farmers, local communities, and representatives of government line departments; (irrigation, fisheries, and wildlife) regarding otter distribution. A total of 253 people were interviewed from abovementioned local communities in the districts of Dir and Swat. At each site local community and concerned government authorities were interviewed to assess the presence of, and identify the key threats to otters. Before conducting each interview, it was confirmed that the person could really recognise otters by showing them pictures of the Eurasian otter. The feedback from the local communities was used to compile information on the presence and absence of otters in the particular vicinities.

Field survey

A total of 39 potential sites along the main river in KPK were marked on a GIS based map. These potential sites were identified based on the recent observations of community-based assessment which includes a questionnaire survey and different professionals including fishermen, hunters, fish traders, fish farmers, local communities, and representatives of government line departments; (irrigation, fisheries, and wildlife). Among 39 potential sites, 31 sites were extensively searched for the existence of Eurasian otters in KPK while eight sites were not searched due to unfavorable conditions: rough terrain and war. The investigation for the presence of L. lutra was conducted using Jeeps and on foot by walking along the banks of water bodies. Otter distribution was assessed by means of a standard otter survey (Mason and Macdonald 1986 and Reuther et al., 2000), which is based on field observations by taking 600 meter transects after every 5-8 kilometers stretch at regular intervals. Both the Districts were extensively searched for signs of Eurasian otters and transects were laid by utilizing the information obtained from local community regarding potential habitats in the area; due to the rough terrain and risky law and order situation, it was not possible to take 600 m transect at every 5-8 kilometer stretch at regular intervals, so transects were laid randomly at each identified site in light of the secondary data and community-based information. Each site was thoroughly scanned for otter signs i.e. spraints, claw marks, grooming sites, food remains and holt presence. The GPS positions and the description of the type of otter sign wherever found were recorded. At each site, the surrounding habitat, vegetation type, soil texture and land use pattern were also recorded. The spraints were described as recent, old and very old based on their consistency and degree of bleaching (Ottino and Giller, 2004).

RESULTS

The present investigation revealed that the population of the Eurasian otter has declined to a great extent in the catchments region in KPK due to habitat degradation and disintegration, deforestation, un-availability of prey species, flash flooding, increased human population and poaching for fur trade. The present investigation also suggested that the existing otter population is not evenly distributed throughout its historic range and hence it is restricted to limited areas of KPK.

Historical and current distribution of Eurasian otter in Khyber-Pukhtoonkhwa

The average responses of people interviewed were categorized on a yearly basis (10 years interval) and the historic presence of the Eurasian otter in Swat and Dir Districts are given in Figures: 2-4 respectively. The current distribution of the Eurasian otter in the study area indicated that 18% of people have seen Eurasian otters within the last three years of the period in the Swat valley. However, 48% people in Upper Dir and 34% people in Lower Dir have observed Eurasian otters within the same time period (Figure 5). Of the total thirty one sites surveyed, only nine sites were found to be positive for otter presence.

The results indicated that the distribution range of the otter covers some potential areas of Swat and Upper Dir which are shown in Figure 6. Secondary data (community questionnaires) indicated 79% people are of the opinion that the Eurasian otter is a permanent resident in the study area, 12.5% considered that the otter is a seasonal migrant while 8.5% people were not able to report its status in the study area. Local communities informed us that otter activities were seen both at night and during the day time. About 47% people observed otter activity in early morning, 37 % people have seen otters at evening while 16 % people reported seeing otters in mid-afternoon. Spraints were well identified along the variously-sized water bodies (main rivers and streams), indicating that an otter population is present in the area. At least 2-3 spraints and 1-2 holts were identified at each positive site. Sites were well worn with holts of various sizes being quantified often at each spot.

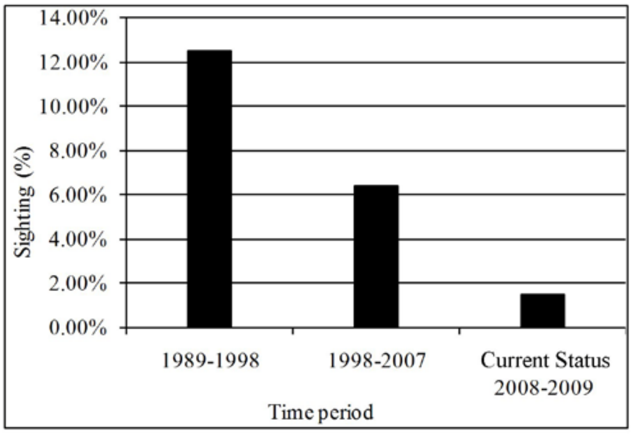

Figure 2. *L. lutra* historical distribution status in District Swat

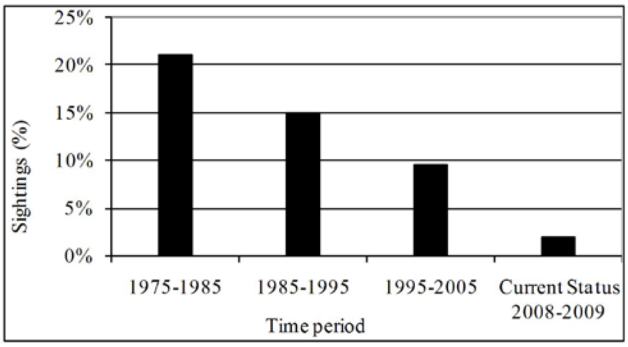

Figure 3. *L. lutra* historical distribution status in District Lower Dir

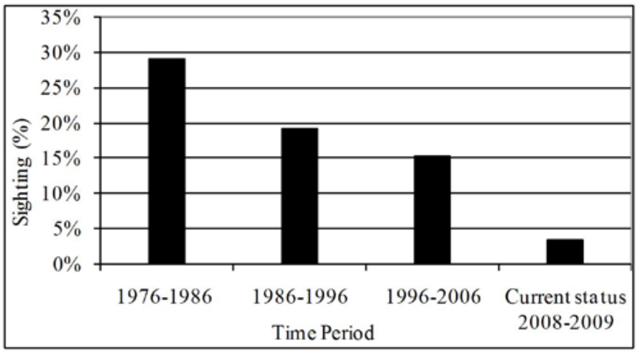

Figure 4. *L. lutra* historical distribution status in District Upper Dir

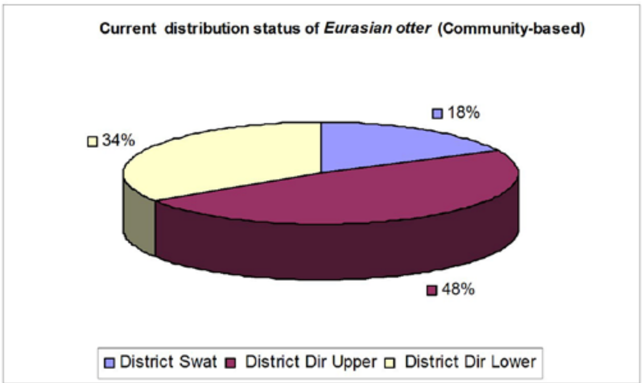

Figure 5. Otter sightings (%) within last three years of time period

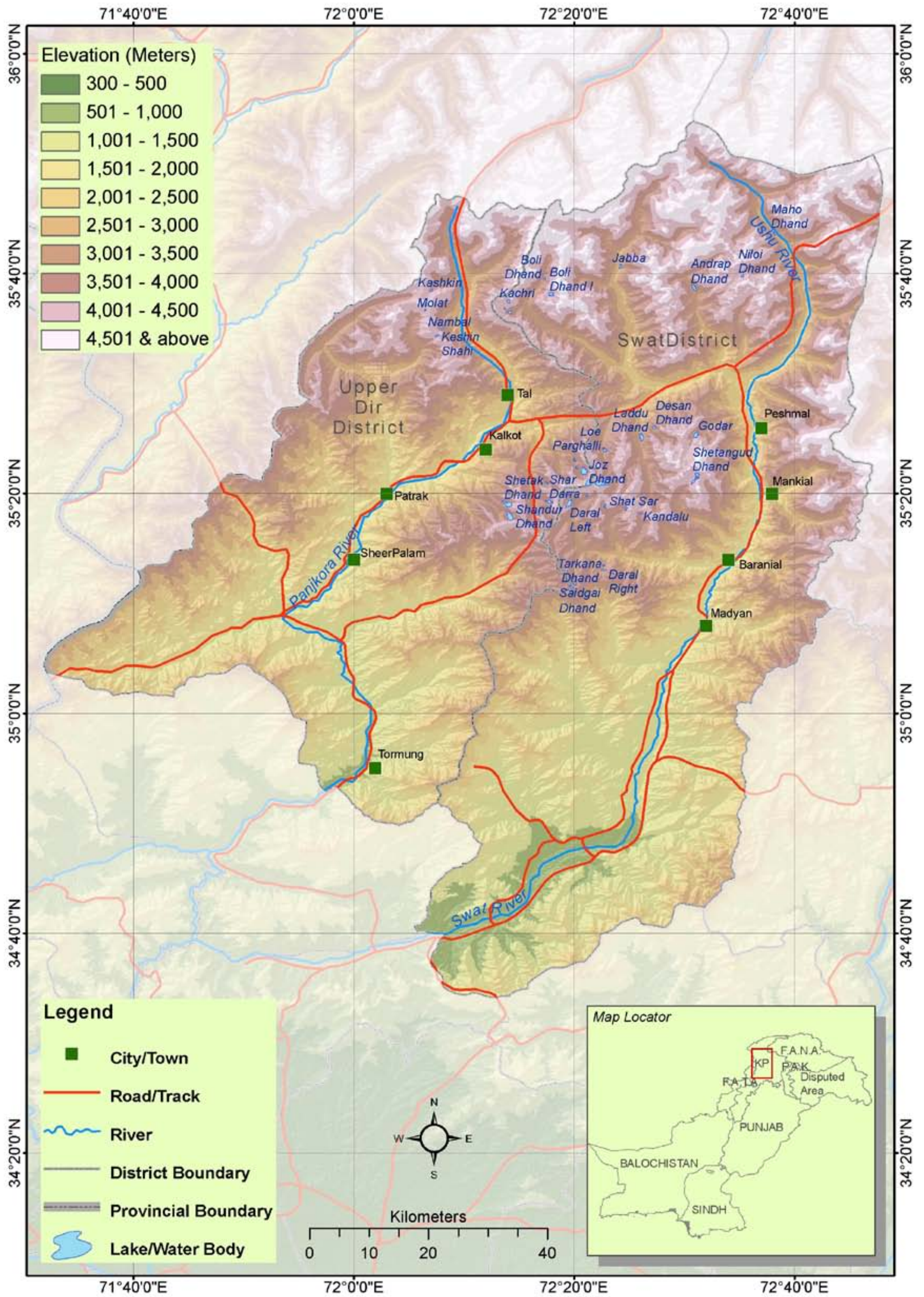

Figure 6. Legend (City/town) on the map represents current distribution of Eurasian otter in KPK where otter presence was confirmed after at least one indirect observation; these areas are still potential habitats for otter.

Factors affecting population

Results of the survey demonstrated that the otter population in the area has decreased by 49.5 % due to over population and habitat destruction, (37.4%) result recorded that otters were hunted and killed, 3.32 % people highlighted the unavailability of the food, 0.5 % people reported that otters were killed in road accidents while 9.2 % people had no knowledge about their disappearance from the study area. This fact showed that anthropogenic activities influenced the presence of otters in the study area. Among 253 questionnaires, 47.4% people reported that otters are hunted for pelts, 13% confirmed that otters are hunted as competitors for fish, 11.1% people indicated that hunting of otter occurs for domestic use while about 28.5% people denied any sort of hunting of the otter in the area.

DISCUSSION

Information from secondary sources such as forest staff, local people and ex-poachers revealed that Eurasian otters were found in the Swat and Dir districts. Strict legislation, lower levels of human activity and protected bank side vegetation may have been the causes for the continued survival of the species (Jefferies, 1989; Mason and Macdonald, 1986; Acharya, 1998). Indirect signs like spraints, holts, grooming sites and claw marks were investigated for positive otter sites in KPK and hence some areas in Dir and Swat districts were marked positive based on these observations (Figure 6). Indirect signs have been used to assess the otter population, though the reliability of using indirect signs has been doubted in some circumstances. Our results are comparable to those found in the investigations conducted by Kruuk (1995), Mason and Macdonald (1993) and Strachan and Jefferies (1996), in that the compiled results of local community responses indicate that the otter population has been decreasing significantly in these areas with the passage of time (Figure 2, 3 and 4). According to the local community, hunting of otters as a fish competitor has been a prevailing cause of decreasing populations of Eurasian otters: Thus humans have posed the greatest threat to otters, both directly and indirectly as discussed by Hussain and Chaudhry (1997) and Lourival et al. (2000). Disturbance to otter habitat was found to be greater in the Swat district compared to Lower Dir, while the habitat of Eurasian Otter was comparatively good in Upper Dir. By relating the anthropogenic activities to the number of otter sightings, it has been observed that the greater the extent of habitat destruction, the lower the number of otters seen in a particular District. These results agree with those obtained by Butler and du Toit, 1994 and Verwoerd, 1987. Fishing activity was observed to be at quite high levels, and this might have played a crucial role in the dislodgment and disappearance of Eurasian otters from their historic range of distribution as suggested by Kruuk (2006) and Hussain (2002). Human disturbance in terms of fishing and dwelling often affected otters (Butler and Toit, 1994; Acharya, 2006).

The distribution range of otters covers some potential areas of Swat and Upper Dir; however, the population was sparse in the northernmost areas, where the winter conditions were harsh, which is also discussed by Shrestha, 1997, Prater, 1971 and Ruiz-Olmo et al., 2008 in their studies. In these alpine areas, all the waters are totally covered with ice and/or there is very low water availability in winter. In the extreme conditions of alpine regions, it is nearly impossible for otters to find any food in winter. Thus these areas in winter time are the limiting factor for the population of otters as also indicated by the investigations of Sulkava, 2007 and Sulkava et al., 2007. Eurasian otters in KPK province suffered from habitat loss, hunting and killing, unavailability of the food and road accidents, which has left them more susceptible to the disturbances which significantly affect all otter populations. These facts have also been confirmed by other workers (e.g. Anoop and Hussain, 2004; Verwoerd, 1987; Butler and du Toit, 1994; Hussain and Chaudhry, 1997b) in their studies.

CONCLUSIONS

This study elucidated the distribution of the Eurasian otter in the Swat and Dir districts of Pakistan. . The Eurasian otter is distributed in Sheer Palam, Tormang, Patrak, Kahlakot and Tal which are situated in the valley of the Dir district, while otters were also confirmed in Madyan, Baronial, Mankial and Peshmal located in the Swat Valley. The Eurasian otter population is more vulnerable in areas of dense human population: anthropogenic activities influenced the presence of otters in the study area. These results revealed that there is utmost necessity for future research to ensure better management for otters as well as to find out possible ways of reducing anthropogenic pressure on otter habitat. This indicates a need for immediate action for otter conservation.

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RÉSUMÉ

FACTEURS INFLUENCANT LA DISTRIBUTION DE LA LOUTRE (*Lutra lutra*) DANS LES DISTRICTS DE SWAT ET DIR, PAKISTAN

Cette étude fait le point sur la distribution de la Loutre d'Europe (*Lutra lutra*) à partir d'une enquête communautaire et des potentialités d'habitat dans deux districts du Pakistan: Khyber Pukhtoon-khwa (KPK). Les résultats indiquent que Palam Sheer, Tormang, Patrak, Kalkot et Tal (Haut Dir), Madyan, Baronial, Mankial et Peshmal (Swat) sont les sites clés pouvant accueillir la Loutre d'Europe. Les données secondaires (enquête communautaire) indiquent quant à elles que 79% de la population interrogée considère que la Loutre est présente de façon permanente sur l'aire d'étude, 12,5% pensent qu'elle est présente de façon saisonnière et 8,5% n'ont pas d'avis. Sur les 31 sites prospectés, seuls neuf se sont révélés positifs. Ceci indique que l'aire de répartition de l'espèce couvre les domaines potentiels des districts de Swat et du haut Dir. En conclusion, la population de loutres est plus vulnérable dans les zones à forte densité humaine et les activités anthropiques influencent fortement la présence ou non de l'espèce dans la région. Il existe donc un besoin immédiat d'actions pour freiner le déclin de l'espèce.

RESUMEN

FACTORES QUE INFLUYEN LA DISTRIBUCIÓN DE LA NUTRIA EURASIA (*Lutra lutra*) EN LOS DISTRITOS DE SWAT Y DIR, PAKISTÁN

Este estudio evaluó la distribución de la nutria común (*Lutra lutra*) a través de encuesta en comunidades, seguido de un investigación de hábitat potencial en dos distritos de Khyber-Pukhtoon Khwa (KPK) - Pakistán. Los resultados del estudio indicaron que Sheer Palam,

Tormang, Patrak, Kalkot y Tal (Alto Dir), Madyan, Baronial, Mankial y Peshmal (Swat), son los hábitats clave para ser sede del nutria común. Los datos secundarios (cuestionarios en las comunidades) indicó que un 79% de personas son de la opinión de que la nutria común es un residente permanente en el área de estudio, el 12,5% reveló que la nutria es un migrante estacional, mientras que 8,5% no fueron capaces de asegurar su estado. Del total de treinta y un lugares censadas, sólo nueve sitios resultaron ser positivos por la presencia de la nutria. Los resultados indicaron que el rango de distribución de la nutria cubre algunas áreas potenciales de Swat y Alto Dir en Pakistán. Este estudio concluye que la población de la nutria es más vulnerable en las zonas de densa población humana. Las actividades antropogénicas son de gran influencia en la presencia de la nutria en la región y por lo tanto requiere acción inmediata para la recuperación de esta población en declive.

A R T I C L E

LOCAL PERCEPTIONS AND IMPLICATIONS FOR GIANT OTTER (*Pteronura brasiliensis*) CONSERVATION AROUND PROTECTED AREAS IN THE EASTERN BRAZILIAN AMAZON

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Abstract: The local success of protected areas for effective biodiversity conservation depends largely on ensuring the integration of local communities and the persistence of wildlife species and ecological processes. We investigated the perceptions of riverine residents living around a sustainable-use protected area towards giant otters (*Pteronura brasiliensis*). Between March and December 2011, we conducted 41 interviews with riverine residents in the region of the National Forest of Amapá (AP, Brazil). These interviews revealed a strong negative attitude towards giant otters, highlighted by recent reports of otters being killed in 12.2% of the interviews. Generalized linear models showed that years of education and age weakly predicted attitudes towards otters in the study area (i.e., respondents with the longest time in education and older were less likely to dislike otters and to consider giant otters as damaging income or fishing activities, respectively). These results suggested that to conserve giant otters in this region efforts should focus on environmental education and long-term research projects.

Keywords: Brazilian Amazon; Giant otter; human-wildlife conflicts; *Pteronura brasiliensis*

INTRODUCTION

The rise in the extent of protected areas is a success for global biodiversity conservation (Stokstad, 2010). However, over 86% of all protected areas worldwide permit some form of human use and in the neotropics the prevalence of sustainable-use reserves is greater than in tropical areas of Africa and Asia (Peres, 2011). Currently, almost 37% of the Brazilian Amazon is protected, but in the current protected area system, 22% are indigenous land and 11% are sustainable-use reserves (e.g., production forests) (Azevedo-Ramos et al., 2006). Therefore, the local success of protected areas for effective biodiversity conservation depends largely on ensuring the integration of local communities with activities aimed at conserving wildlife species and ecological processes.

The increase and expansion of human populations means that biodiversity and species conservation activities are intrinsically associated with the socio-economic context (Marshall et al., 2007; Dickman, 2010). The resolution of human-wildlife conflicts (Dickman, 2010), success of re-introduction (Morzillo et al., 2010), and effectiveness of protected areas (Andam et al., 2008) are all dependent on the local context, which includes the perceptions of stakeholders.

Human perceptions towards carnivores differ with a number of variables including: gender (Campbell and Torres Alvarado, 2011), age (Morzillo et al., 2010; Campbell and Torres Alvarado, 2011), species (Lescureux and Linnell, 2010; Campbell and Torres Alvarado, 2011), knowledge/education (Morzillo et al., 2010; Lescureux et al., 2011), location (Dar et al., 2009; Liu et al., 2011), occupation (Hazzah et al., 2009; Lescureux and Linnell, 2010), frequency of contact (Hazzah et al., 2009; Lescureux and Linnell, 2010; Lescureux et al., 2011; Liu et al., 2011), and religious/belief systems (Hazzah et al., 2009; Liu et al., 2011). This lability in perceptions means that through actions such as environmental education it is possible to modify human perceptions, which can directly influence human behaviours with positive outcomes such as reducing human wildlife conflicts and promoting the conservation of biodiversity (Dickman, 2010) but see (Liu et al., 2011).

As found in other carnivore species, human perceptions towards otters differ depending on the socio-economic context. Perceptions may range from positive when otters can act as tourist attractions capable of generating revenue, neutral in agricultural landscapes where they have no impact on local economies (Norris and Michalski, 2009), to negative where giant otters are perceived as competitors by fisherman (Gómez and Jorgenson, 1999; Recharte et al., 2008). Although some studies report correlations between the perceived or real magnitude of damages (e.g. financial losses) and implementation of lethal control measures (Kloskowski, 2011), there is often considerable disparity between the real and perceived impacts of otters (such as net damage and stock consumption) (Gómez and Jorgenson, 1999; Freitas et al., 2007; Recharte et al., 2008; Rosas-Ribeiro et al., 2011; Vaclavikova et al., 2011). Across the Amazon basin, riverine communities struggle to sustain livelihoods. These communities depend on fish as a source of protein and/or financial income. Therefore any real or perceived losses caused by otters will lead to negative impacts on regional conservation efforts. For example damage to even a single fishing net may result not only in injuries to otters but also significant losses for local communities that struggle to sustain livelihoods. As such understanding and resolving otter-human conflicts is vital for both sustainable socio-economic development and biodiversity conservation.

Giant otter populations were decimated throughout their range by the fur trade, for example, 1000–3000 pelts were exported annually from the Brazilian Amazon during the 1950–60's (Smith, 1980). Additionally, habitat destruction (Michalski and Peres, 2005), and illegal hunting are recognised as principal threats to the remaining giant otter populations (Carter and Rosas, 1997; Duplaix et al., 2008). Due to their piscivorous diet, giant otters are widely perceived as competitors by fisherman across the Amazon basin (Gómez and Jorgenson, 1999; Recharte et al., 2008; Rosas-Ribeiro et al., 2011). Therefore, developing effective mitigation strategies for human-otter conflicts is necessary to prevent local communities in the remaining giant otter strongholds from adopting lethal control in retaliation for perceived and/or real losses. We investigated attitudes of riverine residents towards giant otters in a poorly studied region of the Brazilian Amazon. We evaluated several socio-economic variables in order to determine their influence on local perceptions and to identify possible conflicts between local residents and giant otters.

MATERIAL AND METHODS

Study area

This study was conducted in the region of the National Forest of Amapá (FLONA), Amapá State, eastern Brazilian Amazon (0°55’29’’N, 51°35’45’’W, Fig. 1). FLONA is a 412,000 ha sustainable-use reserve, adjacent to continuous undisturbed forest areas and maintains the full community of medium and large bodied vertebrates. This protected area experiences low levels of anthropogenic perturbations, in part because only eight families live on the reserve border, and the nearest city (Porto Grande) is located 46 km by river from the area (Fig. 1).

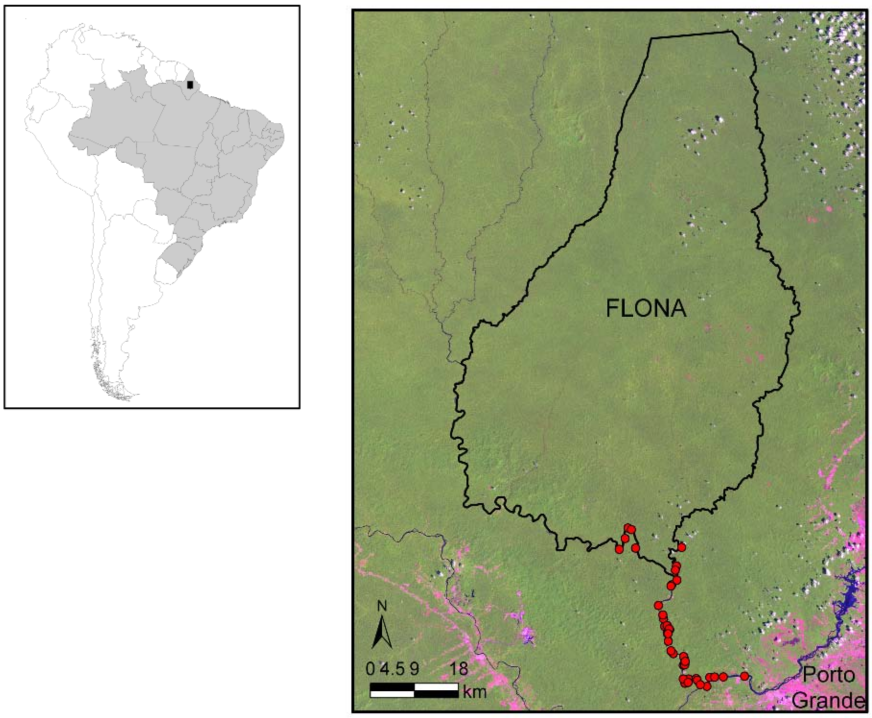

Figure 1. Location of the study area in Amapá State, eastern Brazilian Amazon. A Landsat TM image (227/67, 25 October 2009) shows the location of the 41 interviews (red circles) conducted between March and December 2011, and the nearest urban centre (Porto Grande). The black line shows the limits of the National Forest of Amapá (FLONA). Green, pink, and blue areas represent forest, non-forest, and open-water cover, respectively.

Data collection

From March to December 2011 we used pre-elaborated questionnaires to interview all local riverine residents along the Araguari and Falsino Rivers from Porto Grande municipality to the nearest protected area (FLONA; Fig. 1). The interviews were conducted on a one to one basis with researchers asking questions and taking notes of the responses.

As a key prerequisite, all riverine residences that we visited were associated with one local informant (long-term resident and or landowner), who was (1) willing to be interviewed, (2) had local information regarding the study area and fishing practices, (3) had knowledge of the local wild fauna, and (4) had been living in the property or close to it for at least one year (mean ± SD = 16.1 ± 13.5 years, range = 1.5 – 51 years; n = 41 respondents). To understand attitudes towards giant otters we focused on replies to six questions (i.e., response variables):

1) List five wild animal species they liked, with species ranked according to the order in which they were mentioned (e.g. first mentioned species was the most liked);
2) List five wild animal species that they disliked, with species ranked according to the order in which they were mentioned (e.g. first mentioned species was the most disliked);
3) Which five wild animal species damage family income, with species ranked according to the order in which they were mentioned (e.g. first mentioned species was the most damaging to income);
4) Which five wild animal species damage (directly or indirectly) fishing activity, with species ranked according to the order in which they were mentioned (e.g. first mentioned species was the most damaging);
5) Whether they had experienced a problem with giant otters (e.g., ripped fishing net) in the past five years, recorded as a single yes or no answer;
6) Whether giant otters had been killed in the region close to their house in the past five years, recorded as a single yes or no answer.

Our pre-elaborated questionnaires were also used to obtain information from the respondent, such as age, years of school education, and the principal source of income, all of which can influence perceptions towards giant otters (i.e., predictor variables).

Data analysis

All analyses were performed in R (R Development Core Team, 2010). To examine if the protected area influenced respondents perceptions towards giant otters we compared responses between i) two classes: within and outside of the protected area and ii) between three classes representing three zones delineated based on proximity to the protected area (near: up to 3 km, intermediate: from 8 to 25 km, and far: from 27 to 43 km). Responses to all six questions were transformed to a binary (yes or no) variable. For example all respondents who mentioned giant otters as one of the disliked species were “yes” and those who did not “no”. We then compared the proportion of respondents who replied yes between the classes (protected area and proximity) using the R function “prop.test”, which tests the null that the proportions (probabilities of success) in several groups are the same.

We used generalized linear models (GLMs – family = binomial, link=logit) to investigate predictors of the perceptions of riverine residents towards giant otters. Perceptions towards giant otters were defined by four responses: “Dislike” (binary response of whether respondents mentioned giant otter as a disliked animal), “Problem” (binary response of whether respondents had ever encountered a problem with giant otters such as damage to fishing nets), “Damage income” (binary response of whether respondents mentioned giant otters as damaging the family income), “Damage fish” (binary response of whether respondents mentioned giant otters as species that damaged fishing activities).

As predictors of interviewee responses we used age (as a continuous variable), the years of school education (split into three classes: illiterate, one to five years, and six to ten years of schooling), distance to FLONA (measured from the Landsat image by following the river channel from the residence to the southeast border of the protected area for all interviews conducted outside FLONA and labelled as zero for all residences located on the border of the protected area), and the principal source of income of the interviewee (three classes: agriculture, fishing, and other). The influence of these predictors on the response variables was tested with separate GLMs to understand how these predictors could affect the perceptions towards giant otters. We adopted a backwards stepwise selection (R function “step”) applying the program defaults to arrive at a most parsimonious (i.e. “best”) model. We compared variable slope estimates in both the full and the “best” model selected, which enables us to avoid well known issues of stepwise approaches (e.g., inflated Type 1 error rates) (Mundry and Nunn, 2009).

RESULTS

We conducted 41 interviews with riverine residents located along the Araguari and Falsino Rivers (Fig. 1). The Euclidian nearest neighbour distance between all interviews was on average 13.4 km (± SD = 9.2 km, range = 0.1-38.4 km, n=820 pairwise comparisons). The principal source of income for the majority of respondents was from agriculture (68.3%, n=28), followed by fishing (21.9%, n=9). Although the majority did not necessarily depend financially on fishing, all respondents went fishing frequently (i.e. at least monthly), with the majority (53.6%, n=22) fishing daily. Fish was an important food item, with all families eating at least 250 grams of fish per week and the majority (80.4%, n = 33) consuming more than 2 kg of fish per week.

None of the interviewees cited giant otters as a “Liked” species, with responses generally neutral i.e. 87.8% (n = 36) interviewees did not mention giant otters as a “Liked” or “Disliked” species. However, considering responses to all questions asked (Table 1) there were clearly strong negative perceptions towards giant otters throughout the region (Fig. 2). The majority of respondents identified giant otters as a species that “caused problems” (e.g. ripped fishing nets) and “damaged fishing activities” (73.2 and 75.6% respectively). When questioned about the top five animals that most damage monthly family income giant otters were cited by six respondents (14.6%) and not mentioned by the remaining 35 residents (85.4%) (Table 1; Fig. 2B).

When asked if interviewees had ever killed giant otters in the past five years in the study area, five (12.2%) confirmed that giant otters had been killed (Table 1) as a result of fear (n=2), anger or simple retaliation during fishing activities (n=3). Although interviewees did not provide exact dates of when the giant otters were killed, the most recent report was one year before our interview. These reports occurred throughout all the classes of proximity from FLONA (n=1, 3, 1, near, intermediate, and far, respectively).

Table 1. Responses from riverine residents interviewed along the Araguari and Falsino rivers. The proportion (expressed as % in the table) of responses were compared i) between two classes: within and outside of the protected area and ii) between three classes representing three zones delineated based on proximity to the protected area. Bold typeface denotes statistically different proportions of responses between classes (α=0.05). Proportions were calculated from the number of respondents who cited giant otters as a “Liked animal”, “Disliked animal”, “Caused problems”, “Damaged income”, “Damage fishing activities” and reported the occurrence of giant otters being killed. Proportions calculated from total number of respondents in each class (column sample sizes).

		Within Protected Area		Proximity to Protected Area		
	All (n=41)	Outside FLONA (n=33)	In FLONA (n=8)	Near (n=11)	Intermediate (n=18)	Far (n=12)
Liked animal	0.0	0.0	0.0	0.0	0.0	0.0
Dislike animal	12.2	15.2	0.0	**0.0**	**27.8**	**0.0**
Cause problems	73.2	78.8	50.0	63.6	77.8	75.0
Damage income	14.6	18.2	0.0	**0.0**	**33.3**	**0.0**
Damage fishing activities	75.6	81.8	50.0	63.6	88.9	66.7
Giant otter killed	12.2	12.1	12.5	9.1	16.7	8.3

Visual inspection revealed that negative perceptions of giant otters as a problem species (Fig. 2D) and a species that damaged fishing activities (Fig. 2C) occurred throughout the region. However, perceptions of dislike (Fig. 2A) and damaging income (Fig. 2B) were clustered within a 15.8 km stretch of river (“intermediate zone”) between the town of Porto Grande and FLONA. Although residents bordering the protected area tended to have less negative perceptions towards giant otters (Table 1) when compared with those living outside, this difference in perceptions was not significant. However, responses did differ significantly between residents when classified into the three "proximity" zones. Respondents living at intermediate distances from the protected area were generally most frequently negative in their perceptions of giant otters (Table 1) and a greater proportion (27.8%) cited giant otters as a "Disliked" species and one that "Damaged income" (33.3%). However, the proportions of negative responses of interviewees living near to and far from the protected area were very similar (Table 1).

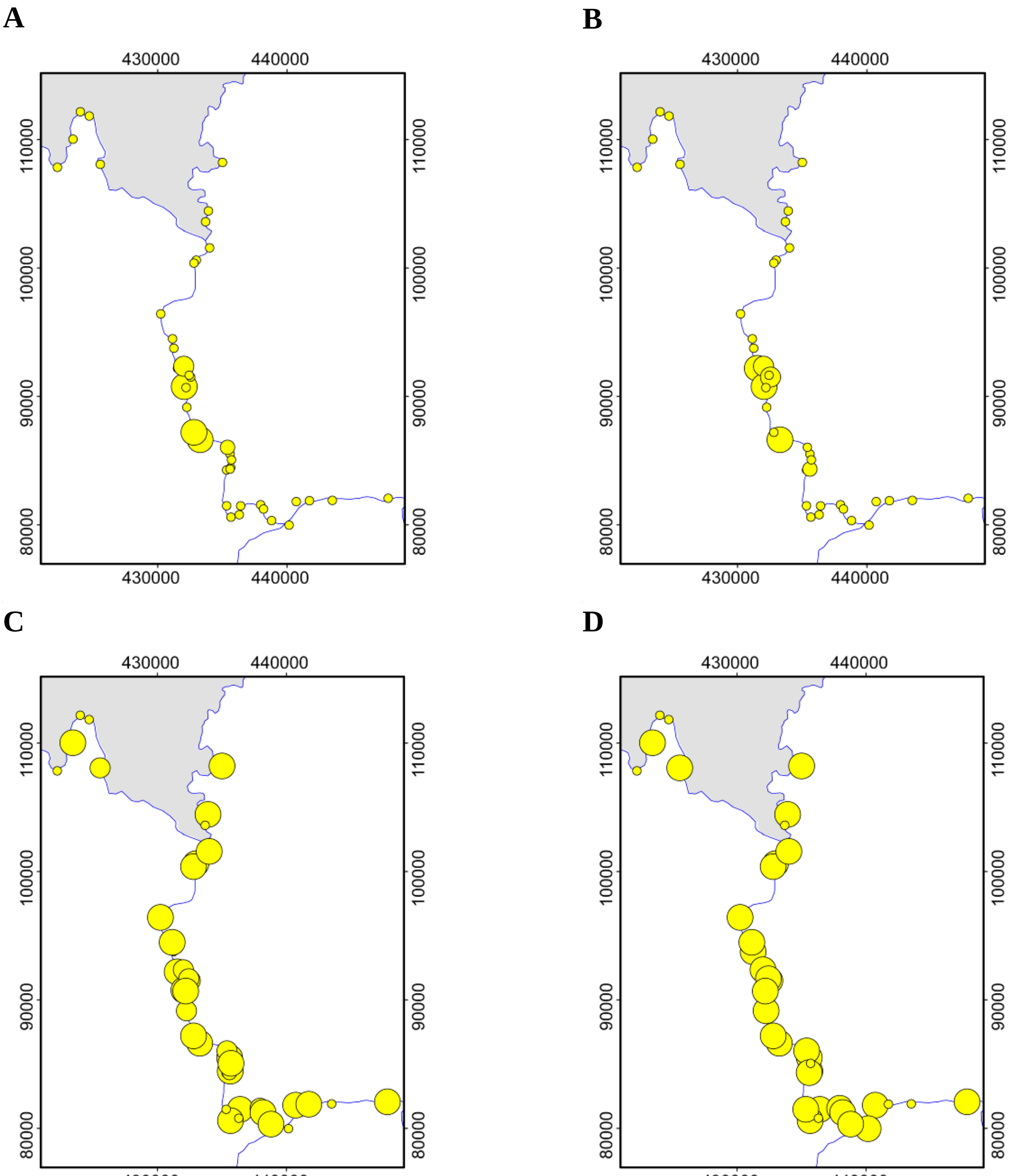

Figure 2. Spatial distribution of riverine perceptions towards giant otters in the study area, showing extent to which respondents: (A) disliked giant otters, (B) perceived that giant otters damaged income, (C) perceived that giant otters damaged fishing activity, and (D) had a problem with giant otters (e.g., ripped fishing net). Increasing symbol size represents more negative perceptions based on the order giant otters were cited in the list of five animals (A, B, and C) or whether they were cited as a problem (D). Grey polygon shows the limits of the National Forest of Amapá (FLONA) and the blue line shows the centre of the major rivers in the study area.

Our GLMs showed that perceptions towards giant otters were hard to predict. Our four predictors were most adequate when used to model when respondents disliked giant otters, however they explained only 28.8 % of this model deviance and the most parsimonious model which retained "Education" (where respondents with the longest time in education were less likely to dislike giant otters) was only marginally significant (P=0.054) (Table 2). The most parsimonious models predicting whether respondents considered that giant otters damaged income and fishing activities both retained only age, with older respondents less likely to consider giant otters as damaging income or fishing activities (deviance explained 8.3 and 4.6% damage income and fishing respectively), however neither model was statistically significant (P=0.093 and P=0.146, damage income and fishing activity respectively) (Table 2).

DISCUSSION

As far as we are aware this study is the first to quantify perceptions of riverine residents towards giant otters in the eastern Brazilian Amazon. Our findings show that giant otters are (1) negatively perceived throughout the study region, (2) more positively perceived by respondents with the longest time in education, (3) less likely to be considered as damaging income or fishing activities by older respondents, and (4) have been killed recently in the area. Our findings reinforce the importance of studies with human-wildlife conflicts in and around sustainable-use reserves in the Brazilian Amazon, in order to ensure the long-term persistence of endangered species.

Conflicts between Amazon fishermen and giant otters have been reported from Colombia (Gómez and Jorgenson, 1999), Peru (Recharte et al., 2008), and Brazil (Rosas-Ribeiro et al., 2011). The primary reason for these conflicts was the overlap in space and time of resource use between humans and giant otters. Fish is an important food resource among Amazonian riverside people (Boischio and Henshel, 2000; Dorea, 2003), and riverine communities have been heavy consumers of fish due to their plentiful availability, and difficulties of acquiring alternative protein sources (e.g., via raising cattle) (Hiraoka, 1992). Similarly, in our study region, all respondents went fishing frequently (at least monthly), with 80% of the people interviewed consuming more than 2 kg of fish per week. This dependence on fish is very similar with that of the giant otter, which are primarily piscivorous and can eat up to 10% of their body weight per day (Duplaix, 1980; Rosas et al., 1999). Therefore, it is not surprising that giant otters are negatively perceived throughout our study region, and that 76% of respondents perceive otters as damaging fishing activities.

Despite well documented fishermen-giant otter conflicts (Duplaix, 1980; Bisbal, 1993; Gómez and Jorgenson, 1999; Recharte et al., 2008; Rosas-Ribeiro et al., 2011) there are no studies reporting socio-economic (such as education level and age) influences on perceptions towards giant otters in riverine communities. Although inference from our sample of 41 riverine residents is limited, the sample included all permanent residents in and around FLONA. As such, our results present a complete representation of the riverine population in the study area.

Our results suggested that older respondents and those with the longest time in education were less likely to dislike otters and to consider giant otters as damaging income or fishing activities. However, these variables were not strong predictors of perceptions in our analyses. We believe that this is partly explained by the profile of the respondents who were in general very similar (i.e., all male, principal income generators, and frequent fishers). These similarities mean that we would not expect to find strong differences in perceptions towards giant otters in the study area. The most surprising result was the widespread negative perceptions and the intensity of kills of giant otters. Based on our interview data, we found

Table 2 – Predictors of perceptions towards giant otters. GLM model results (coefficients with associated Z values in parenthesis) of perceptions towards giant otters from 41 interviews with riverine residents in the eastern Brazilian Amazon. Perceptions represented by 4 binary response variables i) “Dislike” (whether respondents mentioned giant otter as a disliked animal), ii) “Problem” (whether respondents had ever encountered a problem with giant otters such as damage to fishing nets), iii) “Damage income” (whether respondents mentioned giant otters as damaging the family income), iv) “Damage fish” (whether respondents mentioned giant otters as species that damaged fishing activities).

	Dislike		Problem		Damage income		Damage fishing	
	Full	Best	Full	Best	Full	Best	Full	Best
Age (years)	-0.066 (-1.38)		0.006 (0.203)		-0.060 (-1.54)	-0.060 (-1.629)	-0.052 (-1.35)	-0.047 (-1.37)
Distance to FLONA (km)	-0.027 (0.60)		0.012 (0.394)	0.010 (0.353)	-0.001 (-0.03)		0.031 (0.91)	
Education (compared with illiterate)								
5 or less years	1.861 (0.01)	1.821 (0.01)	-0.558 (-0.57)		0.342 (0.25)		-0.672 (-0.65)	
6 to 10 years	0.178 (0.00)	-0.000 (0.00)	-1.540 (-1.35)		0.492 (0.30)		-2.142 (-1.67)	
Principal income (compared with fishing)								
Agriculture	0.825 (0.53)		-0.121 (-0.09)		1.253 (0.87)		-1.726 (-1.41)	
Other	-0.858 (-0.66)		0.477 (0.48)		0.535 (0.47)		0.853 (0.69)	
Model Deviance explained (%)	28.81	19.21	4.84	0.26	11.33	8.28	16.98	4.64
Model AIC	35.64	30.56	59.38	51.56	44.27	35.31	51.82	47.44
Model significance	0.188	0.054	0.889	0.724	0.695	0.093	0.258	0.146

that a minimum of 0.6 giant otters per 10 km of river had been killed in the past five years in a relatively short river stretch (ca. 86.1 km).

For a long lived species such as giant otters (Carter and Rosas, 1997) with a complex social structure (Duplaix, 1980; Davenport, 2010), human induced mortalities may strongly influence (both directly and indirectly) the long-term persistence of the species in the area. In an area of the Peruvian Amazon where the giant otter population was increasing, hunters and fishermen rarely hunted the species due to limited markets and/or uses (Recharte Uscamaita and Bodmer, 2010). In our study area, we have no published historical or recent data on the giant otter population. Thus, further studies must be conducted in order to evaluate if the giant otter population is increasing, stable or decreasing and the potential impact of the kills around the protected area.

Previous studies have demonstrated that inappropriately managed tourism can threaten giant otter populations within protected areas (Schenck and Staib, 1992). Tourism does not occur in our study area and our results suggested that the activities of local residents within and around the protected area (FLONA) are the major threats to giant otter populations. Proximity to the protected area did not strongly influence perceptions towards giant otters in the study area. Additionally, reported kills of giant otters were also widely distributed. Although the protected area does not appear to influence negatively the perceptions towards giant otters, it is also not increasing the positive answers of the interviewees.

The protected area (FLONA) is a sustainable-use reserve, which is supposed to be sustainable for both people and wildlife species. Considering the regional socio-economic context (all riverine residents have a low income and, in general, low education level), a positive management action for FLONA would be a closer engagement with the human population particularly to encourage and support the adoption of sustainable activities (e.g., extraction of non-timber products) within and around FLONA. If such activities were coupled with environmental education we believe that a truly sustainable co-existence between local community and giant otters could be achieved.

More standardized studies that apply detailed questionnaires are needed throughout the species range. For example based on questions involving lists of most liked and disliked animals in another study region in the Brazilian Amazon, Norris and Michalski (2009), found that landowners had neutral attitudes towards giant otters. However, here we showed that the simple question generating a list of animals that were liked and disliked on its own is not sufficient to assess perceptions. Although we believe that conclusions from Norris and Michalski (2009) are valid as landowners in the same region never cited giant otters as a species that damaged income in a larger set of interviews (n=236, Michalski et al., 2006), future studies should adopt more detailed questions such as those presented here.

With the expansion of human settlements across the Amazon, our conclusions highlight the importance of detailed studies that could provide information in order to focus conservation efforts in areas with potential human-otter conflicts. This detailed information is required to inform the development and application of environmental education activities and facilitate the sustainable development of livelihoods and local communities within and around the expanding network of sustainable-use reserves.

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RÉSUMÉ

PERCEPTIONS ET IMPLICATIONS LOCALES POUR LA CONSERVATION DE LA LOUTRE GEANTE (Ptenonura brasiliensis) AUTOUR D'AIRES PROTEGEES BRESILIENNES DE L'EST DE L'AMAZONE

Le succès des aires protégées pour la conservation de la biodiversité dépend en grande partie de l'intégration des communautés locales et de la persistance d'espèces sauvages et de processus écologiques. Nous avons étudié les perceptions de résidents riverains d'une zone protégée pour les loutres géantes (*Pteronura brasiliensis*). Entre Mars et Décembre 2011, nous avons mené 41 interviews dans la région de la Forêt Nationale de l'Amapá (AP, Brésil). Ces dernières ont révélé une forte attitude négative à l'égard des loutres géantes, soutenu par le rapport de loutres tuées dans 12,2% des conversations. Les modèles linéaires généralisés ont montré que des années d'éducation et l'âge des personnes concernées limitent les attitudes néfastes envers la Loutre dans la zone d'étude (les personnes sondées ayant une éducation avancée et plus âgées étaient moins susceptibles de ne pas aimer les loutres et d'envisager des loutres géantes comme non préjudiciables pour leurs revenus ou pour les activités de pêche). Ces résultats suggèrent que pour conserver des loutres géantes dans cette région, les efforts devraient se concentrer sur l'éducation environnementale et les projets de recherche à long terme.

RESUMEN

PERCEPCIONES LOCALES E IMPLICACIONES PARA LA CONSERVACION DEL LOBO DE RIO (*Pteronura brasiliensis*) ALREDEDOR DE ÁREAS PROTEGIDAS EN LA AMAZONIA ORIENTAL DEL BRASIL

El éxito local de áreas protegidas para la conservación de la biodiversidad depende en gran parte en asegurar la integración de comunidades locales y la persistencia de la vida silvestre y procesos ecológicos. Investigamos percepciones de gente local viviendo alrededor de un área protegida de uso-sostenible hacia el lobo de río (*Pteronura brasiliensis*). Entre Marzo y Noviembre 2011, llevamos a cabo 41 entrevistas con los residentes ribereños de la región del Bosque Nacional de Amapá (AP, Brasil). Estas entrevistas revelaron una fuerte actitud negativa hacia el Lobo de Río, resaltado por los informes recientes que nutrias fueron asesinadas en un 12,2% de las entrevistas. Modelos lineales generalizados mostró que los años de la educación y la edad predice débilmente las actitudes hacia las nutrias en la zona de estudio (es decir, los encuestados con más tiempo en la educación y los mayores de edad eran menos propensos a rechazar las nutrias y considerar a lobos de río como perjudicial a sus ingresos o las actividades de pesca, respectivamente). Estos resultados sugieren que para conservar el lobo de río en la región se debe enfocar en la educación ambiental y proyectos de investigación a largo plazo.

A R T I C L E

RESTORATION OF THE OTTER HABITATS IN LUXEMBOURG AND BELGIUM: 5-YEAR ACTIONS IN FAVOUR OF THE EURASIAN OTTER (*Lutra lutra*)

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Abstract: In 2005, 7 partners including 5 Nature Parks (Haute-Sûre, Haute-Sûre Forêt d'Anlier, Our, Hautes Fagnes-Eifel, Two Ourthes), the Hëllef fir d´Natur foundation and the Centre de Recherche Public (Gabriel Lippmann) proposed a LIFE-Nature Project to preserve and restore the habitats of the last otters in Luxembourg and Belgium.
This wide and cross-border project aimed to improve the otter's 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 to contribute to re-establish stable otter populations in our countries.
To reach these objectives, the following actions were defined: (1) improvement of the natural fish productivity (by the restoration of 6 spawning grounds and the removal of 21 obstacles for fish migration), (2) decrease the impacts related to the presence of cattle alongside rivers (installation of 262 drinking troughs, 61 km of fences, 23 footbridges), (3) promotion of native tree species by the early cutting of spruce forests in floodplains (150 ha), (4) exploitation of the woods while respecting watercourses, (5) stimulation of connections between catchment's areas by planting the riverbanks with native trees and shrubs (23 km) and the digging of ponds (178), (6) installation of secure passageways under bridges for the otter but also for small mammals (the management of 9 otter passages), (7) creation of nature reserves (105 ha) and otter havens (31) and finally (8) management of invasive plants (189 ha) in the Natura 2000 areas.
Public awareness was also an important element of the project with the production of a travelling exhibition and an educational file. Moreover, a network of otter observers composed of volunteers was set up to try to find footprints and spraints in the study area between 2007 and 2010.

Keywords: restoration of habitats; public awareness; LIFE-Nature project; Eurasian otter

INTRODUCTION

The Eurasian otter (*Lutra lutra* L.) is an endangered mammal in Western Europe in other regions as well as Luxembourg and the South-east of Belgium

(Walloon Region). Since the beginning of the 1990s, otter populations in France, Germany, England, and other European countries have recolonized a part of the previous distribution area from which it had disappeared during the first half of the twentieth century (Bouchardy, 2001). This is partly a consequence of its protected status by the Berne Convention (1982). In the process of their recolonization, otters mostly used large rivers as migration corridors. For this reason, it appears very important to improve the otter habitat quality in order to allow its dispersal without reintroduction programme.

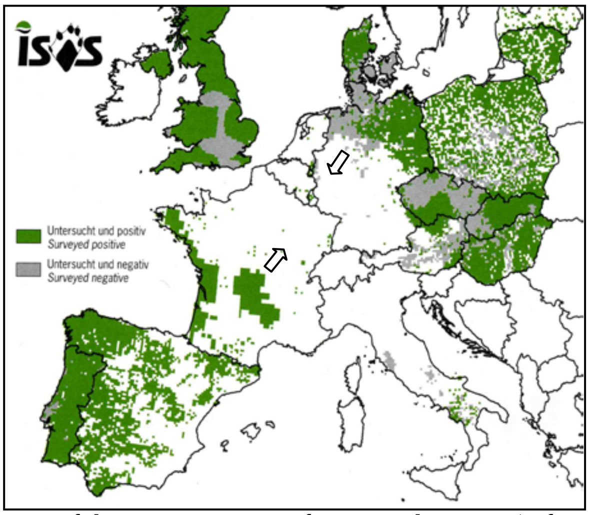

Figure 1. Distribution map of the Eurasian otter referring to the ISOS (Information System for Otter Surveys) databank system (UTM grid 10 km, period 1999-2003) (Reuther et al., 2004).

Until the 1990's and even later, the otter was considered as very rare in Luxembourg and in the Walloon Region (Reuther et al., 2004) (Fig. 1). Only a few individuals were present along the Sûre and the Our Rivers, the two Ourthes Rivers, and the Semois River. These individuals seemed to lead an erratic life and were not likely to encounter each other (Groupe Loutre Luxembourgeois, 1994).

In 1994, the Otter Group in Luxembourg assessed the quality of river habitats for the otter. The results of this study demonstrated that only 40% of the rivers in Luxembourg were suitable for otter populations (Groupe Loutre Luxembourg, 1997). Furthermore, contamination levels of PCBs in fish, an important food resource for the otter, were considered as critical (more than 150 ng PCB/ng fresh body weight) in numerous rivers according to the critical threshold level defined by Leonards et al. (1994). Therefore, all these habitats were considered as potential habitats with risks. In order to improve the situation, some actions were undertaken along the Upper Sûre River to improve the otter habitat and indirectly the water quality: planting of indigenous trees (willows and alders) along riverbanks and setting up of "otter havens" conventions to involve private owners in the protection of natural structures of the river and to avoid human disturbance.

Ten years later, 7 partners (3 of Belgium and 4 of Luxembourg) submitted a LIFE-Nature project to restore otter habitats in the North of Luxembourg and the Southeast of the Walloon Region (Fig. 2). The study area comprised the upper part and the mid part of the Sûre River, the basins of the Two Ourthes Rivers and the Our River.

The main objectives of this cross-border project were to:

1. Assess the quality of otter habitats and threats (water quality, refuges, contaminants, potential risks like traffic road accidents, etc),

2. Improve otter habitats with management measures such as the installation of fences along riverbanks, drinking troughs and mitigation measures under bridges, etc,
3. Protect the last otters in Belgium and in Luxembourg,
4. Facilitate the otter migration and try to restore corridors between the two main western European otter populations

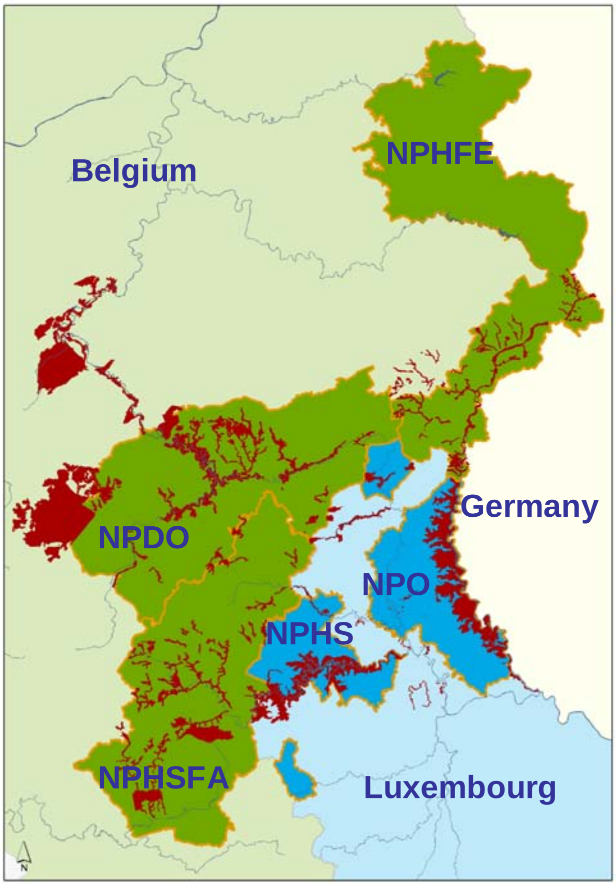

Figure 2. Map of the study area: red surfaces represent Natura 2000 areas.

METHODOLOGIES

To implement mitigation measures on the area covered (Fig. 2), some prior investigations were carried out to assess existing habitats for the survival of otters and define areas of priority where actions should be focused in order to enhance the quality of these habitats. This process followed a recognized and adapted methodology. In the same way, a European and standardized survey method was used to follow the evolution of the otter population in Luxembourg and in the South-east of Belgium.

The food quality (especially fish that represent 80 % of the otter's food sources) was also assessed.

These three methodologies are described hereafter:

Assessment of otter habitats and black spots

The methodology used (Schmidt et al., 2008) was adapted from Libois (2000) and consists of noting and assessing all the structures (woodheap, brambles bush and willows clump, etc) on both sides of the riverbanks. A value is established for the different structures, according to the proximity of the river (5 or 10 metres), the presence of potential disturbances (e.g. a road or a camping site), the presence of remarkable features of the structure (e.g. burrows, cavities in trees,), which allows otters to live there in quiet conditions during the day at least. All these data were encoded in a Geodata base with point feature classes. This database is connected to a Geographic Information System (GIS, Arcmap) to elaborate maps and statistical models.

The assessment of the habitat quality was based on the number of remarkable structures present in an area of 500 m^2. The habitat potentiality was defined upon the possibility for one otter to find a quiet place during the day.

On the basis of the numbers of structures per square of 500 m side length, priorities of habitat restoration by river sector were defined by considering at least three successive squares (Fig. 3).

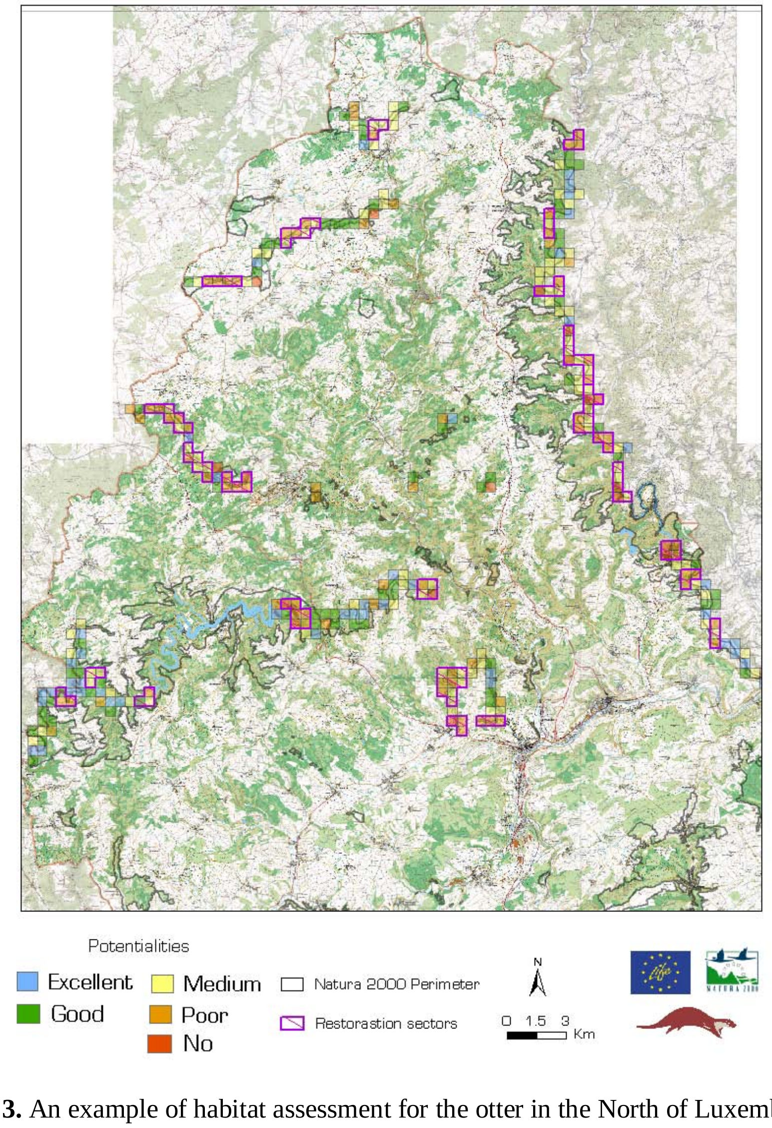

Figure 3. An example of habitat assessment for the otter in the North of Luxembourg (restoration priority areas are in pink).

The selection of the priority areas enables an adequate management of the different mitigation measures proposed. Furthermore, this databank integrated the data concerning black spots like coniferous forests, water access for cattle, sewage effluent, erosion of riverbanks and dangerous bridges.

Standardised survey of the European Otter populations

To document the evolution of the otters' population in the study area on the basis of otter tracks and spraints mapping, we used the Information System for Otter Surveys (ISOS) developed by Reuther et al. in 2000 as a standardized and European methodology. It utilizes a UTM (United Transversal Mercator) grid with squares of 10x10 km (Fig. 4) divided in four squares of 5x5 km where one survey is done between September and April, every three years. This survey has a total stretch of 600 m along one side of the riverbank.

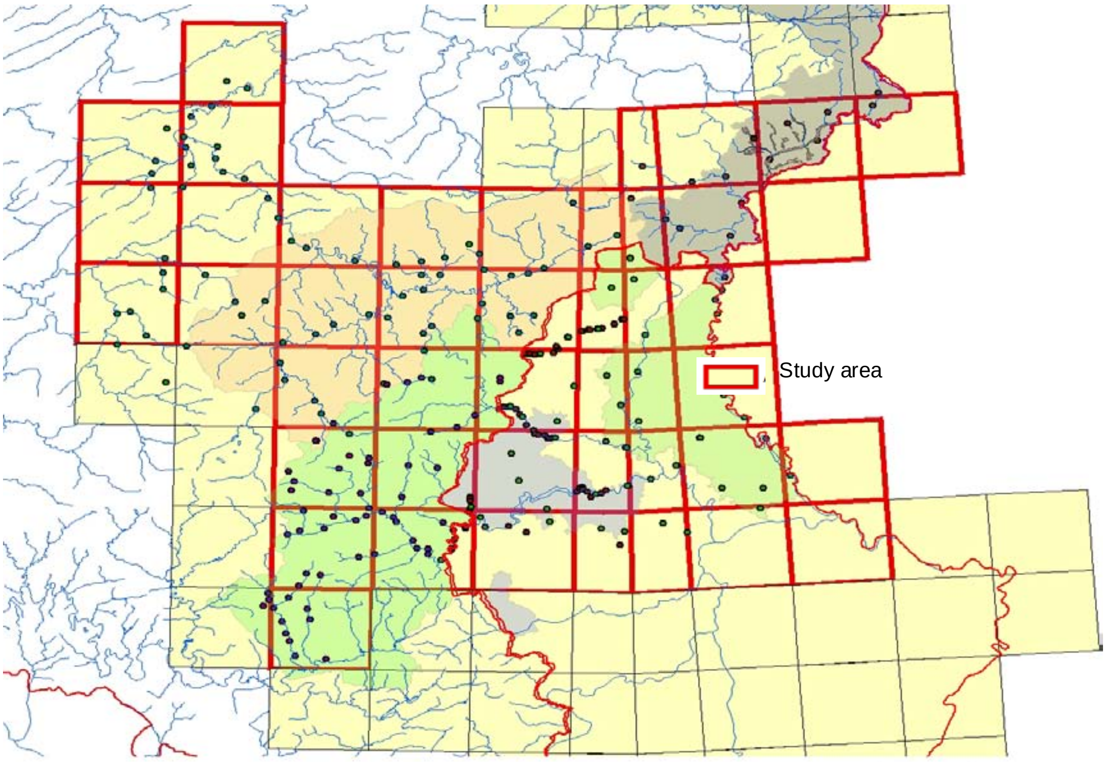

Figure 4. Application of the ISOS methodology to the study area (squares of 10x10 km)

The simplified ISOS methodology integrating 16 sites in the square of 10x10 km was also used to intensify the investigation. In this case, the survey was made yearly around each spot check.

Assessment of the evolution of contaminants in fish

To assess the contamination in fish, a study of the content of polychlorinated biphenyls (PCB), heavy metals (cadmium, chromium, mercury and lead) and pesticides (DDD, DDT, DDE) was carried out in 1994 on four species of fish: the barbel (*Barbus barbus*), the chub (*Squalius cephalus*), the eel (*Anguilla anguilla*) and the stone loach (*Barbatula barbatula*) in 20 sites and in 2007 with the same species and parameters essentially to compare the evolution of these contaminants.

RESULTS

Globally, the action's realisations generally surpassed the objectives defined at the beginning of the project (Table 1).

Table 1. Global results of the LIFE-Nature project: objectives at the beginning and realisations at the end of the project after 5 ½ years.

Type of action	What was planned	What was carried Out	% of realisation
The restoration of damp floodplains by:			
The clearing of softwoods and restoration of floodplains (ha)	133	150	113 %
The digging of ponds (number)	40	178	445 %
The purchasing of land for the creation of nature reserves (ha)	57	105	184 %
The collaboration with farmers by:			
The installation of fences along waterways (Km)	54	61	113 %
The of installation of drinking troughs (number)	96	163	169 %
The installation of footbridges for cattle (number)	14	23	164 %
The planting of hedges or trees along streams (Km)	28	23	82 %
The layout and management of watercourses by:			
The restoration of spawning grounds and backwaters (number)	8	7	87 %
The removal of obstacles for the fish migration (number)	20	21	105 %
The creation of otter havens (number)	25	31	124 %
The installation of artificial burrows (number)	9	9	100 %
The secure passageways for mammals under road bridges (number)	7	9	128 %
The management of invasive plants: the Giant hogweed, the Himalayan balsam, spireas, the Japanese knotweed (ha)	96	189	197 %

The percentage of realization was often above 100 % (between 100 % and 445 %) except for the planting of hedges (82 %) and the restoration of spawning grounds (87 %).

The lack of plantation of hedges is principally due to the low acceptance by farmers of this kind of management in farming. The restoration of spawning ground and backwaters needs a lot of time for the feasibility study, for convincing the owners and for obtaining all the authorizations to carry out the management. The possibilities of the project were limited in this respect. Hereafter, the detailed results of the project are presented.

Water quality and fish contaminants

Between 1995 and 2007, in many cases, the level of PCBs was clearly decreasing compared to the study carried out in 1995 (Hugla *et al.*, 1998). However, this decrease is very variable from site to site and species to species (stable to 10 times more).

To assess the impact on the otter, the level of contamination of PCBs in otter livers potentially feeding on these fish was predicted with a mathematical model. The conclusion was that the current situation could affect the reestablishment of the otter population in this area (Boscher et al., 2010).

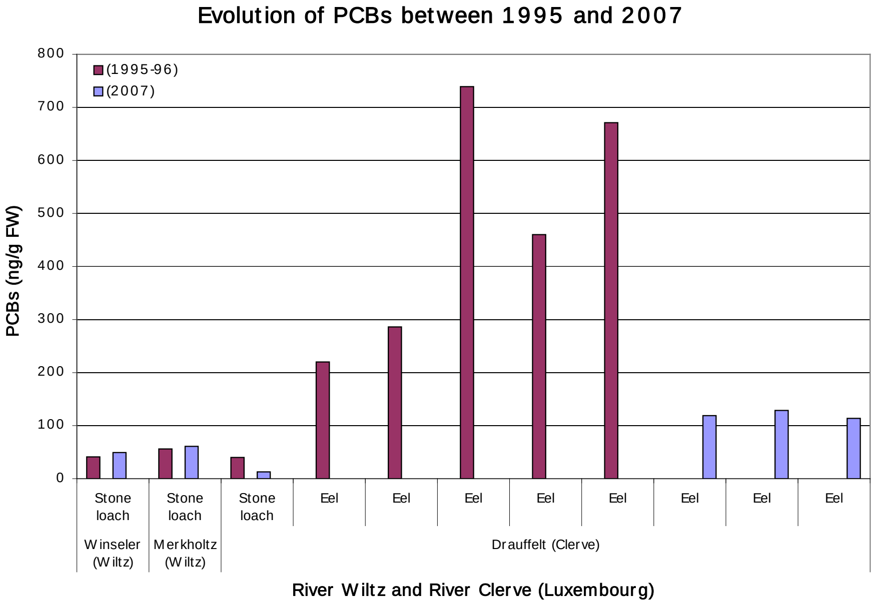

Figure 5. Level of PCBs in eel and stone loach in the Wiltz and the Clerve Rivers. Comparison between 1995-1996 and 2007

Cadmium and mercury concentrations in fish were found to be above the recommended value for the otter in some rivers of Luxembourg (the Our, the Wiltz and the Clerve Rivers) (Boscher et al., 2010) and Belgium (the Our and the Two Ourthes Rivers) (Boscher et al., 2008). The evolution of the pesticides concentrations in fish is quite the same as for PCBs: a decrease of about 10 times the concentration from 1994 and in some cases under the detection level (Boscher et al., 2008).

These results were used to achieve an otter action programme plan to enhance the water quality (a sewage treatment plan) and to try to locate and eliminate micropollutant sources (PCBs and heavy metals).

Protection of otter habitats and potential resting places

The first objective of the project was to protect the capacity of resting places and favourable ecosystems for the otter, such as meadows of wetlands and alder river forests. To achieve this objective, about 105 ha of land were acquired for the creation of natural reserves (the initial objective was 57 ha). Moreover, agreements with private owners and associations were initiated to create 31 otter havens (Fig 6).

Figure 6. Examples of otter havens along the Upper Sûre and Our Rivers

Otter havens consisted of 30 years long agreements signed with private owners and nature conservation associations in order to protect habitats of the otter, avoid human disturbance (noise, accidental trapping, dogs wandering, etc) and maintain riverbanks in natural conditions.

Restoration of humid floodplains to enhance quality of the otter habitat

The presence of spruce plantations in floodplains reduces the possibility of natural habitats favourable for the otter, like bramble bushes and reed-beds. The restoration of floodplains was carried out by an earlier deforestation of about 150 ha of spruce stands in the study area (Fig. 7). With financial compensation established in an agreement signed on a voluntary basis for 30 years, private owners accepted to do an early cutting and to replant only softwoods like alders, willows, ashes, maples.

Figure 7. Example of an early cutting of spruce plantations along the Ourthe in an area of 8 ha (situation before and after)

Some sites were bought and used as nature reserves with a natural reforestation, extensive meadows or a combination of both. Their management was assigned to the Walloon Administration (Nature and Forestry Department) in Belgium respectively to the *Hëllef fir d´Natur foundation* in Luxembourg.

Protection and management of the riverbanks

Livestock grazing can damage riverbanks and have a negative impact on the water quality. To solve this problem, the free installation of fences, drinking troughs and footbridges was offered to farmers (Fig. 8). In exchange, owners have to maintain the material and control it once a year. These conditions are described in a 5-year long agreement. Furthermore, the planting of trees on the riverbanks was proposed to avoid soil erosion.

Figure 8. An example of cattle water access (on the left) solved with the installation of a fixed fence, a solar drinking trough and plantations (on the right) along the riverbank of the Troine River

The result of this action consisted in: the installation of 61 km of fences, 263 drinking troughs and the plantation of 23 km of young trees (alders and willows mostly) on the riverbanks, on a width of about 3 to 5 m.

Enhancement and diversification of the food resources

One of the most important targets of this project was to restore the natural productivity of the watercourses in the study area. To this end, 7 spawning grounds were restored (Fig. 9), 21 obstacles for fish migration were removed (Fig. 10) and 178 ponds were dug (Fig. 11).

Figure 9. The spawning ground to Afru along the Ourthe River, before and after the restoration.

Figure 10. The removal of a concrete obstacle on the Wiltz River (before and after the work).

Figure 11. Examples of new ponds dug in 2010 and 2011 along the Wiltz and the Wark Rivers

These kinds of management measures are likely to enhance (1) the fish mobility, which is necessary for the reproduction and the genetic mixing of fish populations, (2) the spring spawning possibilities for the pike and white fish in backwaters, and (3) the number of favourable sites for amphibian reproduction.

Improvement of the living conditions for the otter

In most European countries, the highest mortality rate for the otter is due to road accidents (from 40 to 80 %) (Etienne, 2005). To avoid or minimize these risks, an assessment of the danger at 245 bridges was made in 2006 and 2007. Seventy of them were considered as dangerous. Considering the intensity of the road traffic, a rigorous selection of the most dangerous bridges was done. Nine of these bridges were equipped with passages and fences to direct the animals under the bridge or in the culvert (Figs 12 and 13).

Figure 12. Example of a culvert passage with fences along the Troine River (Neimillen).

Figure 13. Example of a local stone passage under a bridge along the Wark River (Welscheid) (before and after the work)

To enhance the availability of resting places and reproduction burrows, 9 artificial otter holts were installed in otter havens (Fig. 14).

Figure 14. Examples of otter holts made of wood or in recycled plastic. On the right, result of the setting along the Wark River

These holts can be used by other species such as the polecat. The durability of the structure is about 20 years for wood and 100 years for plastic.

Moreover, improving the otter's habitats means preserving the indigenous vegetation like bramble stands and prickly bushes, and clumps of willows that are used by the otter as shelter during the day. To avoid the degradation of these riverside structures by invading plants like the giant hogweed (*Heracleum mantegazzianum*), the Japanese and the Sakhalin knotweeds (*Fallopia japonica*) (*Fallopia sakhalinensis*), different species of spireas (*Spirea spp*.), and the Himalayan balsam (*Impatiens glandulifera*), about 189 ha of invasive plants were managed during 5 ½ years. These measures (pulling up of hogweed roots, mowing of balsams and spireas, etc) (Fig. 15) were made principally along the Two Ourthes Rivers in Belgium and on the Our and the Upper Sûre Rivers in Luxembourg with the collaboration of a lot of partners (administrations, volunteers, municipalities. etc).

Figure 15. Illustration of the treatment of invasive plants (Sakhalin knotweed on the left, Giant hogweed in the centre, spireas on the right).

The results of these treatments were divergent, from about 70 % of eradication with the Himalayan balsam and the spireas to more than 90 % with the Giant hogweed. There were real difficulties with the two knotweeds (two times a year mowing and then covering with a tilth) because of the dense root system of this plant.

Public awareness and education

At the start of the project, a call was made for volunteers to create a network of otter track observers. About 316 people were trained to recognize footprints and excrement of mammals living along the watercourses. About 120 volunteers were involved in the observers network at the beginning in 2008. Each member of the network was assigned to cover a square of the ISOS method in 2008 and in 2010. Otter tracking "Weekends" were also organized for training and exchanging

information in the volunteer group. Furthermore, a mammal track's guide was published in French and German languages in order to be used in the field.
Despite the fact that neither tracks, nor otter spraints have been found in the study area, more than 700 data on mammal presence information were collected and encoded in a database of the Walloon Region and Luxembourg. Three photo traps placed under bridges managed to pick up some photos of different mammals but still no otters (Fig. 16).

Figure 16. During the night, pictures of a stone marten, a wild cat and a fox

To reach the objective of awareness of the general public two educational tools were developed and used: an educational file "On the tracks of the otter" and a travelling and interactive exhibition (Fig. 17) produced with the help of teachers and educational specialists. More than 4200 people and 2800 pupils participated in information and educational activities between 2005 and 2010.

Figure 17. Illustrations of the educational file and the travelling exhibition

DISCUSSION AND CONCLUSION

Despite the fact that the project objectives were reached far beyond the initial planning, a lot of work remains if the black spots assessment and the percentages of realization are compared (Table 2). These percentages vary from 2.3 to 76.5 %, indicating that there are high deviations between the results of actions in the different perimeters.

This variation is principally due to the acceptance of the project and the sensitisation of the people concerned (farmers, private owners,), but also to the large amounts of black spots assessed at the beginning of the project in the different perimeters.

If most of the risks of road accidents along bridges from the principal watercourses have been reduced, the connections studies (Degen, 2008; Tock, 2008) have emphasised that passages between catchments remain dangerous for the otter in case of migration. Thus, for example, about 10 bridges that need to be managed were identified in order to avoid road accidents in the Sûre catchments.

Different authors (Kruuk, 2006; Reuther, 2004) mentioned risks that could affect the conservation of the Eurasian otter: problem of availability of water, of food and habitat, pollution burden, difficulties of exchange and expansion, density of road traffic, etc.

Table 2. Balance sheet of the managed black spots in the different catchment perimeters in the study area of the project.

Balance sheet of black spots												
	Water access for cattle			Lack of fence along rivers (km)			Spruce surfaces (ha)			Obstacles to fish migration		
Nature 2000 area	Inventory	solved	%	Inventory	solved	%	Inventory	solved	%	Inventory	solved	%
Perimeter 1 - Belgian Our catchment												
BE33059	25	3	12%	9.52	3.98	42%	15.39	0	0%	21	0	0%
BE33061	no inventory							14				
BE33062	31	0	0%	11.57	0.37	3%	25.23	0	0%	16	0	0%
BE33063	8	0	0%	1.27	0	0%	1.17	0	0%	2	0	0%
BE33064	8	0	0%	3.84	0.43	11%	11.77	4	34%	4	1	25%
BE33065	40	0	0%	11.76	0	0%	28.59	0	0%	10	0	0%
TOTAL	**112**	**3**	**12%**	**37.96**	**4.78**	**13%**	**82.15**	**18**	**22%**	**53**	**1**	**1.9%**
Perimeter 2 - Two Ourthes catchment												
BE34003	no inventory											
BE34008	no inventory											
BE34012	17	11	65%	1.474	1.595	108%	8.5	0.62	7%	3	0	0%
BE34023	6	3	50%	1.343	0.763	57%	55.8	3.33	6%	2	0	0%
BE34024	31	8	26%	2.662	2.941	110%	287.6	42.60	15%	6	0	0%
BE34029	no inventory			0								
BE34031	95	31	33%	14.89	16.612	112%	27	11.70	43%	4	0	0%
BE34032	6	5	83%	0	1.273		104.3	13.70	13%	1	2	200%
BE34033	17	0	0%	3.622	0	0%	6.6	0	0%	4	0	0%
BE34034	no inventory											
TOTAL	**172**	**58**	**34%**	**23.991**	**23.184**	**97%**	**489.8**	**71.95**	**15%**	**20**	**2**	**10%**
Perimeter 3 - Belgian Sûre catchment												
BE34035	42	6	14%	8.07	2.714	34%	10.83	2.55	24%	6	0	0%
BE34039	72	12	17%	44.58	7.269	16%	82.67	22.32	27%	14	4	29%
BE34040	14	4	29%	5.56	1.662	30%	24.32	1.81	7%	3	0	0%
BE34041	14	0	0%	2.42	0	0%	16.86	2.90	17%	9	0	0%
BE34051	17	4	24%	9.91	2.942	30%	56.28	9.88	18%	8	1	13%
TOTAL	**159**	**26**	**16%**	**70.54**	**14.587**	**21%**	**190.96**	**39.46**	**21%**	**40**	**5**	**13%**
Perimeter 4 - Luxemburgish Our catchment												
LU0001033	no inventory						0					
LU0001038	16	0	0%	3.05	0.075	2.5%	3.37	3.625	107.6%	9	0	0.0%
LU0001042	no inventory						0					
LU0001043	no inventory						0					
LU0001002	44	3	6.8%	11.86	0.725	6.1%	14.72	0.909	6.2%	2	0	0.0%
LU0001003	47	8	17.0%	9.9	1.247	12.6%	10.31	0.529	5.1%	25	11	44.0%
TOTAL	**107**	**11**	**10.3%**	**24.81**	**2.047**	**8.3%**	**28.40**	**5.063**	**17.8%**	**36**	**11**	**30.6%**
Perimeter 5 - Luxemburgish Sûre catchment												
LU0001005	18	6	33.3%	9.38	2.26	24.1%	5.03	0.414	8.2%	28	2	7.1%
LU0001006	1	0	0.0%	0.374	0	0.0%	0.71	0	0.0%	4	0	0.0%
LU0001007	16	11	68.8%	8.44	5.873	69.6%	9.47	15.129	159.8%	23	0	0.0%
LU0001008	7	2	28.6%	5.65	1.654	29.3%	3.53	0	0.0%	16	0	0.0%
LU0001051	17	2	11.8%	6.53	0.54	8.3%	2.98	0	0.0%	15	0	0.0%
TOTAL	**59**	**21**	**35.6%**	**30.37**	**10.327**	**34.0%**	**21.72**	**15.54**	**71.5%**	**86**	**2**	**2.3%**

In the study area, there is in general enough water, habitat and food supply. However, problems due to road traffic in the connection areas and contamination by pollutants (PCBs, heavy metals) remain potential risks for the otter and are the most important to be solved.

The possibilities of recolonization are noticeable but have to be improved with other connections like the Semois River, the Low Sûre River and the Moselle River. In consequence, a transnational otter action plan has been set up for the next 10 years in order to manage these connections (Plan loutre, 2011-2021).

Some actions like the restoration of floodplains by the earlier deforestation of spruce stands and the management of invasive plants seem to have a more indirect and long terme impact on the otter conservation and a more direct impact on biodiversity and diversity of habitat of the otter.

An important objective for the future is to maintain the different structures and tools generated by the project. This includes the activities of the observers' network, the monitoring of otter passages and artificial holts, the application of the different agreements signed with farmers and private owners, and the use of the interactive and educational exhibition. This kind of activity enacted by the European Commission is essential to follow the return of the otter and guarantee the durability of the measures of the LIFE project after its official term (After LIFE project).

About the different actions made, it is also of consequence to know which are relevant and which are secondary. It is for example useful to see if artificial otter holts are well installed and used. In this point of view, artificial holts have to be located where there is little natural cover and minimal disturbance by humans and particularly by dogs (Sussex Otters and Rivers project, 2008). The future monitoring has to confirm if these managements were useful and optimal or not.

What are the main conclusions and lessons to be learned from this LIFE-Nature project?

To reach the predefined objectives, it is really important to begin early the sensitization of the population, to convince farmers, private owners and administrations to participate actively in the project. Quick and concrete examples of achievements are important to immediately give a positive image of the project in order to involve other farmers and private owners. Motivated partners who are likely to push forward the project are essential. With 7 partners, 20 different actions and a budget of 3,891 million Euros, it is necessary to have a good coordination, to be flexible and adapt the objectives and budgets of the different actions depending on the assessments and new targets that could be defined during the process. Thus, the European Commission accepted three codicils of the project to adapt and reach the modified objectives per action.

Fourteen people have worked together on the project with different expertise. However, some particular aspects of the project (the building of otter passages, the concept of the travelling exhibition, the cutting of spruces, the writing of agreements, etc) necessitate different skills, among others technical and jurist advice. The cross border particularities of this kind of project are relevant but not always easy to manage. To assure the achievement of the different tasks, a coordination structure was based on a cross border technical committee, two national follow up committees and one cross border follow up committee, which was composed of different administrations, ministries and partners of the project.

To avoid overlap of actions between projects, it is helpful to have exchanges with other LIFE or Interreg projects by comparing methodologies and aims as well as to find potential synergies.

Otter conservation and management without a real population is a challenge for the future and the return of this species in our countries.

ACKNOWLEDGEMENTS - First of all, we would like to thank the European Commission, the Ministry of Sustainable Development and Infrastructures (MDDI), the Ministry of Home Affaires and the Greater Region (MIGR) of Luxembourg and the Walloon Region (Agriculture, Natural Resources and Environment Operational General Department) for the financial support in the framework of the LIFE-Nature project (LIFE05 NAT/B/000085). We also thank Dr R. Libois and V. Schockert for their scientific support on otter habitat methodology and Prof. J.P. Thomé (University of Liège, B) for PCB, heavy metal and pesticide analyses in fish from the Walloon Region, the Aktion Fischotterschutz e. V. (D) for their scientific help on otter ecology training and for the nice photos we were allowed to take and use, Alterra (N) for DNA analyses of spraints. The collaboration of the different administrations and enterprises that worked with us in the field to reach the objectives of the different actions of the project is also greatly acknowledged. Finally, our gratitude goes to the farmers, private owners, teachers and volunteers who contributed to the success of this LIFE project.
In memory of Jim Conroy who supported us during the project.

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RESUME

LA RESTAURATION DES HABITATS DE LA LOUTRE AU GRAND-DUCHÉ DE LUXEMBOURG ET EN BELGIQUE: 5 ANNÉES D'ACTIONS EN FAVEUR DE LA LOUTRE D'EUROPE (*Lutra lutra*)

En 2005, 7 partenaires dont 5 parcs naturels (Haute-Sûre, Haute-Sûre et Forêt d'Anlier, Our, Hautes Fagnes-Eifel et deux Ourthes), la fondation Hëllef fir d'Natur et le Centre de Recherche Public – Gabriel Lippmann ont proposé un projet LIFE-Nature pour préserver et restaurer les habitats des dernières loutres au Luxembourg et en Belgique.

Cet ambitieux projet transfrontalier visait à améliorer les habitats de la loutre et à tenter de restaurer les couloirs de migration situés entre les deux principales populations de loutre de

France et d'Allemagne en vue de faciliter la migration des espèces et contribuer à rétablir des populations de loutre stables dans nos régions. Pour atteindre ces objectifs, les actions suivantes ont été définies et mises en oeuvre : (1) l'amélioration de la productivité piscicole (par la restauration de 6 frayères et la suppression de 21 obstacles à la migration des poissons), (2) la diminution de l'impact lié à la présence du bétail le long des cours d'eau (par l'installation de 262 abreuvoirs, la pose de 61 km de clôture et 23 passerelles), (3) la promotion d'essences arbustives indigènes par la coupe précoce des forêts résineuses situées en zones inondables (150 ha), (4) l'exploitation du bois tout en respectant les cours d'eau, (5) l'aménagement de connexions entre bassins versants par la plantation des berges à l'aide d'arbres et arbustes indigènes (23 km) et le creusement de mares (178), (6) l'installation de passages sécurisés sous les ponts pour loutre mais également pour les petits mammifères (la construction de 9 passages), (7) la création de réserves naturelles (105 ha) et de havres de paix pour la loutre (31) et finalement (8) la gestion des plantes invasives (189 ha) dans les zones Natura 2000.
La sensibilisation du public fut également un élément important du projet avec la conception et la réalisation d'une exposition itinérante et d'un dossier éducatif. Par ailleurs, un réseau d'observateurs loutre, composé de volontaires, a été mis en place afin d'essayer de trouver des traces de pas et des épreintes dans la zone d'étude entre 2007 et 2010.

RESUMEN

RESTAURACIÓN DE HÁBITATS DE NUTRIA EN LUXEMBURGO Y BÉLGICA: ACCIONES DURANTE 5 AÑOS EN FAVOR DE LA NUTRIA EURASIÁTICA (*Lutra lutra*)

En 2005, 7 instituciones (5 Parques Naturales -Haute-Sûre, Haute-Sûre Forêt d'Anlier, Our, Hautes Fagnes-Eifel, Two Ourthes), la Fundación Hëllef fir d´Natur y el Centre de Recherche Public (Gabriel Lippmann)), se asociaron para proponer un Proyecto LIFE-Nature para preservar y restaurar los hábitats de las últimas nutrias en Luxemburgo y Bélgica. Este amplio proyecto trans-fronterizo está dirigido a mejorar los hábitats de las nutrias, y tratar de construir ó reconstruir corredores entre las dos importantes poblaciones de nutrias localizadas en Francia y Alemania, para facilitar la migración de la especie y contribuir a re-establecer poblaciones estables de nutria en nuestros países. Para alcanzar estos objetivos, fueron definidas las siguientes acciones: (1) mejora de la productividad natural de peces (mediante la restauración de 6 áreas de desove y la remoción de 21 obstáculos a la migración de peces), (2) disminución de los impactos relacionados con la presencia de ganado vacuno a lo largo de los ríos (instalación de 262 bebederos, 61 km de alambrados, 23 puentes peatonales), (3) promoción de especies nativas de árboles, mediante la corta temprana de bosques de abeto en las llanuras de inundación (150 ha), (4) explotación de los bosques respetando al mismo tiempo los cursos de agua, (5) estimulación de las conexiones entre las cuencas, plantando los bancos ribereños con árboles y arbustos nativos (23 km) y excavando lagunitas (178), (6) instalación de pasajes seguros para la nutria -pero también para pequeños mamíferos-, por debajo de los puentes (manejo de 9 pasajes de nutria), (7) creación de reservas naturales (105 ha) y refugios de nutrias (31) y finalmente (8) manejo de plantas invasoras (189 ha) en las áreas Natura 2000. La concienciación pública también fue un elemento importante del proyecto, con la producción de una exhibición itinerante y un portafolio educativo. Más aún, se estableció una red de observadores de nutria, compuesta por voluntarios, para tratar de encontrar huellas y marcas en el área de estudio entre 2007 y 2010.

OSG MEMBER NEWS

OSG MEMBERS IN THE NEWS

- 30/01/12: **Saving the world's biggest river otter:** Jessica Groenendijk talks to Monga Bay about conservation of *Pteronura brasiliensis* in Peru.
- 22/02/12: **On sea otters, we need to see the big picture**: Jim Estes discusses the conflict between otter conservation and abalone fishing
- 19/03/12 - 23/03/12: **Die "Wölfe der Flüsse"**: Christof Schenck talks to Radio Österreich 1 about Giant Otters

NEW OTTER „DOCTOR“:
Cristine Trinca succesfully defended her PhD entitled:
Evolutionary history and molecular ecology of the Neotropical otter (*Lontra longicaudis*) (Carnivora, Mustelidae)” at the Universidade Federal do Rio Grande do Sul in Brasil.
CONGRATULATIONS from the otter community!

NEW MEMBERS OF OSG
Brittany Blades, USA: I have worked with sea otters at two different AZA facilities, where I have had the opportunity to care for and train the otters including designing and administering enrichment devices. I plan to educate others about otter conservation through public presentations as well as sharing and learning as much I can with other zoological colleagues.

Jim Bodkin, USA: I have more than 30 years of experience leading research on the ecology and biology of sea otters and the nearshore marine ecosystems they occupy. I am interested in using my knowledge and experience to aid in efforts to conserve, manage and educate concerning sea otters and their habitats.

Antonio Canu, Italy: Naturalist and journalist, I am among the founders of the Italian Otter Group. I am an expert on protected area management (I have been head of the WWF Italy protected areas and am currently president of WWF Oasi, a company created to manage the protected areas of WWF). I have taken part in the national action plan on the otter as well as have an active role in coordinating groups for conservation programs on the Italian population. More generally I take part in conservation and awareness raising projects on the otter. I am author of several books and documents on the subject.

Alexandros Karamanlidis, Greece: Since 2010, I have been coordinating the research activities on Eurasian otters *(Lutra lutra*) of the Greek NGO ARCTUROS. A preliminary assessment of the status and distribution of the species in Lakes Zazari and Heimaditida in the Prefecture of Florina in Macedonia in northern Greece has been completed and research efforts will focus now on remote (i.e. use of infrared cameras) and genetic monitoring of the species. The aim of this phase of the project is to establish a monitoring methodology for the species that can be applied throughout the country. I am relatively new to otters, having previously worked on Mediterranean monk seals, brown bears and wolves. I am a member of the Pinniped SG, and the European Brown Bear Expert Team of the Bear SG.

Linda Nichol, Canada: I am a research biologist with Fisheries and Oceans Canada. My sea otter research involves population surveys to assess trends in population growth and range of occupation of BC's recovering sea otter population. Additional collaborative research involves examining habitat selection and use by sea otters, foraging ecology and assessment of health and disease in the population.

Catherine O'Reilly, Ireland: As part of the INTERREG 4A Ireland-Wales Project "Mammals in a Sustainable Environment" we are monitoring a number of otter populations in Ireland and Wales using genetic analysis of spraints. This project started in March 2011 and will run until the end of 2013 and is aimed at getting volunteers involved in mammal monitoring and conservation (for further details see www.miseproject.ie).

Gareth Parry, United Kingdom: I have a long-standing personal and professional interest in otters involving academic research, ecological consultation and advising direct conservation action. My particular expertise is in the field of otter dietary analysis and survey techniques, with experience on multiple otter projects throughout the UK.

Carolina Ribas, Brazil:I have been worked with giant otters in Southern Pantanal, Brazil, since 2002 with the objective of studying the social relations of the species over time. In recent years I have used molecular tools to investigate questions about kinship, paternity and molecular diversity.

Alan Shabel, USA: My current research focuses on the morphology and ecology of African otters, including both living and fossil species. I rely on anatomical and biogeochemical data to elucidate evolutionary trends in diet, behavior, and phylogenetic relationships.

Larissa Silva, Peru: My experience working with giant river otters has shown me many similarities with humans, and now I know how unprotected they are, and how much they depend on us. The more that giant river otters are very exposed and vulnerable, the more they are entitled to protection.
Gracias a las experiencias trabajando con lobos de rio, he visto muchas semejanzas con los seres humanos, y me doy cuenta cuan indefensos están y de cuanto dependen de nosotros. Cuanto más expuestos e indefensos estén los lobos de rio, más derecho tienen a ser protegidos.

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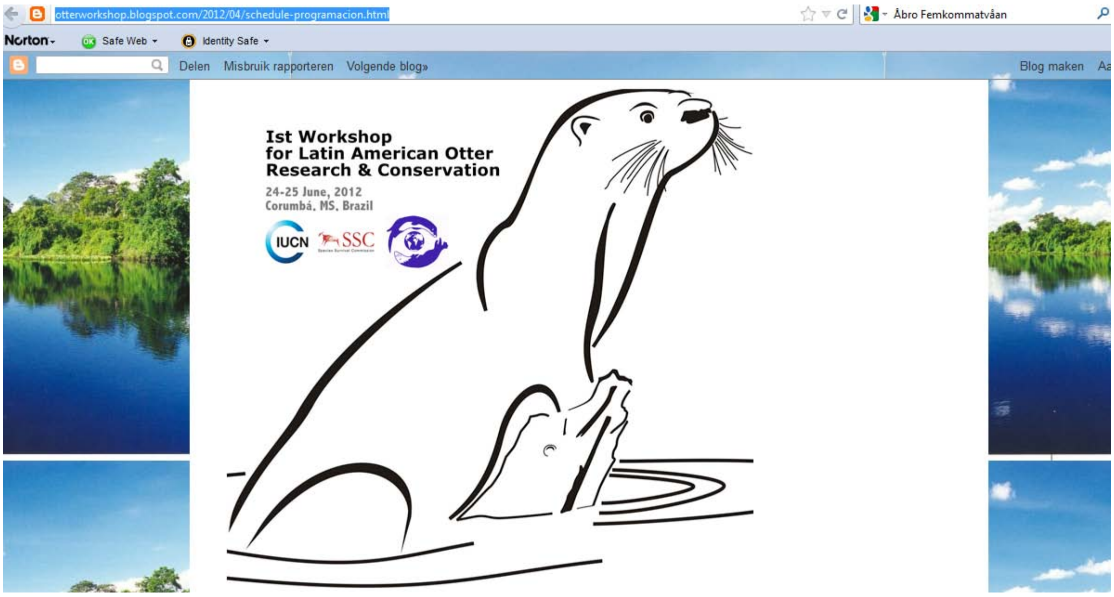


This Workshop aims to discuss in a deeper way the conservation status of each otter species in their distribution range and to improve the efficiency in collecting new data and the practical application of this information.

We also have the specific objectives of:

1. To evaluate the conservation status of all Latin-American otters in all countries of their original distribution range;
2. To define common, specific and national threats for all species;
3. To propose standard methodologies for studying Latin America otters, applicable, if possible, generally to all of them, in order to generate comparable estimates among regions and species.

For more information please visit:

http://otterworkshop.blogspot.com/2012/04/schedule-programacion.html

VIRTUAL OTTER

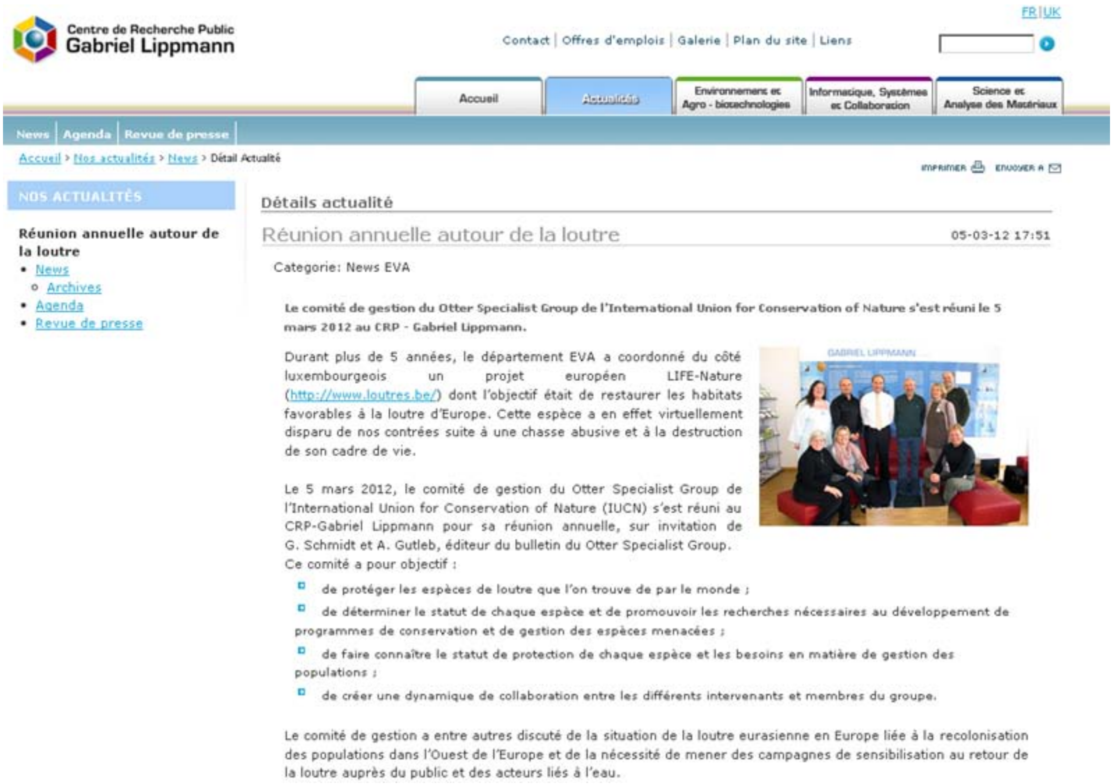
Dear all,

I just created the Neotropical Otter group in Facebook.
http://www.facebook.com/?ref=logo#!/home.php?sk=group_205422956157387&ap=1
Please join and forward to other people that may be interested.

Regards,

Marcelo Rheingantz

SCREEN SHOT OF THE MONTH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IMPRIMER ENVOYER A

NOS ACTUALITÉS

Réunion annuelle autour de la loutre

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Détails actualité

Réunion annuelle autour de la loutre 05-03-12 17:51

Categorie: News EVA

Le comité de gestion du Otter Specialist Group de l'International Union for Conservation of Nature s'est réuni le 5 mars 2012 au CRP - Gabriel Lippmann.

Durant plus de 5 années, le département EVA a coordonné du côté luxembourgeois un projet européen LIFE-Nature (http://www.loutres.be/) dont l'objectif était de restaurer les habitats favorables à la loutre d'Europe. Cette espèce a en effet virtuellement disparu de nos contrées suite à une chasse abusive et à la destruction de son cadre de vie.

Le 5 mars 2012, le comité de gestion du Otter Specialist Group de l'International Union for Conservation of Nature (IUCN) s'est réuni au CRP-Gabriel Lippmann pour sa réunion annuelle, sur invitation de G. Schmidt et A. Gutleb, éditeur du bulletin du Otter Specialist Group.
Ce comité a pour objectif :

- de protéger les espèces de loutre que l'on trouve de par le monde ;
- de déterminer le statut de chaque espèce et de promouvoir les recherches nécessaires au développement de programmes de conservation et de gestion des espèces menacées ;
- de faire connaître le statut de protection de chaque espèce et les besoins en matière de gestion des populations ;
- de créer une dynamique de collaboration entre les différents intervenants et membres du groupe.

Le comité de gestion a entre autres discuté de la situation de la loutre eurasienne en Europe liée à la recolonisation des populations dans l'Ouest de l'Europe et de la nécessité de mener des campagnes de sensibilisation au retour de la loutre auprès du public et des acteurs liés à l'eau.

The steering committee of the OSG held a meeting in Luxembourg. The event was made public on the website of the CRP – Gabriel Lippmann that hosted the meeting (see also the Chairman's Report in issue 29/2).

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SPECIES IDENTIFICATION

http://www.abro.se/produkter/ol-egentillverkad/fem-komma-tvaan/fem-komma-tvaan/

Which species of mustelids is on this beer can from Sweden?