NOTE FROM THE EDITOR

NOTE FROM THE EDITOR

Dear Friends and Colleagues!

We have just closed issue 25/2 and opened issue 26/1. The fact that we had two issues in 2008 after three intermediate years where we had only one seems to me as the proof that the online version is finally fully accepted. I really hope that this positive trend continues and Lesley and I will do our best to make the IUCN Otter Specialist Group Bulletin to a flourishing way to publish your results. The fact that all manuscripts are also uploaded to the Directory of Open Access Journals (http://www.doaj.org) will further contribute to the visibility of your results.

Thanks to Michael Belanger, Mark Bowler, Elisabeth Chadwick, Paul Chanin, Claudio Chehebar, Syed Hussain, Anna Loy, Claudio Soto Azat, Maximiliano Sepulveda, and Vania Carolina Fonseca da Silva who put efforts into improving the submitted manuscripts by doing an excellent job as reviewers. On the other hand it is also interesting for me to see who, after invitation to perform a review, is not even answering that this does not fit in the moment, something that would be perfectly fine with me. Be sure that I will not bother this small group of persons in the future with any request.

I am completely depending on the help of persons to translate the French and Spanish abstracts of all articles and I want to express my sincere thanks to Núria Martínez Carreras, Fabrice Capber, Alain Dohet, Frederic Giraud, Laurent Mercier, Gerard Schmidt, Mauricio Montaño Garces, and Daniel Scognamillo, who translated abstracts during the last months.

Congratulations to Dilian Georgiev, who recently finished his PhD on Eurasian otters in Bulgaria. Unfortunately the thesis itself is only available in Bulgarian but some excerpts of his work have already been published in the past and another piece of work can be found in this issue.

I want to remind you also on the excellent work Lesley does. Probably only I know how much work and efforts she puts in publishing the Bulletin online, how fast she changes tiny errors, last minute requests etc. and it is a great pleasure for me to do this together with her.

With regards,

Arno

OSG Group Members News

News Items Involving OSG Members

- Pathological findings in 66 wild European otters (*Lutra lutra*) in Scotland: 2007-2008 - Grace and Paul Yoxon and Jim Conroy collaborated with Adrian Philbey, Dominic McCafferty and Glen Tyler on a presentation made by Adrian at the 63rd Annual Meeting of the Association of Veterinary Teaching and Research Work, Scarborough, England, 6-8 April 2009. (PDF 2 MB)

New Members of OSG

Thus far this year, we have welcomed 15 new members to the OSG: you can read more about them on the Members-Only pages.

Masood Arshad, Pakistan: I am Programme manager for the Pakistan Wetlands Programme, organising the conservation of Wetlands Dependent Biodiversity especially the endemic Indus Dolphin, highly traded softshelled turtles, severely hunted populations of crocodile, Hog Deer and the ruthlessly killed species of otters. Pakistan is lucky to host two species of otters (Eurasian Otter and the Smooth Coated Otter). Both species are facing risk and are threatened. We have initiated efforts to conserve both the species and have worked in 2007 and also in 2008 on this programme.

Lyca Sandrea G. Castro, Phillippines: My team and I are working on surveying for Asian small-clawed otters on Palewan, Phillippines

Gareth DaBell, United Kingdom: I work with two female Asian Small-Clawed Otters at the Lakes Aquarium. I am particularly interested in the role of training in otter welfare, specifically using training to overcome behavioural problems. I also plan to privately establish an otter boarding facility for zoo otters that need a temporary home whilst a permanent home is being found for them; I can also offer behavioural assessment and modification for these animals.

Ruth Davidson, Indonesia: I am hand-raising an orphaned Asian Small-Clawed Otter cub in Jakarta. I am actively involved with informal community education about the otters in our area, and am looking into possibilties for otter rehabilitation here.

Morten Elmeros, Denmark: I work on applied research and management of mammals, focusing on carnivore population dynamics and spatial ecology, and monitoring of carnivores and bats, landscape ecology including fragmentation and fauna passages, environmental impact assessment, management plans, environmental capacity building and ecotoxicological risk assessment.

Allison Ford, USA: I am the new Executive Director of the Otter Project, looking after Sea Otters in California.

Waseem Ahmad Khan, Pakistan: By membership of this group, I hope tp fully utilize my expertise for natural resources management, specifically biodiversity conservation, environmental sustainability, Natural history museology, scientific

research, and project planning & management for a better environment in the country.

Reinhard Klenke, Germany: I work on Sustainable Development of Forest Landscapes in the Northeastern Lowlands of Germany. I am also active in analysis and modelling of habitat suitability of selected species of birds and mammals, behavioural ecology, Population ecology, Landscape ecology, Evolutionary biology, Applied computer science (Ecological modelling, Databases). I am interested in Island biogeography, Metapopulation theory and Evolutionary epistemology.

Rachel Kuhn, France:I have worked on otters for many years, in France and then in Germany at the Otter-Zentrum. My PhD is on the Comparative analysis of structural and functional hair coat characteristics, including heat loss regulation, in the Lutrinae (Carnivora: Mustelidae). I currently work for the French Mammal Society (SFEPM) on the editing of the National Action Plan for Otters.

Ivan Rubiano, Colombia: I am a veterinarian with extensive experience in the rearing and rehabilitating of orphaned Giant Otter cubs. I am an advisor to the OSG Captive Otter Taskforce.

Katrin Ruff, Germany: I did my PhD on Nutrition and energetics of otters, and am now working for OtterFranken, establishing a habitat corridor connecting the Czech Republic through Upper Franconia in Germany to Luxembourg and Belgium to connect the eastern and western European otter populations. I am nutrition advisor to the OSG Captive Otter Taskforce .

Steven Schaefer, USA: Since I was a child I have been interested in otters. I graduated from Columbia University majoring in Biology and did my course work for a degree in wildlife biology at University of Vermont. While there I did a paper on otter populations by comparing trapping records and interviewing trappers. I have recently retired from a career as a lawyer and want to get back into the Biology. I helped start a 501c (non-profit) corporation that does mostly Manatee work. I serve on the board and do a lot of volunteer work capturing, tagging and monitoring of manatees. The name of the group is sea@shore Alliance and the web site is sea2shore.org. At this point I would like to try to do a population study on the otters in this area.

Chris Shepherd, Malaysia: I have been working for TRAFFIC in Southeast Asia for many years and have been recording evidence and observations on Smooth-coated and Small-clawed Otters mainly in Malaysia. The trade in otters in Asia is a field I am having a close look at. This is becoming a huge problem, with shipments of thousands at a time becoming a regular issue, mostly coming from Myanmar, India and Bangladesh.

Aleš Toman, Czech Republic: I am the Zoologist at Jihlava Zoo and interested in captive otter husbandry and welfare. I am a member of the OSG Captive Otter Taskforce.

Rob Williams, Peru: I am the Director of Frankfurt Zoological Society's Andes-Amazon Conservation Programme and have been in charge of the Giant Otter project in Peru since 2006.

R E P O R T

EURASIAN OTTERS IN MICRO DAMS OF SOUTHERN BULGARIA: WHERE TO PLACE THE MONITORING ZONES?

Dilian GEORGIEV
Department of Ecology and Environmental Conservation, Faculty of Biology, University of Plovdiv, Tzar Assen Str. 24, BG-4000 Plovdiv, Bulgaria, e-mail: diliangeorgiev@abv.bg

(received 21st January 2009, accepted 5th March 2009)

ABSTRACT: Ten micro dam sites were studied in Southern Bulgaria between 2005 and 2007. They were situated below 700 metres above sea level in the Upper Thracian Valley and the Sredna Gora mountain. All the bank perimeters, totaling 24.72 kilometres, were walked searching for otter spraint sites. Most of them were found in the area around the river inflow (n=53, 40.5%) followed by those near the wall of the dam (n=39, 29.8%). The other spraint sites were found in the two other zones of equal length in the middle part of the basins. The average levels of preference index showed the highest levels in the river inlet and dam wall zones. They were highest at the river inflow end, 1.6 (min-max=0.7–4.0) and a little lower near the wall, 1.2 (min-max=0.0–3.0). The middle zones of the basin were not so preferentially selected as spraint sites by otters, having index values about three times lower. We recommend otter monitoring at such basins to be focused on the areas close to the main river filling them.

INTRODUCTION

The Eurasian otter (*Lutra lutra*) occurs in a variety of habitats (Kruuk, 2006) that can be divided into two groups: – permanent (used throughout the year) and temporary (used for restricted periods) (Georgiev, 2005). The so-called "standard" method for otter population monitoring was developed for rivers (Reuther et al., 2000) where 600m lengths of river are selected at intervals of 5 – 8 km and searched for evidence of otter presence. Until now it has not been adapted for standing waters (Chanin, 2003), despite some data on the otter signs occurring around lakes (Erlinge, 1967, 1968) and large dams (Georgiev and Stoycheva, 2006).

The micro dam lakes of Bulgaria are man made otter habitats built mainly during the communist regime in the country (1944-1989). According to the accepted classification by Nankinov et al. (2004) used to calculate breeding numbers of water birds in Bulgaria, these structures have a mean water surface area of 10.3 hectares (min-max = 1.01–184.42 ha) and an average perimeter of 1463.05 metres (min-max = 367.85–16124.61 m). There are now over 2000 in number (Uzunov, 1982, Nankinov et al., 2004) and is one of the possible reasons for the growth of the national otter population in the 20th century (Spiridonov and Spassov, 1989). The micro dam density is highest in lowland areas there being, for example, about 4-5 basins (min 1-2, max 10-12) per one 10 x 10 UTM grid square in the Upper Thracian Valley. These dams create more living space for otters by converting the small temporary streams into permanently usable sites. At the same time they enhance the carrying capacity of medium sized rivers by creating more suitable bank line and increase the "edge

effect" between two ecotones. This improves the habitat for fish, thereby increasing fish number and diversity, which in turn provides more available food for both otters and man. This habitat mimics the old native landscape around Bulgarian rivers, such as large marshlands and flood forests, especially in the lowlands. Despite the high levels of poaching nowadays (Georgiev, 2007) these habitats are preferred by otters in Bulgaria (Georgiev, 2005). Standing waters are also preferentially selected by resident reproductive females otters for their natal holts (Liles, 2003).

Theoretically, otters can inhabit the micro dam basins in the south of Bulgaria during the whole year (all four seasons) depending on the human activities. At some dam sites, after harvesting the fish stocks, the owners open the dams and allow the impounded water to escape leaving only the original feeder stream flowing. This happens during the autumn/winter season when even a small river or stream has enough water to maintain a constant flow. Very often in Southern Bulgaria the winters are mild, and where standing waters exist they do not freeze (or freeze only for short periods). During colder winters, if the dam basin is still full of water, owners keep open holes in the ice to provide fresh air to the fish, or lower the water level beneath the ice surface for the same reason. Such human activities support the otter by allowing access to water during the winter. Also, in areas with rich littoral vegetation, when the plant material breaks down and rots, thinner ice is observed in which otters can easily make holes. Such otter-made gaps were observed in roots of *Juncus* sp. (Borisov, pers.comm.) and *Typha* sp. (Dulev, pers.comm).

As it is obvious that micro dams create important otter habitats, they should be monitored for proper conservation of the species in Bulgaria. In this paper we want to answer the question as to where the monitoring transects of the "standard" method have to be undertaken when carrying out surveys in such habitats. According to Chanin (2003) priority has to be given to surveying sections most favoured by otters. As the spraints are known as the most frequent otter field signs we investigated otter site marking preferences in different parts of the micro dam basins in our survey area.

MATERIALS AND METHODS

Ten micro dam sites were studied in Southern Bulgaria between 2005 and 2007. They were situated below 700 metres above sea level in the Upper Thracian Valley (near the villages of Podlson, Konush, Zlato Pole and the town of Stara Zagora – Zagorka dam) and the low mountain of Stredna Gora (near the villages of Malka Vereya, Kolena, Starozagorski Bani, Matenitza, Starosel and Krastevich). All the perimeters, totalling 24.72 kilometres, were walked in a search for otter spraints. Only spraint sites were counted and their location noted. A spraint site was defined as a place where spraints were found at least 1m from other spraints (Kruuk et al., 1986). All marking sites found were mapped using a GPS receiver. Our study was focused on otter preference for placing their marking sites in four micro dam basin stretch units measured from the point of the river inflow to the centre of the dam wall using the computer programme Map Source (Garmin Inc., 2003) to calculate the centre line of the basin. The line was then divided into four equal parts numbered I, II, III, IV starting at the river inflow end and following the direction of water flow (Figure 1). Site preference (PI) for marking was determined using the Robel et al. (1970) index:

$$PI=OUPi/HAPi$$

Where OUPi is the observed proportion of marking sites in each site expressed as the number of spraint sites found in each site over the total number of sites, and HAPi is the proportion of each dam basin segment length studied over the total dam basin's length (Carugati et al., 1995). The Mann-Witney U-test was used to evaluate the statistical difference between two different areas at the micro dams for which spraint sites were totalled: the two central bank segments of the dam basins (2 and 3 in Fig. 1) against spraint sites at inflow and wall zone (1 and 4 in Fig. 1).

RESULTS AND DISCUSSION

A total of 131 otter spraint sites were recorded at the 10 micro dam basins surveyed. Most were found in the areas close to the river inflow (n = 53, 40.5%), followed by those near the wall of the dam (n = 39, 29.8%) (Table 1). The rest of the spraint sites were found in the two other equal length zones in the middle parts of the basins. The average levels of preference index showed highest levels at the river inflow zone: - 1.6 (min-max = 0.7 – 4.0) and a little lower near the wall: - 1.2 (min-max = 0.03-3.0) Table 1, Fig. 1). The middle zones of the basins were not so preferred as spraint sites having an average index level about three times lower. The two end zones (total results for all spraint sites at the inflow and wall zones on the one hand and in both central ¼ zones of the basins on the other) differed significantly (U-test, U = 26, *P* = 0.03). From all dam zones used in this study, spraint was always found in the zone covering the river inflow. The possible reasons for otter preference in marking the dam end zones and river inflow zones were proposed by Georgiev (2005) and Georgiev and Stoycheva (2006) – good bank slope, denser bank and littoral vegetation and low human disturbance, all of which favour holt site selection, plus the provision of a good food base. Also, Erlinge (1967, 1968) highlighted the running water between standing waters as important migration corridors for otters, which could explain the high marking density near the dam walls in our area.

Table 1. Micro dams in Southern Bulgaria surveyed for otter preference in spraint site selection. Each dam bank and water surface length, each ¼ zone length, number of spraint sites, and preference index per zone are given.

Micro dam	Bank line length [km]	Water surface length [meters]	Each zone lenth [meters]	Sprainting site number per zone				Preference index per zone			
				I	II	III	IV	I	II	III	IV
vill. Podslon	2.07	922	230.5	1	0	0	0	4.00	0.00	0.00	0.00
vill. Malka Vereya	0.92	347	86.8	2	1	1	3	1.14	0.57	0.57	1.71
vill. Kolena	3.43	1048	262.0	3	1	0	2	2.00	0.67	0.00	1.33
Zagorka dam	2.17	226	56.5	10	0	0	0	4.00	0.00	0.00	0.00
Starozagoski Bani	0.84	358	89.5	6	2	4	7	1.26	0.42	0.84	1.47
vill. Konush	2.92	1027	256.8	11	7	1	1	2.20	1.40	0.20	0.20
vill. Zlato Pole 1	2.66	1036	259.0	4	1	0	1	2.67	0.67	0.00	0.67
vill. Zlato Pole 2	4.60	2013	503.3	2	0	0	6	1.00	0.00	0.00	3.00
vill. Starosel	2.50	603	150.8	6	9	4	8	0.89	1.33	0.59	1.19
vill. Matenitza	1.22	466	116.5	1	1	2	2	0.67	0.67	1.33	1.33
vill. Krastevitch	1.39	428	107.0	7	3	2	9	1.33	0.57	0.38	1.71
Total/average	24.72	8474		53	25	14	39	1.62	0.76	0.43	1.19

Having these results, we searched for otter signs at the end zones on 42 micro dam sites in Southern Bulgaria (the Upper Thracian Valley, Sakar, Dervent, Sredna Gora

and Rhodopes mountains). We found spraint on 34 of them (81%) and no otter signs on 8 (19%). As the Bulgarian otter population is well known to be numerous over the last twenty years (Spiridonov and Spassov, 1989; Georgiev and Koshev, 2006), and the "standard" monitoring results interpretation states that having over 70% sites positive the population is in good condition (Chanin, 2003), we could conclude that surveying the end zones of micro dam basins is giving satisfying results. Accordingly we recommend otter monitoring at such basins to be focussed on the nearby river areas. The walls of the dams, which are readily accessible, can have priority, and only in case of a negative result need the next search involve the river inflow to the dam basin.

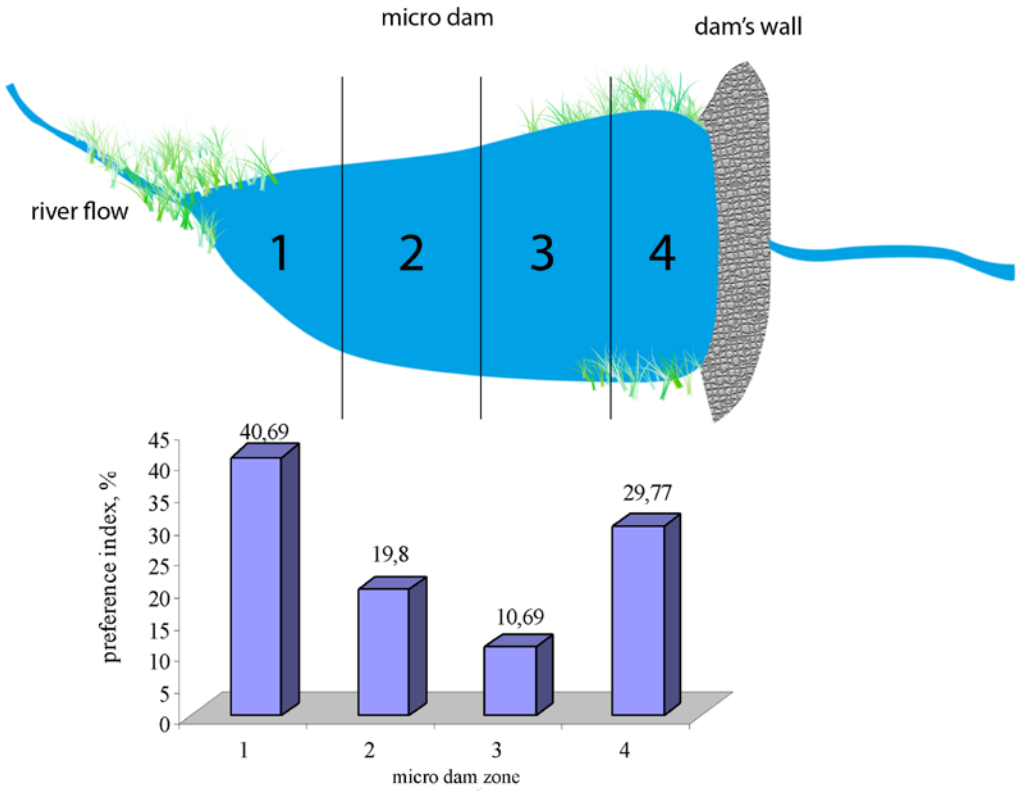


Figure 1. Plan of a micro dam basin separated into four equal units in length and the otter preference for placing spraint sites in each one of them (the mean values of the preference index was expressed as percent proportions for better visualisation).

ACKNOWLEDGEMENTS – I would like to thank Boris Borisov and Georgi Dulev (NGO "Green Balkans") for the valuable information about the micro dams and otters during the freezing period. I thank Slaveya Stoycheva for the technical support in the field and for designing the micro dam project.

REFERENCES

Carugati C., Rowe-Rowe D., Perrin M. (1995). Habitat use by *Aonyx capensis* and *Lutra maculicolis* in the Natal Drakensberg (South Africa): preliminary results. Hystrix 7, 239-242.

Chanin P. (2003). Monitoring the Otter *Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series No. 10, English Nature, Peterborough, 47 pp.

Erlinge S. (1967). Home range of the otter *Lutra lutra* L. in Southern Sweden. Oikos 18, 186-209.

Erlinge S. (1968). Territoriality of the otter *Lutra lutra* L. Oikos 19, 81-98.

Reuther C., Dolch D., Green R., Jahrl J., Jefferies D.J., Krekemeyer A., Kucerova M., Madsen A.B., Romanowski J., Roche K., Ruiz-Olmo J., Teubner J. and Trindade A. (2000). Surveying and monitoring distribution and population trends of the Eurasian otter (*Lutra lutra*). Guidelines and evaluation of the Standard Method for surveys as recommended by the European section of the IUCN/SSC Otter Specialist Group, Habitat, 12, 1-152.

Georgiev D. (2005). Habitats of the Otter (*Lutra lutra* L.) in some Regions of Southern Bulgaria. - IUCN Otter Spec. Group Bull. 18, 6-13.

Georgiev D., Stoycheva S. (2006). Habitats, Distribution and Population Density Otter Survey in the Western Rhodopes Mountains (Southern Bulgaria). IUCN Otter Spec. Group Bull. 23, 35-43.

Georgiev, D., Koshev, J. (2006). A report on the distribution and the habitats of the otter (*Lutra lutr*a) in Bulgaria, and taking a part in the preparing of a conception of its conservation in the country in the Natura 2000 network. Ministry of the Environment and waters, Bulgaria, 17 pp. [In Bulgarian].

Georgiev D. (2007). Otter *(Lutra lutra* L.) mortalities in Southern Bulgaria: a case study. IUCN Otter Spec. Group Bull. 24, 36-40.

Kruuk H., Conroy J. W. H., Glimmerveen U., Ouwerkerk E. J., (1986). The use of spraints to survey populations of otters *Lutra lutra*. Biological Conservation, 35, 187-194.

Kruuk H. (2006). Otters: ecology, behaviour and conservation. Oxford University Press, 265 pp.

Liles G. (2003). Otter Breeding Sites: Conservation and Management. Conserving Natura 2000 Rivers Conservation Techniques, Series №5, English Nature, Peterborough, 34 pp.

Nankinov D., Dutsov A., Nikolov B., Borisov B., Stoyanov G., Gradev G., Georgiev D., Popov D., Domuschiev D., Kirov D., Tilova E., Nikolov I., Ivanov I., Dichev K., Popov K., Karaivanov N., Todorov N., Shurulinkov P., Stanchev R., Aleksov R., Tzonev R., Marin S., Staikov S., Nikolov S., Dalakchieva S., Ivanov S., Nikolov H. (2004). Breeding totals of the ornithofauna in Bulgaria, 2004. "Ornithofauna" Team at the "Fauna" Working Group, Natura 2000 DEPA project in Bulgaria. Green Balkans, Plovdiv, 32 pp.

Robel P., Briggs J., Cebula J., Silvy N., Vers C., Watt P. (1970). Greater prairie chicken ranges, movements, and habitat usage in Kansas. J. Wildl. Manag. 34, 286-306.

Spiridonov G., Spassov N. (1989). The otter (*Lutra lutra* L., 1758) in Bulgaria, its state and conservation. Hist. Natur. Bulg. 1, 57-63.

Uzunov B. (1982). The lakes of Bulgaria. Priroda, BAS, Sofia, 5, 38-43. [In Bulgarian].

RESUME

LES LOUTRES EUROPÉENNES DANS LES MICRO BARRAGES DU SUD DE LA BULGARIE: OU DISPOSER LES ZONES DE MONITORING?

Dix sites de micro barrages ont été étudiés sans le sud de la Bulgarie entre 2005 et 2007. Ils sont situés à 700 mètres au dessus du niveau de la mer dans le haut de la vallée de Thrace et dans le massif de Sredna Gora. La totalité des berges a été étudiée à pied, soit 24.72 km, à la recherche de sites de marquage. La plupart d'entre eux ont été découverts le long des cours d'eau (n=53, 40.5%), puis d'autres près des barrages (n=39, 29.8%). Les autres sites de marquage ont été découverts dans deux autres zones de longueur égale au milieu des bassins. La moyenne des niveaux de l'index de préférence montre des valeurs plus élevées à l'arrivée des cours d'eau et sur les barrages. Elles étaient les plus élevées à la fin des cours d'eau, 1.6 (min-max 0.7-4.0), et un peu plus basses près des barrages, 1.2 (min-max=0.0-3.0). Les loutres ne déposent préférentiellement pas d'épreintes dans les zones au milieu des bassins, le valeurs de l'index y sont trois fois plus basses. Nous suggérons que le monitoring des loutres dans de tels bassins soit centré vers les zones d'afflux des rivières principales.

RESUMEN

NUTRIAS EURASIATICAS EN LAS MICRO PRESAS DEL SUR DE BULGARIA. DONDE COLOCAR LAS AREAS DE MONITOREO?

Diez sitios de micro-represas fueron estudiados en el sur de Bulgaria entre el 2005 y 2007. Estos estaban ubicados bajo los 700 m de altura en el Valle superior de Thracian y las montañas de Sredna Gora. Todo el perímetro de las riberas, el que totalizó 24.72 km, fue prospectado a pie para la búsqueda de fecas de nutrias. La mayoría de estas fueron encontradas en áreas alrededor del flujo del río (n=53, 40.5%), seguidos por aquellos ubicados en la pared de la represa (n=39, 29.8%). Fecas fueron también encontradas en otras dos zonas de igual longitud en la parte central de las cuencas. Los niveles promedio del índice de preferencia arrojaron los máximos niveles para la entrada del río y las áreas del muro de la represa. Ellos fueron mayores hacia el término de la entrada del río, 1.6 (min-max=0.7–4.0) y un tanto menor cercano al muro, 1.2 (min-max=0.0–3.0). Las áreas medias de las cuencas no fueron preferencialmente seleccionadas como áreas de defecación, teniendo valores de índice tres veces menores. Recomendamos que se realice monitoreo de las nutrias de esta cuenca poniendo mayor atención a las áreas cercanas a los ríos que llenan las represas.

R E P O R T

MONITORING PERIPHERAL POPULATIONS OF THE EURASIAN OTTER (*Lutra lutra*) IN SOUTHERN ITALY: NEW OCCURRENCES IN THE SILA NATIONAL PARK

Manlio MARCELLI*, Romina FUSILLO
LUTRIA snc - Wildlife Research, Via Stefano Oberto 69, 00173 Rome, Italy. e-mail: manlio.marcelli@lutria.eu
** corresponding author*

(received 19th April 2009, accepted 9th May 2009)

Abstract: After a period of strong decline, the Eurasian otter (*Lutra lutra*) has re-expanded its area of distribution in Italy from 1984 to 2004, mainly toward the southern periphery of its range. The Sila National Park is located in a strategic position along a drainage divide separating southern peripheral otter populations from unoccupied but potentially recolonizable habitats. A research project aimed to evaluate the aquatic habitats of the Sila National Park for otter recolonization is now in progress. At present, we have surveyed 14 sampling sites to detect otter presence in the study area. Two positive sites were found on the Arvo river. These records represent the first evidence of otter presence in the Sila area after extinction apparently occurred in the late 1970s. One of the two positive sites was negative in the 2003. These data seem to indicate that otter recolonization in the southern periphery of Italian distribution range is still in progress. Management actions in the Sila National Park may favour recolonization processes.

Keywords: Eurasian otter; false absences; Southern Italy; recolonization; Standard survey

INTRODUCTION

In Italy, the distribution of otter (*Lutra lutra*) has been restricted mainly to the southern regions of the peninsula since 1984 (Cassola, 1986). The species has been listed nationally as 'critically endangered' (Calvario and Sarrocco, 1997). From 1984 to 2004 Italian otters have re-expanded their distribution, recolonizing previously unfavourable habitat, mainly toward the southern periphery of their former range (Marcelli and Fusillo, in press). During the 2002–2004 Southern Italy survey we detected new otter occurrences in the Savuto, Neto and Crocchio river basins within the Calabria region. These locations designed the recent southern edge of the otter range in Italy (Marcelli and Fusillo, in press). Otter occurrences at the southern edge were strongly discontinuous in the space. Moreover, annual and monthly repeated surveys in some locations of this peripheral area have revealed variable results (Marcelli, 2006; authors' unpublished data), probably due to local extinction/colonization dynamics or false absences. Local extinctions and colonizations occurring on a short time scale are expected because of low habitat quality at the range edges of a species and source-sink dynamics (Pulliam, 1988; Brown et al., 1996). The incidence of false absences during standard otter surveys (Reuther et al., 2000) at the range edges may be due to low density of otters. Low otter density may translate into low spraint (otter faeces) density and, as a consequence, in low detectability during standard surveys.

Monitoring otter occupancy and distribution dynamics at range edges is essential, especially in protected areas, as a basis for conservation actions aimed to favour recolonization processes. However, low otter detectability in peripheral areas may reduce the effectiveness of standard surveys. A possible way to deal with imperfect detection of species is to increase sampling effort by multiple visits at sampling units within a defined sampling season (MacKenzie, 2005).
The Sila National Park (SNP) is a protected area located in the southern edge of the Italian otter range (Fig. 1). Its territory is included in an extensive mountainous plateau (Sila Massif). Small streams with oligotrophic conditions flow from the Sila upland to lowlands surrounding the Park. A drainage divide along the major dimension of the Park separates the western Crati and Savuto rivers where otter occurrence was respectively 46.7% and 80.0% (Fusillo et al., 2003), from the eastern Neto river and other small rivers with sporadic or without otter presence (Fig. 1). Dam construction in the 1920s formed three large lakes along the drainage divide. The Sila lakes have apparently available fish resources and could be an important habitat for otters. However, no information exists about otter presence in the last 3 decades in the territory of the Park. Apparently, otter extinction occurred in this area in the late 1970s (Cassola, 1986).

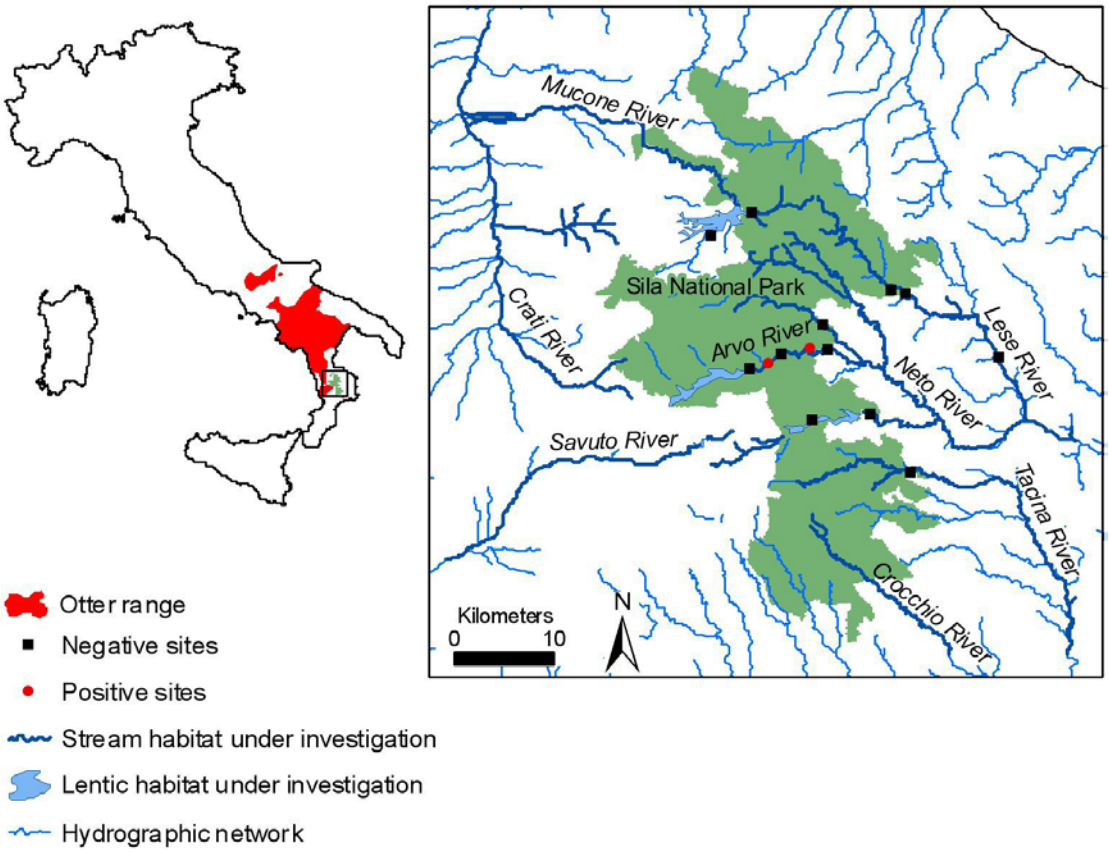


Figure 1 Distribution range of the otter (*Lutra lutra*) in Italy (Marcelli, 2006) and map of the study area.

In this paper, we present some preliminary results of a research project in progress aimed to assess the status of the otter in the SNP and the potential suitability of the aquatic habitats of the SNP for otter recolonization at the southern edge. We planned activities of this research project to 1) document the presence of otters in the SNP by field survey, 2) estimate the proportion of habitat used by otters in the streams and

lakes within SNP and in the neighbouring areas after accounting for imperfect detection, 3) identify potential corridors crossing the drainage divide and connecting established populations of Crati and Savuto rivers with Neto and others small rivers on the east side of the Park.

STUDY AREA AND METHODS

In order to define the study area and the aquatic habitat to be investigated, we selected a portion of semi-continuous hydrographic network (1/250000) along the western and eastern river basins crossing the SNP by using a GIS. The Sila lakes were also considered (Fig. 1). The study area includes very different vegetation types and climatic conditions, changing from the mediterranean types of the lowlands areas to the continental types of the Sila upland. Elevation of the SNP ranges from 445 to 1928 m, with a mean of 1339 m. Vegetation is dominated by coniferous forests. Human density is low (48 inhabitants/km^2). Lowlands around the SNP have much higher human densities.

We selected a random sample of 70 squares from the UTM 1-km squares intersecting the aquatic habitat. The minimum distance between sampling squares was set to 1 km. Otter presence-absence data are being collected in the selected squares by searching otter spraints. In order to account for low otter detectability we have planned a minimum number of three repeated visits (sampling occasions). At each visit a stream section up to 600-m in length inside a 1-km square will be explored for searching spraints (Reuther et al., 2000). Repeated visits will be carried out monthly.

Random selection of sampling units adopted in this study differs from uniform sampling of the standard method for determination of otter distribution (Strachan and Jefferies, 1996; Reuther et al., 2000). Nevertheless, random selection allows reliable inference on habitat use by species (MacKenzie and Royle, 2005). Moreover, a minimum distance of 1 km is suitable to study habitat use on a fine scale in our small study area.

Occupancy models by Mackenzie et al. (2002) will be used to estimate the true proportion of used habitat after accounting for imperfect detection. Corridors will be identified by using logistic regression modelling and GIS.

A survey of otter distribution has begun in March 2009 and will continue until to September 2009.

RESULTS AND DISCUSSION

At present we have surveyed 14 sites of the first sampling occasion. We have found 3 spraints at 2 sites along the Arvo river in the SNP (Fig. 1). The age of the spraints was probably 1-2 weeks old (dry but still smelling). Altitude of sites were 1116 and 1213 m. These records represent the first evidence of otter presence in the SNP and the highest altitude of the recent otter occurrence documented in Italy. Survey sites on the Sila lakes were negative. The naïve estimate of used habitat (sum of positive squares/total squares) in the sampled area was 14.0%. However, we had some evidence that we collected some false absences. In fact, along the Arvo river we did not find spraints in 2 sites very close to the positive sites, within a distance of 2 km (Fig. 1). Most likely otters used these river sections, but spraints were not found. False absences in our data could be due to the combined effects of low otter density and intense raining and flooding of the winter season (Fusillo et al., 2007). Rains and floods could have washed spraints and destroyed traditional marking sites, respectively.

The latter effect was evident in a section of a tributary of the Neto river. In the ongoing survey, we were not able to find spraints at this section. Recent flooding has profoundly changed the stream morphology at this section destroying some traditional marking sites confirmed by us in the 2003, 2004 and 2008. Repeated surveys in the next months are necessary to attribute the negative outcome at the Neto river site to a local extinction or to a false absence.

One of the 2 positive sites detected during the ongoing fieldwork was surveyed by us also in the summer of 2003. It was negative at that time (Marcelli and Fusillo, in press). These data seem to indicate that otter recolonization in the southern periphery of Italian range is still in progress. Long term monitoring could evidence unstable presence of the otters in the Sila upland. However, our preliminary findings seem to indicate that the habitats within the SNP may be at least suitable corridors for otters. As a consequence, management actions in the SNP seem very important to favour otter recolonization in the context of conservation planning at national scale. Fish availability could be a key factor for otter conservation in this area characterized by oligotrophic streams. Some pilot fish restoration actions have been realized in the SNP through the re-introduction of *Salmo trutta macrostigma*, an endemic Italian subspecies. The presence of otters is a strong motivation for improving management and conservation of fish populations in the SNP.

Acknowledgments - The research project has been funded by the Sila National Park and the Department of Environmental Policies of the Calabria Region. We thank Dr. Michele Laudati for providing facilities in organizational aspects. Two anonymous referees provided helpful comments on an earlier version of this manuscript.

REFERENCES

Brown, J.H, Stevens, G.C., Kaufman, D.M. (1996).The geographic range: size, shape, boundaries, and internal structure. *Annu. Rev. Ecol. Syst.* **27**: 597–623.

Calvario, E., Sarrocco, S. (eds) (1997). Red list of Italian vertebrates. WWF Italia, Roma. Settore Diversita` Biologica. Serie Ecosistema Italia. DB6: 1–81.

Cassola, F. (ed) (1986). The Otter in Italy. Status, Distribution and Conservation of an Endangered Species. WWF Italia, Roma, Serie Atti e Studi 5.

Fusillo, R., Marcelli, M., Boitani, L. (2003). Progetto di Ricerca sulla lontra nel Parco Nazionale del Cilento e Vallo di Diano. Relazione conclusiva. Giugno 2003. Dept of Animal and Human Biology, University of Rome La Sapienza. Technical report [In Italian].

Fusillo, R., Marcelli, M., Boitani, L. (2007). Survey of an otter *Lutra lutra* population in Southern Italy: site occupancy and influence of sampling season on species detection. *Acta Theriol.* **52**: 251–260.

MacKenzie, D.I. (2005). What are the issues with presence–absence data for wildlife managers? *J. Wildl. Manage.* **69(3)**:849–886.

MacKenzie, D.I., Nichols, J.D., Lachman, G.B., Droege, S., Royle, J.A., Langtimm, C.A. (2002). Estimating site occupancy rates when detection probabilities are less than one. *Ecology* **83**: 2248–2255.

MacKenzie, D.I., Royle, J.A. (2005). Designing occupancy studies: general advice and allocating survey effort. *J. Appl. Ecol.* **42**: 1105–1114.

Marcelli, M. (2006). Spatial structure and ecological determinants of otter (*Lutra lutra*) distribution in Italy. Development of predictive models for ecological inference and conservation. PhD Dissertation, University of Rome La Sapienza. [In Italian with English summary].

Marcelli, M., Fusillo, R. In press. Assessing range re-expansion and recolonization of human-impacted landscapes by threatened species: a case study of the otter (*Lutra lutra*) in Italy. *Biodiv. Conserv.* (published online 05 March 2009).

Pulliam, H. R. (1988). Sources, sinks, and population regulation. Am. Nat. **132**: 652–661.

Reuther, C., Dolch, D., Green, R., Jahrl, J., Jefferies, D., Krekemeyer, A., Kucerova, M., Madsen, A.B., Romanowski, J., Roche, K., Ruiz-Olmo, J., Teubner, J., Trinidade, A. (2000). Surveying and monitoring distribution and population trends of the Eurasian Otter (*Lutra lutra*)

– Guidelines and evaluation of the standard method for surveys as recommended by the European Section of the IUCN/SSC Otter Specialist Group. Habitat No. 12, Hankensbüttel.

Strachan, R., Jefferies, D.J. (1996). Otter survey of England 1991–1994. A report on the decline and recovery of the otter in England and on its distribution, status and conservation in 1991–1994. The Vincent Wildlife Trust, London.

RESUME

SUIVI DES POPULATIONS PÉRIPHÉRIQUES DE LOUTRE D'EUROPE (*Lutra lutra*) DANS LE SUD DE L'ITALIE: NOUVELLE DONNÉES DE PRÉSENCE DANS LE PARC NATIONAL DE LA SILA

Après une période de fort déclin, la Loutre d'Europe (*Lutra lutra*) a recolonisé une partie de l'Italie entre 1984 et 2004, surtout en périphérie sud de son aire de répartition. Le Parc National de la Sila possède une position stratégique le long d'un réseau hydrographique séparant les populations du sud de l'aire de répartition de zones inoccupées mais potentiellement recolonisables. Une étude est actuellement en cours afin d'évaluer la qualité des habitats aquatiques du Parc National de la Sila dans le cadre d'une recolonisation par la Loutre. À ce jour et au sein de l'aire d'étude, 14 sites ont été analysés afin de détecter la présence de l'espèce. Deux sites se sont révélés positifs sur le fleuve Arvo. Ces données sont les premiers signes de présence de la Loutre dans le Parc National de la Sila après que l'extinction se soit apparemment produite vers la fin des années 1970. Notons que l'un des deux sites positifs était négatif en 2003. Ceci semble indiquer que la recolonisation en périphérie sud de l'aire de distribution italienne soit toujours en progression. Les actions de gestion du Parc National de la Sila doit à l'avenir favoriser le processus de recolonisation.

RESUMEN

MONITOREO DE POBLACIONES PERIFERICAS DE NUTRIA EURASIATICA (*Lutra lutra*) EN EL SUR DE ITALIA: NUEVAS APARICIONES EN EL PARQUE NACIONAL DE LA SILA.

Luego de un período de fuerte disminución poblacional, la nutria eurasiatica (*Lutra lutra*) ha re-expandido su área de distribución en Italia entre 1984 y 2004, principalmente hacia el extremo sur de su territorio original. El Parque Nacional de la Sila está localizado en una posición estratégica a lo largo de una divisoria separando las poblaciones periféricas al sur, de hábitats no ocupados pero potencialmente recolonizables al norte. Un projecto de investigación encaminado a evaluar los hábitas acuaticos del Parque Nacional de la Sila para recolonización de nutria se encuentra en progreso. Hasta la fehca, se han monitoreado 14 sitios de muestreo para detectar la presencia de nutria en el área de estudio. Dos sitios a lo largo del rio Arvo demostraron precencia de nutrias. Estos sitios representan la primera evidencia de nutrias en el Parque Nacional de la Sila luego de su extincion supuestamente hacia finales de los años 70s. Uno de los dos sitios positivos fue negativo durante el monitoreo del año 2003 probablemente debido a falsas ausencias. Estos datos parecen indicar que la recolonización de nutria sobre el extremo sur la región de distribució en Italia continúa en progreso. La recolonización del Parque Nacional de la Sila podrían favorecerce con acciones de manejo adecuadas.

R E P O R T

A SURVEY OF SMOOTH COATED OTTERS (*Lutrogale perspicillata sindica*) IN THE SINDH PROVINCE OF PAKISTAN

Waseem Ahmad KHAN[1], Mohammad QASIM[1], Ejaz AHMAD[1], Ghulam AKBAR[1], Ali Hassan HABIB[1], Hassan ALI[1], Faisal MUEEN[1], Abdul Aleem CHAUDHRY[1], Shahid IQBAL[1], Hussain Bux BHAAGAT[2], Mohammad AKHTAR[3], Mohammad Shafiq AHMAD[3]

[1]WWF Pakistan, 60 - Bazar Road, Sector G - 6/4, Islamabad, Pakistan.
e-mail: khanwa@hotmail.com
[2]Sindh Wildlife Department, Government of Sindh, Wildlife Complex, Arain Road, Abad, Sukkur
[3]Department of Zoology, University of the Punjab, Quaid-e-Azam Campus, Lahore, Pakistan

(received 22nd April 2009, accepted 11th May 2009)

ABSTRACT: The present report reveals the findings of surveys conducted jointly by Sindh Wildlife Department (SWD), Government of Sindh and WWF Pakistan, Islamabad (WWF-P) during November-December, 2008 and February 2009 with the objectives to confirm the existence of Smooth coated otter (*Lutrogale perspicillita sindica*) in different areas in Sindh and to identify various threats to otter population. An area of about 5,000 km was traversed covering 36 different sites in 12 districts of Sindh province where there were reports of otter existence. The existence of otter was confirmed at 25 sites in 11 districts. Evidence like recent otter tracks, remains of fish eaten by otter, otter spraints, and holts was gathered and local residents and fishermen were interviewed to verify the existence of otter at every site. Five sites located in four different districts were identified where an otter population exists throughout the year, whereas otters visited all the other sites occasionally over different seasons, in search of food. Various threats to the species identified during the surveys included hunting for fur, habitat degradation, water pollution, weak enforcement of wildlife laws, increasing tourism and competition and conflicts between otters and fishermen. The total population of Smooth coated otter was also estimated over the 25 sites as 178.

Keywords - Sindh otter, Indus eco-region, Sindh Wildlife Department, Indus for All Program

INTRODUCTION

Otter Conservation Project (OCP): The first phase of the Indus Eco-region Conservation Program of WWF-Pakistan, also known as the ***Indus for All Program***, has prioritized three threatened wildlife species; Marsh crocodile (*Crocodilus palustris*), Hog deer (*Axis porcinus*) and Smooth coated otter (*Lutrogale perspicillta*) as species of special concern, and intends to conserve these species in the Indus eco-region through their protection, habitat restoration, relocation and management with the help of local communities and the Sindh Wildlife Department (SWD). In this context, ***Indus for All Program*** has funded a two year (October 2008 to September 2010) Otter Conservation Project (OCP) for SWD via its Partnership Fund. This article is based on the findings of surveys conducted jointly by SWD and WWF-P, Islamabad under the OCP during November 23 to December 04, 2008 and February 12 to 21, 2009.

The Study Area: The study area is the Sindh province of Pakistan, comprising 23 districts, and is located in the southeastern part of Pakistan between latitudes N 23° and 28° and longitudes E 66° and 71°, covering an area of 140,914 km² (about 18% of the country's total land) and a population of 42.4 million (about 23 % of country's total population) (Government of Pakistan, 1998). It is bounded on its northwest by Baluchistan Province, on the northeast by Punjab Province, on the southern side by the Arabian Sea and towards the east by the Rajasthan and Gujrat states of India (Figure 1).

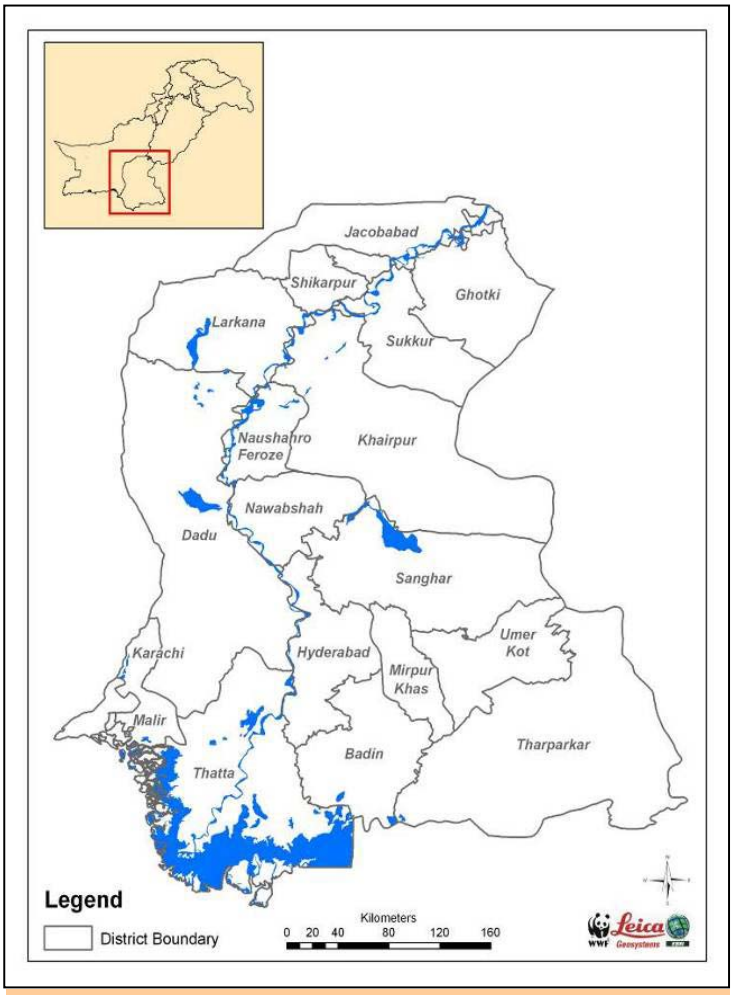


Fig. 1: Map of study area © WWF-P, Islamabad

Physiography: The study area represents four geophysical parts, with the Khirthar mountain range on its west; a central plain bifurcated by Indus River, a desert belt at its east and the Indus delta on its south. The Indus River is regarded as the lifeline and backbone of the economy for the Province, fulfilling the irrigation and drinking water requirements of the Province, thus playing an important role in regulating the economy of the country (Akbar, 2008).

Wetlands: In Sindh, there is a network of canals originating from three different barrages (Guddu, Sukkur and Kotri) on the Indus River. A large number of freshwater lakes and ponds of varying sizes are formed due to seepage of water along different canals and annual inundation of river water during the monsoon, and these provide suitable habitats for the Smooth coated otter (Akbar 2008).

Vegetation: Four types of distinct ecosystems exist in the study area, *i.e.*, tropical thorn forests, riverine, wetlands and coastal ecosystems (Akbar, 2008).

Wildlife: Sindh, having diversified habitat types, hosts a huge variety of amphibian, reptilian, avian and mammalian fauna. Key mammalian species include Asiatic Jackal (*Canis aureus*), Wolf (*Canis lupus*), Striped hyena (*Hyaena hyaena*), Caracal (*Felis caracal*), Smooth coated otter (*Lutrogale perspicillata*), Hog deer (*Axis porcinus*), Sindh ibex (*Capra aegagrus*), Chinkara (*Gazella bennettii*), Indus dolphin (*Platanista minor*) amongst others.

Otters: Pakistan is home to two species of otters: Smooth coated otter (*Lutrogale perspicillata*) and Eurasian otter (*Lutra lutra*). The Eurasian otter occurs in the northern mountainous region while the Smooth coated otter occurs in Sindh, Punjab and North West Frontier Province (NWFP) of Pakistan. The sub species found particularly along the Indus River has been referred as “Sindh otter” (*Lutrogale perspicillata sindica*) (Pocock, 1939). It is known as “Oodh Balao” and “Paani ki Billee” (water cat) in Urdu language, “Ludhro” (singular) and “Ludhra” (plural) in Sindhi language, “Luddhar” in Punjabi language and “Da Khwar Spay” (water dog) in Pushto language in NWFP.

Importance of the Smooth Coated Otter: Apart from its ecological role, the species has become a potential source of income for the local communities. An otter skin can fulfill the basic needs of a rural family for at least six months. Hundreds of nomadic people are involved in the illegal trade in wild animals and animal parts in the country; otter skin is amongst the highly priced wildlife products and fetches price ranging from Pak Rupees 30,000,- to 60,000,- (Khan et. al., 2008). This illegal practice, however, has put the otter population at risk.

Objectives of the study: The objectives of the study included determining the otter population and its distribution, identification of potential habitats and understanding the potential threats to the species in Sindh province.

REVIEW OF LITERATURE

Many studies have been conducted on otters in different countries of the world. However, in Pakistan only a few workers have dealt with the otters. Khan and Hasnain (2008) estimated the population of Smooth coated otter around Keti Shah riverine forest in Sukkur district and in a part of Nara canal lying within Sanghar district in Sindh. A detailed literature review on Smooth coated otter has also been conducted by Khan et al. (2008) that contains information about previous studies on Smooth coated otter in relation to its nomenclature, status, distribution and geographical range, biology, habitat, behavior and ecology, ecological role, food and feeding habits, breeding, territory size and threats. Gachal et al. (2007) studied the physio-chemical parameters of water samples from two different sites in River Indus representing the otter habitats and found them contaminated and not suitable for otter existence. Ellerman and Scot (1951), Ellerman (1961) and Prater (1965) have confirmed the occurrence of this species in Pakistan. Various authors (Siddiqui, 1969; Ahmad and Ghalib, 1975; Roberts, 1997, 2005) described otter in their published material while discussing mammalian fauna of Sindh province.

METHODOLOGY

The study area represents different types of habitats and terrains comprising semi desert plains, cultivated lands, wild lands, river, barrages, canals, lakes, ponds and fish farms etc. Therefore, different direct and indirect methods were applied to find out the potential sites of the occurrence in the study area.

Apart from gathering secondary information from published and unpublished reports about populations and distribution of otters in the study area, relevant people in different areas including the officials of SWD, WWF-P, Fisheries and Irrigation Departments, Fisher Folk Forum, local hunters, local fishermen, fish farmers, fish traders, boatmen and some political and influential people were contacted to obtain their views about existence of the otters in study area. Fish markets in different districts where the fishermen daily gather to sell their catch were also visited in order to listen to different fishermen and fish traders and to gather some information about the existence of the otter and problems for fishermen related to the otters.

According to the information obtained through all the sources, 12 districts containing potential otter habitats were marked on a district map of the Sindh Province. Almost every possible potential otter site was visited for the confirmation of otter existence. Recent otter tracks, remains of eaten fish by otter, otter spraints and holts were the means to confirm the existence of otters. GPS coordinates at every site were recorded to develop the population distribution maps. Photographs of otter tracks, remains of eaten fish by otter, otter spraints and otter habitats were also taken.

During the survey, an attempt was also made to estimate the existing population of Smooth coated otter in the study area. This population estimation was made by using Tracks Count Technique (Brower et. al., 1990) at five sites (site No. 3, 4, 5, 13 and 14; table 3) while at rest of the 20 sites, the estimates were based only on interviews with locals, fishermen, fish farmers and hunters.

Equipment and field kits used during the surveys included Digital camera (Canon EOS 30 D), search lights, measuring tape, binoculars (10 x 50), GPS (Garmin Map 76) and field guide books.

RESULTS

An area of about 5,000 km was traversed in 12 districts of Sindh. A total of 36 sites were visited to record the existence of otter, of which 25 sites in 11 districts were positive (Table 1).

Table 1: Sites where otter existence was confirmed during the survey

Sr. No.	Site	District	GPS Coordinates	Habitat Description
1	Guddu Barrage	Kashmore	N 28º 23' .796" E 69º 44' .574"	Thickly vegetated banks with *Typha*, *Saccharum* etc.
2	Summanu Lake	Ghotki	N 28º 23' .748" E 69º 43' .869"	Thickly vegetated banks with *Typha*, *Saccharum.*
3	Keti Shah	Sukkur	N 27º 46' .299" E 68º 55' .442"	River banks with *Tamarix*, *Saccharum*, *Phragmites*
4	Keti Shah	Sukkur	N 27º 48' .068" E 68º 54' .054"	River banks with *Tamarix*, *Saccharum*, *Phragmites*
5	Keti Shah	Sukkur	N 27º 46' .785" E 68º 55' .183"	River banks with *Tamarix sp.*, *Saccharum*, *Phragmites*
6	Hummal Lake	Qambar Shahdadkot	N 27º 41' .159" E 68º 51' .166"	Sparse *Typha* growths in patches in the lake
7	Hummal Lake	Qambar Shahdadkot	N 26º 49' .267" E 67º 39' .388"	Sparse *Typha* growth in patches at small islands in the lake
8	Nara Canal	Khairpur	N 26º 27' .097" E 68º 54' .113"	Banks covered with thick vegetation, Mesquite etc.
9	Jamrao Headwork	Nawab Shah	N 26º 56' .005" E 68º 58' .327"	Mesquite, *Saccharum*, *Typha* etc. along banks
10	Baqar Lake	Sanghar	N 26º 50' .744" E 68º 47' .399"	Sand dunes along one side and vegetation; *Typha*, *Saccharum* etc. along the other sides
11	Dhalor Mori	Sanghar	N 25º 05' .570" E 69º 09' .531"	Fish farms surrounded by thick vegetation of *Typha*, *Saccharum* etc.
12	Khipro Canal	Sanghar	N 26º 06' .103" E 69º 00' .926"	Canal banks covered by thick vegetation of *Typha*, *Saccharum* etc.
13	Nara Canal	Sanghar	N 26º 07' .049" E 69º 00' .790"	Canal banks covered by *Typha*, *Saccharum*, Masquite, etc.
14	Goath Leghari	Sanghar	N 26º 09' .275" E 68º 59' .470"	Agricultural fields and *Typha* and *Saccharum* along water bodies
15	Chotiari Reservoir	Sanghar	N 26º 12' .313" E 68º 59' .571"	Thick vegetation of *Typha*, *Saccharum*, Mesquite, etc.
16	Usman Ibopoto	Sanghar	N 26º 13' .617" E 69º 02' .206"	Agricultural fields and *Typha* and *Saccharum* along water bodies
17	Power House	Sanghar	N 26º 24' .412" E 68º 52' .766"	Agricultural fields and *Typha* and *Saccharum* along water bodies
18	Manchhar Lake	Jamshoro	N 26º 25' .097" E 67º 39' .113"	Sparse *Typha* growths in patches at small islands in the lake
19	Talar village	Badin	N 24º 46' .244" E 68º 56' .414"	Agricultural fields, *Saccharum* and *Typha* along ponds at wild lands
20	Mirpur Sakro	Thatta	N 24º 35' .349" E 67º 44' .668"	Agricultural fields, *Saccharum* and *Typha* along ponds at wild lands
21	Mirpur Sakro	Thatta	N 24º 35' .855" E 67º 44' .023"	Agricultural fields, *Saccharum* and *Typha* along ponds at wild lands

22	Haleji Lake	Thatta	N 24º 47' .212" E 67º 45' .947"	Thick vegetation, *Typha*, Masquite *Saccharum* etc. around the lake
23	KDA Branch Canal Chilya	Thatta	N 24º 48' .017" E 67º 58' .860"	Canal banks covered by thick vegetation of *Typha*, *Saccharum* etc
24	Keenjhar Lake	Thatta	N 25º 01' 254" E 68º 01' 215"	Thick vegetation, *Typha*, Mesquite *Saccharum* etc. around the lake
25	Jamrau canal	Mirpur Khas	N 25º 35' 33.8" E 69º 04' 40.4"	Canal banks covered by *Typha*, *Saccharum*, Mesquite etc.

Historical Distribution of Smooth coated otter in Sindh

Based on the available literature and personal communication with biologists, the historical distribution of Smooth coated otters in Sindh Province was plotted on a map (Figure. 2). The wildlife conservation movement started in Pakistan during early 1970's after the report about the WWF expedition to Pakistan (Mountfort and Poore, 1968) and the Wildlife Enquiry Committee Report under the Ministry of Agriculture and Works (Government of Pakistan, 1971). Results of the research conducted prior to this conservation movement in the country have been considered as historical data for plotting the distribution of the Smooth coated otters in the study area. According to these records, Smooth coated otters existed along the River Indus throughout the Sindh Province (Blanford, 1881; Murray, 1884) and in upper Sindh, lower Indus valley and eastern Nara (Pocock, 1939). According to Mountfort (1969) and WWF (1967) the Smooth coated otters existed in the Indus River in West Pakistan. Roberts (1977 revised edition in 1997) reported the existence of the species at Keti Bunder, Sindh coast, Sundari Lake and east Nara swamps and described its range beyond the lower Indus.

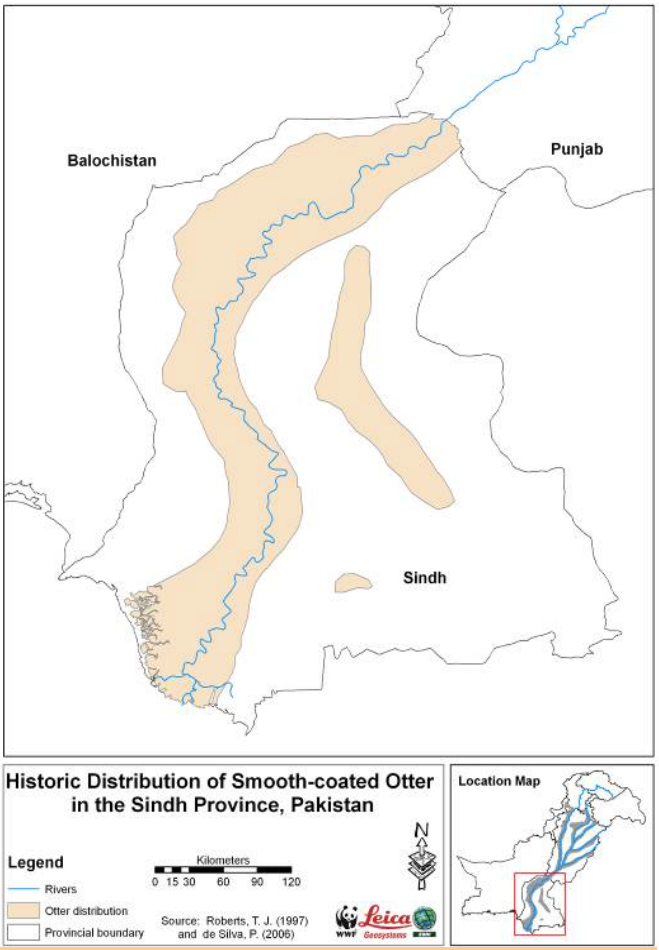


Fig. 2: Historical distribution of Smooth coated otter in Sindh © GIS Lab, WWF Pakistan

Current Distribution of the Smooth coated otter in Sindh

Thirty-six sites in 12 districts in the study area were searched for evidence of the Smooth coated otter, and its existence was confirmed at 25 sites in 11 districts (Table 1; Fig. 3).

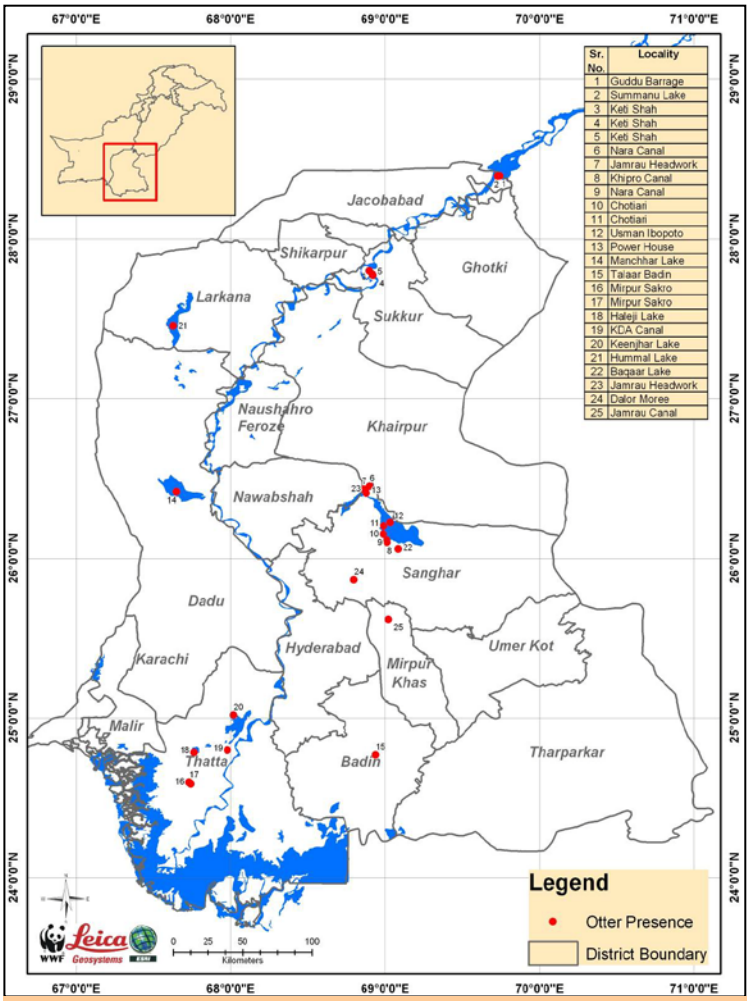


Fig. 3: Current distribution of Smooth coated otter in Sindh © GIS Lab, WWF Pakistan

Observation Records of Otter

Only at one site (out of the 25) near the Power Hose in Chotiari Wetlands Complex (site No. 17), was the otter observed directly; a female with six newly born cubs (Fig. 6). At the rest of the 24 sites, the existence of otters was confirmed on the basis of indirect evidence such as tracks, spraints, holts, remains of eaten fish by otter and interviews with locals, fishermen and fish farmers (Table 2; Fig 4 and 5).

Estimated Otter Population

The population of smooth coated otter was estimated around 178 (152 to 204) at all the sites where there were evidences of otter existence (Table 2). These estimates are based on Track Count Method at five sites (site No. 3, 4, 5, 13 and 14) while at the rest of 20 sites these depended on interviews.

Fig. 4: Otter spraint in Chotiari, Sanghar © WWF-P, Islamabad

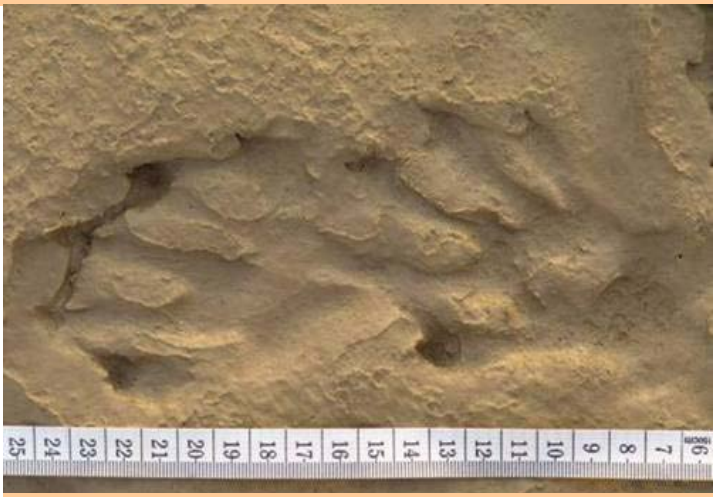


Fig 5: Otter tracks along Nara canal, Sanghar © WWF-P, Islamabad

Fig. 6: Six otter cubs near Power House, Chotiari © Indus for All Programme

Table 2: Observation records and estimated numbers of otters

Sr. No.	Location	Estimated Otter Population	Direct Obser-vation	Indirect Observations				
				Otter Holts	foot print	spraint signs	eaten fish	interview
1	Gudu Barrage	**10 - 12**	-	-	-	√	-	√
2	Sumanu Lake	**10 - 12**	-	-	√	-	-	√
3	Keti Shah	**6**	-	-	√	-	-	√
4	Keti Shah	**4**	-	-	√	-	-	√
5	Keti Shah	**2**	-	-	√	-	-	√
6	Hummal Lake	**4 - 6**	-	-	-	-	-	√
7	Hummal Lake	**6 - 8**	-	-	-	-	-	√
8	Nara Canal	**8 - 10**	-	-	√	-	-	√
9	Head Jamrau	**10 - 16**	-	√	√	-	-	√
10	Baqar Lake	**4 - 6**	-	-	√	-	-	√
11	Dhalor Mori	4 - 6	-	-	√	-	-	√
12	Khipro Canal	**4 - 6**	-	-	-	-	-	√
13	Nara Canal	**8**	-	-	√	-	-	√
14	Goth Leghari	**8**	-	-	√	-	-	√
15	Chotiari	**2 - 4**	-	-	√	√	-	√
16	Ibopoto	**2 - 4**	-	-	√	-	-	√
17	Power House	**8 - 10**	√	-	√	√	-	√
18	Manchar lake	**4 - 6**	-	-	-	-	-	√
19	Talaar	**6 - 8**	-	-	√	-	√	√
20	Mirpur Sakro	**4 - 6**	-	-	√	-	-	√
21	Mirpur Sakro	**4 - 6**	-	-	√	-	-	√
22	Haleji Lake	**12 - 18**	-	-	√	√	-	√
23	KDA Branch	**6 - 8**	-	-	√	-	-	√
24	Keenjhar lake	**4 - 6**	-	-	√	-	-	√
25	Jamrau canal	**12 - 18**	-	-	√	-	-	√
Total Population		**152 - 204**	**178 animals in the study area**					

Potential Otter Sites

Criteria were developed to identify the potential otter sites in the study area as follows.

- Whether otters occur at the site throughout the year
- Whether the site offers a potential and healthy habitat to otters
- Whether adequate food is available
- The level of human disturbance at the site
- Whether the habitat provides suitable breeding sites
- Whether the area is easily accessible

Using these the selection criteria, out of the 25 sites, five (Nos. 1, 8, 13, 15 and 22) in four districts were identified as the potential sites (Table 3).

Table 3: Potential otter sites identified during the reconnaissance survey

Sr. No.	Site	District	GPS Coordinates
1	Guddu Barrage	Ghotki	N 28º 23’ .796” E 69º 44’ .574”
2	Nara Canal	Khairpur	N 26º 27’ .097” E 68º 54’ .113”
3	Nara Canal	Sanghar	N 26º 07’ .049” E 69º 00’ .790”
4	Power House, Chotiari	Sanghar	N 26º 12’ .313” E 68º 59’ .571”
5	Haleji Lake	Thatta	N 24º 47’ .212” E 67º 45’ .947”

Conservation Status of Smooth coated otter

The Smooth coated otter is categorized as Near Threatened (IUCN Red List of Pakistan Mammals, 2005). Although it is protected (P) in Sindh under Sindh Wildlife Protection Ordinance 1972 and enlisted in Appendix II of the CITES Category 2007, the otter is considered to be on the decline due to habitat fragmentation, conflicts with fishermen and hunting for its pelt (Roberts, 1997; Gachal et al., 2007). Due to high levels of pollution in Hummal and Manchhar Lakes, the otter has almost disappeared from these two large lakes. The case of Keenjhar Lake is somewhat different, where increased human activities as a result of ill-planned tourism and over-fishing have forced the otters to leave. In Keenjhar Lake, the otter is still found and one animal was found dead in May 2008 on the nearby road, killed by a vehicle. In Chotiari Wetlands Complex, *Typha* cutting and burning of the undergrowth are the major factors that force the resident otter populations to move locally.

THREATS TO SMOOTH COATED OTTER IN SINDH

Major threats to Smooth coated otter identified during the study are discussed below:

Otter Hunting for Fur Trade

A nomadic tribe named differently in different areas in the country (Baagree, Oadh, Pakhee Waas, Changar), and working under the shelter and protection of some resourceful people and wildlife products dealers and traders, is the major culprit in otter skin trade (Fig. 7 and 8). More than 400 well-trained hunters belonging to this tribe are actively hunting wild animals in the country. According to the hunters there are two types of otters, a white and a dark one. The hunters are paid by the dealers or middlemen Rs. 12,000 to 15,000 (US $ 150 to 180) for the dark skin and Rs. 25,000 to 30,000 (US $ 312 to 375) for the white skin, whereas the middlemen earn from the traders Rs. 30,000 (US $ 375) for the dark skin and Rs. 60,000 (US $ 750) for the white skin. Unfortunately, no white skin was available.

Fig. 7: Settlement of nomadic tribe near Sanghar © WWF-P, Islamabad

Fig. 8: Settlement of nomadic tribe near Sanghar © WWF-P, Islamabad

Habitat Degradation

The otter, being an amphibious animal, utilizes both water and land environments for its various activities and hence, both water and land collectively constitute its habitat. The aquatic part provides food, while the terrestrial part provides necessary shelter and refuge to the animal. Unfortunately, in the study both aquatic and terrestrial habitats of otter have seriously deteriorated because of:

i. Water Pollution

Manchhar Lake is the largest freshwater body in South Asia covering an area of 233 km2. Since 1982, the Right Bank Outfall Drain (RBOD), stretching over 111 km, is dumping the sewage, waste water and industrial effluents into the lake from six different towns and cities located on the right bank of the River Indus and to the north of the lake. This practice has severely damaged the water quality and associated biodiversity, and has affected the livelihood of over 50,000 people. The level of pollution in the lake can be assessed by the fact that the annual fish catch from the lake is now less than 100 tons, whilst it was 300 tons in 1994 and 3,000 tons in 1950 (Mustafa 2008). Under such environmental conditions, it is hard for the otter to survive where it was once found in abundance. The case is similar for the Hummal Lake, as the two lakes are connected.

ii. Clearing of Vegetation

Otter habitats in most of the study area consist mostly of *Typha sp.* along with *Phragmites* and *Saccharum sp.* These three plant species provide refuge, shelter and the breeding grounds to the species. *Typha sp.*, which is around 70% of the vegetation in most of the otter habitats in the study area, is cut for various purposes by the locals and nomads (Fig. 9). Mostly it is used for making mats to cover the roofs of temporary houses (Fig. 10 and 11). *Typha* from an area of almost 2.5m^2 is required for making one mat measuring 2.5 x 5.5 m. A single person can make four such mats in a day. These people are paid Rs. 50 (US $ 0.63) for one mat and hundreds of such mats are made weekly and sold in nearby towns. Annual *Typha* cutting forces the otters to move and look for some other refuge at least during *Typha* harvesting, and thus it poses a serious threat to its resident population.

Fig. 9: Cutting of *Typha* from otter habitat © WWF-P, Islamabad

Fig. 10: Making of sheets from *Typha* © WWF-P, Islamabad

Fig. 11: Piled up sheets of Typha
© WWF-P, Islamabad

Weak Enforcement of Wildlife Laws

The decline in otter populations even in the presence of Sindh Wildlife Protection Ordinance 1972 suggests that the protection is not effective and there are gaps in the implementation of the wildlife laws (Shafiq, 2005). Poor law enforcement due for various reasons like lack of trained staff and funds is also contributing to the otter decline in the study area.

Burning of Undergrowth

Thick vegetation of Mesquite (*Prosopis juliflora*) in Chotiari Wetlands Complex is burnt dried annually by the local communities to have fuel wood as well as fresh grasses for their livestock (Fig. 12). These fires in otter habitat not only disturb the fauna of the area but also remove the refuge and shelter of the otter and force it to move to other areas at least for a short period of two to three months during the year.

Fig. 12: Burning of undergrowth
© WWF-P, Islamabad

Presence of hunting and feral dogs

Hunting and feral dogs in the study area especially around Keenjhar Lake are a threat to otters especially the cubs.

Tourism

Thousands of tourists from Karachi, Hyderabad, Thatta and other cities visit Keenjhar and Haleji Lakes on weekly basis, and otter populations have been greatly affected at these two sites. According to the locals, about six to eight year back, the otter was commonly found around Keenjhar Lake but now it is difficult to locate. Dumping of polythene bags, plastic bottles, glass bulbs and other non-degradable wastes are some of the negative impacts associated with the tourism that affect the habitat quality.

Keenjhar Lake, covering an area of 9,842 ha (98.42 km^2), is a good income resource for fisherman of Thatta district where 10,766 fishermen with 1,205 boats are actively involved in fishing. The total annual fish catch from the lake has been reduced from 194,861kg in 2001-02 to 27,351 kg in 2004-05 (*Indus for All Program*, 2006). These figures reflect the over-exploitation of the fisheries resources in the lake. Such anthropogenic activities encompassing over 10,000 fishermen and thousands of tourists at the lake on daily basis has adversely affected the otter population.

Human-Otter Conflicts

Many fish farmers and locals consider otters as pest and try to kill them whenever they get a chance. There are some reports of huge damage to fish stocks in fishponds and many fish farmers have closed their fish farms due to otters' attacks on the fish stocks in their fish farms. Similarly, *Typha* and *Saccharum sp.* constituting the major part of otter habitat also provide a source of livelihood for the local communities in the study area. Therefore, upon utilization of common resources by both otters and human, there is serious conflict between the two.

Competition for Food

Fish provides food for both human and otters. There are hundreds of small and large freshwater lakes in the study area, and many fish farms in the area. People have also converted many of these natural freshwater lakes into fish farms. Human occupancy on natural wetlands has also created a difficult situation for otters who rely on natural wetlands for food, and they have either to forage far away or to attack the fish farms. Thus, otters in the study area do not have permanent refuge, feeding and breeding grounds and have to move seasonally, which constitutes a continuous disturbance for otters.

Otter attacks on Humans

The otter is considered a dangerous animal among the locals. There are many examples of otter attacks on humans in the study area, but all such attacks by otters were found to be in self-defense.

DISCUSSION

There are very few and insufficient data available from literature to compare the past and present status of Smooth coated otter in the study area, but after interviewing a number of people from all the 25 sites in the study area where the existence of otter was confirmed during the survey, it was found that the otter population is facing a decline. The main reasons for this are poor the economic condition of local communities, unemployment and lack of awareness about otters and to some extent, fish farming. High demand of otter skin in China and Tibet (IOSF 2008) and its high price (Khan et al., 2008) in the study area, and low risk for the hunters due to weak enforcement of wildlife laws, have encouraged otter hunting by the poor local communities.

Once existing in vast areas almost all along Indus River and irrigation system in Sindh (Roberts, 1997; Khan and Husnain, 2008), Smooth coated otters have been compelled now to live in scattered populations in fragmented habitats, and to keep moving for survival in the study area, due to habitat destruction through vegetation removal, water pollution and planned annual forest fires, over-hunting, lack of awareness and continuous and regular human intrusions/disturbances in otter habitats. Only five sites in the study area, out of 25 during the survey, were found to be the potential sites of the Smooth coated otter where it could be found through out the year, while rest of the 20 sites of otter existence were those visited by otters occasionally in different seasons. Despite all this, some of the local fishermen consider otter's presence as a blessing as they get more fish trapped in their nets due to otter activity. Fishermen that used to keep otters as pets and as assistants for fishing in the past revealed that otter is a very intelligent and loyal animal and can be tamed in a short period of time.

Breeding by Smooth coated otters and birth of the cubs may occur at any time throughout the year (Roberts, 1997; Foster-Turley, 1992). Litter size of 2 to 4 cubs is normal (Roberts, 1997), but during the survey six cubs were found with a mother at Chotiari Wetlands Complex in Sanghar District. According to fishermen and some hunters, six otter cubs per pregnancy are a common phenomenon.

The Baagree Tribe is playing a key role in the decline of Smooth coated otter. It is very unfortunate that hunting habits actively contribute to threaten the wildlife in the country even in the presence of wildlife protection laws.

CONCLUSION

The Smooth coated otter is an important ecological indicator of a healthy wetland and associated biodiversity, especially the fish fauna. Once distributed widely throughout Sindh, it exists in fragmented habitats in isolated populations now. If threats and stresses continue to exist, it will vanish. Hence, it is mandatory to conserve this species through restoration of its habitats, minimizing the threats and its relocation from sensitive to protected habitats.

Acknowledgements - A number of people from different government departments and non-government organizations including Fisheries Department, Pakistan Fisher Folk Forum, Sindh Rangers, District Government, Wildlife Department, Irrigation Department, Local Influential People, Local fishermen, fish farmers and hunters facilitated and supported our team during the survey. We are much obliged and grateful to all those people and sincerely acknowledge their assistance in this survey for Smooth coated otter in Sindh Province. We are also thankful to the Partnership Fund, *Indus for All Program* for providing financial support to the Otter Conservation Project.

REFERENCES

Ahmed, M.F., Ghalib, S.A. (1975). A Checklist of Mammals of Pakistan. Rec. Zool. Surv. Pak. VII(1&2):1-34.

Akbar, G. (2008). Assessment of Natural Vegetation of Indus for All Project Sites. Internal Report, WWF Pakistan 396 pp.

Blanford, W.T. (1881). Fauna of British India. Mammalia. Taylor & Francis, London.

Brower, J., Zar, J., Ende, C. (1990). Field and Laboratory Methods for General Ecology. Wm. C. Brown Publishers, 2460 Kerper Boulevard, Dubuque, IA 52001.

CITES. (2007). Appendices I, II and III valid from 13 September 2007. International Environment House, Chemin des Anemones, CH -1219 Chatelaine, Geneva, Switzerland. 46 pp.

Ellerman, J.R. (1961). The Fauna of India - Mammalia. Zoological Survey of India, Calcutta.

Ellerman, J.R., Morrison-Scot, T.C. (1951). Checklist of Palaearctic and Indian Mammals 1758 to 1946. British Museum (Natural History), England.

Foster-Turley, P.A. (1992). Conservation aspects of the ecology of Asian Small Clawed and Smooth Coated Otters on the Malay Peninsulas. *IUCN Otter Specialist Group Bulletin*. **7**:26-29.

Gachal, G.S., Memon, Z., Qadir, A.H., Yusuf, S.M., Siddiqui, M. (2007). Ecological Impact on the status of Otter *(Lutrogale perspicillata). Sindh University Research Journal*. **39**(2): 19-26.

Government of Pakistan. (1998). Census Report of Pakistan, Population Census Organization Statistic Division, Islamabad, Provincial Census report of Sindh, Dec 2001

Government of Pakistan. (1971). Wildlife Enquiry Committee Report. Ministry of Agriculture and Research. 44 pp

Indus for All Program, 2006. Fisheries Fact Sheet. 606 Fortune Center, 6th Floor, Block 6, PECHS, Shahrah-e-Faisal, Karachi.

IOSF. (2008). Alarming Trade in Otter Fur. IOSF. 7 Black Park, Bradford, Isle of Skye, IV49 9DE, Scotland. 11 pp

IUCN. (2008). IUCN Red List of Threatened Species 2008. [Available from http://www.iucnredlist.org accessed 20/04/09].

IUCN. (2005). Status and Red List of Pakistan Mammals based on Pakistan's Conservation Assessment and Management Plan for Mammals. Pakistan. 344 pp.

Khan, W.A., Hasnain, S.A. (2008). Large Mammals at Indus for All Programme Sites (unpublished Report). WWF-P, Karachi. 88 pp.

Khan, W. A., Qasim, M., Ahmad, E., Bhagat, H. B. (2008). Literature review on biology and ecology of Smooth coated otter (*Lutrogale perspicillata*). Internal Report, WWF Pakistan, Ferozepur Road, Lahore. 13 pp.

Mountfort, G. (1969). The Vanishing Jungle. Collins, St. James's Place, London 286 pp.

Mountfort, G., Poore, D. (1968). Report on the 1967 World Wildlife Fund Expedition to Pakistan. 45 pp .

Murray, J.A. (1884). The Vertebrate Zoology of Sind. Richardson, London.

Mustafa, G. (2008). Past Present and Future of Manchhar Lake. Pakistan Fisherfolk Forum, Hyderabad

Pocock, R.I. (1939). Notes on some British Indian Otters with description of two new species. *Journal Bombay Natural History Society*. **41**: 514-518.

Prater, S.H. (1965). The book of Indian Animals. *Bombay Natural History Society*. 323 pp.

Qazilbash, A.A., Rind, A.A. (2008). Lake Manchhar: a classic example of how water projects affect sustainable livelihoods.

Roberts, T.J. (2005). Field Guide to the Large and Medium Sized Mammals of Pakistan. Oxford University Press, Karachi.

Roberts, T.J. (1997). The Mammals of Pakistan. Revised Edition, Oxford University Press, 5-Bangalore Town, Sharae Faisal, Karachi. 525 pp.

Shafiq, M.M. (2005). Wildlife Acts & Rules of Pakistan. Pakistan Forest Institute Peshawar. 297 pp.

Siddiqui, M.S.U. (1969). Fauna of Pakistan. Agricultural Research Council, Government of Pakistan, Karachi

RESUME

UNE ENQUÊTE SUR LA LOUTRE À PELAGE LISSE (*Lutrogale perspicillata sindica*) DANS LA PROVINCE DE SINDH, PAKISTAN.

Ce rapport révèle les conclusions d'enquêtes de terrain accomplies conjointement par le Département de la Faune Sauvage de la province de Sindh (SWD), le Gouvernement de Sindh et le WWF Pakistan basé à Islamabad (WWF-P) entre novembre-décembre 2008 et février 2009. Les objectifs étaient de confirmer l'existence de la Loutre à pelage lisse (*Lutrogale perspicillata sindica*) dans différentes régions de Sindh et d'identifier les menaces pesant sur la population. Une région d'environ 5000 km a été prospectée couvrant 36 sites dans 12 districts de la province où la Loutre y était déjà mentionnée. La présence de l'espèce a été confirmée sur 25 sites pour 11 districts. Les preuves récentes de présence comme les empreintes, les restes de poissons, les épreintes et les catiches ont été collectées. De plus, les résidents locaux ainsi que les pêcheurs ont été sondés afin de confirmer l'existence de la Loutre sur chacun des sites. Cinq sites positifs dans quatre districts différents présentent une population régulière tout au long de l'année alors que les autres sites positifs ne sont fréquentés qu'occasionnellement en fonction des saisons notamment pour la recherche de nourriture. De nombreuses menaces pesant sur l'espèce ont été identifiées durant l'enquête: la chasse pour le pelage, la dégradation des habitats, la pollution de l'eau, la faible application des lois de conservation de la faune sauvage, l'augmentation du tourisme et enfin la compétition ou les conflits entre loutres et pêcheurs.

Sur ces 25 sites, la population totale de Loutre à pelage lisse a été estimée à 178 individus.

RESUMEN

RELEVAMIENTO DE NUTRIA DE RÍO DE EPELAJE SUAVE (*Lutrogale perspicillata sindica*) EN SINDH, PROVINCIA DE PAKISTÁN.

El presente reporte revela los hallazgos de relevamientos conducidos en conjunto por el Departamento de Vida Silvestre de Sindh (SWD), el gobierno de Sindh y el Fondo para la Vida Silvestre Mundial Pakistan, Islamabad (WWF-P) durante noviembre-diciembre del año 2008 y febrero del 2009 con los objetivos de confirmar la existencia de nutria de río de pelaje sueve (*Lutrogale perspicillata sindica*) en diferentes áreas de Sindh y para identificar varias amenazas para la población de nutrias de río. Un área de 5.000 km^2 fue recorrida cubriendo 36 sitios diferentes en 12 distritos de la provincia de Sindh donde la existencia de nutria de río fue reportada. La presencia de nutria de río fue confirmada en 25 sitios en 11 distritos. Evidencias como huellas recientes de nutria de río, restos de peces recientemente consumidos, feces, y madrigueras fueron collectadas y residentes locales y persadores fueron entrevistados para verificar la existencia de nutrias de río en cada sitio. Cinco sitios localizados en cuatro distritos diferentes fueron identificados donde poblaciones de nutria de río estivieron presentes a lo largo del año, los otros sitios fueron visitados por nutrias de río ocacionalmente durante diferentes estaciones, en búsqueda de comida. Amenazas para la especie identificadas durante los relevamientos fueron cacería por la piel, degradación de hábitat, polución de agua, falta de implementación de leyes de vida silvestre, incremento del turismo y competición y conflictos entre nutria de río y pescadores. Una población total estimada de nutria de río de pelaje suave de 178 individuos fue estimada para los 25 sitios.

R E P O R T

A Review on Research and Conservation of Otters in Nepal

Gandhiv KAFLE
Affiliate member, IUCN/SSC Otter Specialist Group
Local Initiatives for Biodiversity, Research and Development
PO Box 324, Pokhara, Nepal
Tel: 977-98460-89929
Corresponding address:gkafle@libird.org
Website: www.gandhiv.synthasite.com

(received 26th April 2009, accepted 16th May 2009)

ABSTRACT: Three species of otters, the Eurasian otter (*Lutra lutra*), the Smooth-coated otter (*Lutrogale perspicillata*) and the Asian small-clawed otter (*Aonyx cinerea*) have been recorded in Nepal. Baseline information on otters is not available for the majority of wetland sites within the country. Freshwater ecosystems, the preferred habitat for otters, are adversely affected by both human and natural causes. This paper provides an overview of research on otters in Nepal to date, the key findings and the ways forward.

Key words: Nepal, otters, status, threats

BACKGROUND

Nepal is situated on the southern slopes of the central Himalayas and occupies a total area of 147,181km^2 between latitudes 26^{o}22' and 30^{o}27' N and longitudes 80^{o}40' and 88^{o}12' E. The average length of the country is 885km from east to west and the width varies from 145km to 241km, with a mean of 193km north to south. Hills and high mountains cover about 86% of the total land area and the remaining 14% are the flatlands of the Terai, which are less than 300m in height. Altitude varies from some 60m above sea level in the Terai to Mount Everest (Sagarmatha) at 8,848m, the highest point in the world (HMGN/MFSC, 2002). According to Hagen (1998), Nepal has seven physiographic zones, which are, from south to north: the Terai, Siwalik Hills zone, Mahabharat Lekh, Midlands, Himalaya, Inner Himalaya, and the Tibetan marginal mountains. The latest physiographic data shows that the total land area of Nepal comprises around 4.27 million hectares of forest (29% of total land area), 1.56 million hectares of scrubland and degraded forest (10.6%), 1.7 million hectares of grassland (12%), 3.0 million hectares of farmland (21%), and about 1.0 million hectares of uncultivated land (7%). A wide range of climatic conditions exists in Nepal mainly as a result of altitudinal variation. This is reflected in the contrasting habitats, vegetation, and fauna that exist in the country. The average annual rainfall in Nepal is about 1600mm, but total precipitation differs in each eco-climatic zone. The eastern region is wetter than the western region. In general, the average temperature decreases by 6^{o}C for every 1,000m gain in altitude (Jha, 1992; HMGN/MFSC, 2002).

Nepal's biodiversity is a reflection of its unique geographic position and altitudinal and climatic variations. Nepal's location in the central portion of the Himalayas places it in the transitional zone between the eastern and western Himalayas. It incorporates the Palaearctic and the Indo-Malayan biogeographical regions and the major floristic provinces of Asia (the Sino-Japanese, Indian, western and central

Asiatic, Southeast Asiatic, and African Indian desert) creating a unique and rich terrestrial biodiversity (HMGN/MFSC, 2002).

Nepal hosts a great diversity of wetlands, which cover approximately five percent of its total land area (DOAD, 1992). The ecological diversity of the wetland ecosystems of Nepal is very great (Scott, 1989). The country has approximately 6,000 rivers and rivulets, including permanent and seasonal rivers, streams and creeks (IUCN Nepal, 2004). The major perennial river systems that drain the country are the Mahakali, Karnali, Narayani, and Koshi Rivers, all of which originate in the Himalayas. Medium-sized rivers include the Babai, West Rapti, Bagmati, Kamla, Kankai, and Mechi; these generally originate in the Mid-hills or in the Mahabharat range. The Terai region has a large number of small and usually seasonal rivers, most of which originate in the Siwalik Hills (HMGN/ADB/FINNIDA 1988). IUCN Nepal has identified 163 wetlands in 19 Terai districts covering 724,257 hectares (Bhandari, 1998). An inventory carried out by the International Centre for Integrated Mountain Development and the United Nations Environment Programme listed 2,323 glacial lakes (75.70 km2) above 3,500 m. in Nepal. These include 182 lakes of 8 hectares or more, and 2,141 with areas less than 8 hectares (Mool et al., 2002).

Nepal's wetlands support significant species diversity and populations of globally threatened flora. Seventeen out of twenty endemic vertebrates found in Nepal – including eight fish and nine herpetofauna species – are wetland dependent (IUCN Nepal, 2004). A total of 182 fish species have been recorded in Nepal, including eight endemic species (Shrestha, 2001). Nepal's wetlands are equally important for flora. Wetland-dependent flora includes the plants that flourish well in wetland habitats such as marshes, swamps, floodlands, in rivers or river banks (Chaudhary, 1998). About 25% of Nepal's estimated 7,000 vascular plant species are wholly or partly wetland dependent. Twenty-six of the 246 angiosperm species are wetland dependent (Shrestha and Joshi, 1996). Of the 91 nationally threatened plants found in Nepal, ten are dependent on wetlands. Nepal's wetlands hold several species of wild cultivars and wild relatives of cultivated crops. At least 318 wetland-dependent plant species have been recorded in the Terai wetlands alone. At least 254 amphibious/emergent species are found exclusively in aquatic habitats (IUCN Nepal, 2004).

A total of 187 mammal species have been recorded in Nepal (Shrestha, 1997). Among these, 27 mammal species have been formally protected under the National Parks and Wildlife Conservation Act 1973. Since then, the list of protected mammals has not been revised. Thirteen otter species lives in the world, five of them inhabiting Asia. Nepal holds three species, the Eurasian otter (*Lutra lutra*), the Smooth-coated otter (*Lutrogale perspicillata*) and the Asian small-clawed otter (*Aonyx cinerea*) representing 1.6% of the mammals cited in the country. There is an important lack of information on the status and ecology of otters in Nepal, and only a few preliminary studies have been conducted (Houghton, 1987; Acharya and Gurung, 1994; Thapa, 2002; Kafle, 2007; Bhandari, 2008; Joshi, 2009; Bhandari and GC, 2008; Kafle, 2008).

Very few references are available in Nepal that address issues on otter conservation and research. Hodgson (1839) was the first to identify the presence of the Eurasian otter, Smooth-coated otter and Asian small-clawed otter in Nepal. Thereafter, only a few scattered otter surveys have been conducted in the country. Houghton (1987)

published an article in the IUCN/SSC Otter Specialist Group Bulletin based on his survey in 1984/85 showing the common occurrence of Smooth-coated otter along the length of Narayani River within the Chitwan National Park of Nepal. Acharya and Gurung (1994) from their 1991 survey, reported on the status of Eurasian otter in the Rupa and Begnas Lakes of Pokhara valley. Thapa (2002) conducted a preliminary survey on the population status of the Smooth-coated otters in the Karnali river of Bardia National Park, and the results are available on the IOSF webpage (http://www.otter.org/nepal.html). The Asian Section of the IUCN/SSC Otter Specialist Group conducted a training workshop on "Survey techniques and monitoring otter populations" for rangers and conservationists in Chitwan National Park, Nepal from 7-9 March 2006. Bhandari (2008) studied the current conservation problems and distribution of otters in the Karnali river of Bardia National Park. Outside of this protected area, some work on the status of the Smooth-coated otter was recently done (Joshi, 2009). Bhandari and GC (2008) published an article on their preliminary survey of the otter in Rupa Lake in the Journal of Wetlands Ecology. Smooth-coated otters are considered to be common in the large rivers of Nepal, particularly Narayani, Koshi, Karnali and Mahakali (Shrestha, 1997). Due to these gaps in the knowledge of otters in the region, Kafle (2008) points out the urgency of direct action for the conservation of otters in Nepal. WFN has launched the Nepal Otter Project (http://www.ottersnepal.org) to initiate long term monitoring and conservation of otters in Nepal in partnership with Chester Zoo and NEF. Thapa (2009) is carrying out another survey of the status, distribution and habitat use by Smooth-coated otters in the Narayani river of Nepal with funds provided by the IOSF (http://www.otter.org/project3.html).

CURRENT STATUS OF OTTERS IN NEPAL

Nepal is home to the Eurasian otter (*Lutra lutra)*, Smooth-coated otter (*Lutrogale perspicillata)* and Asian small-clawed otter (*Aonyx cinerea)* (Hodgson 1839). Nepal holds three out of the four species of Asian otters (Figure 1).

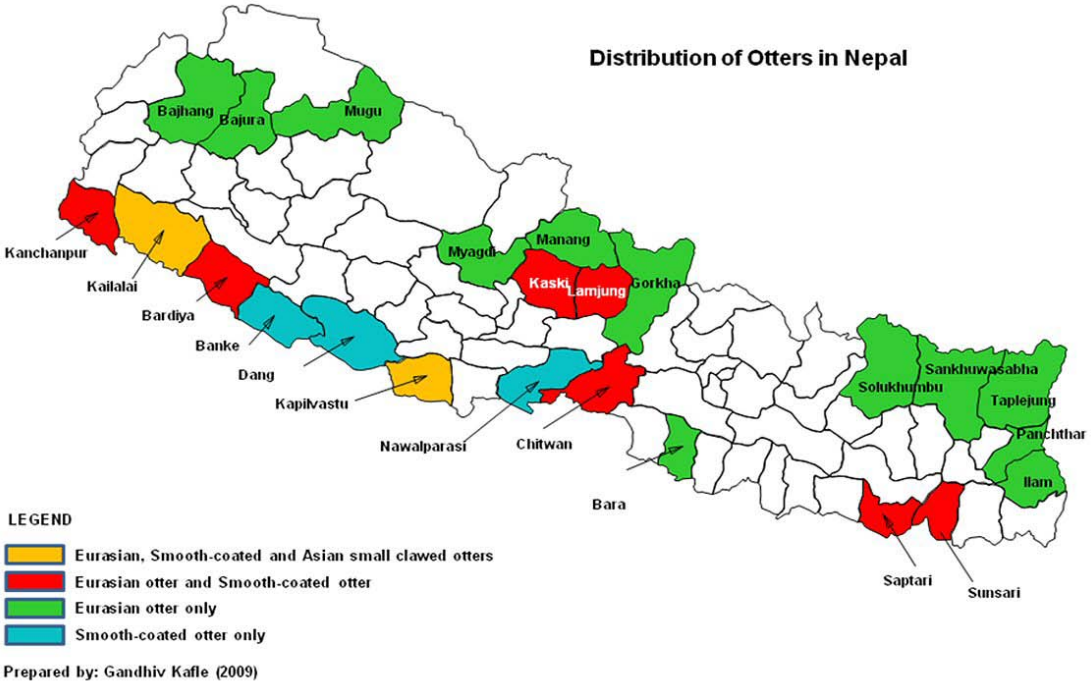


Figure 1: Map showing distribution of otters in Nepal

Distribution of Otters in Nepal

The presence of otters has been confirmed in 24 districts of Nepal covering both lowland and hilly regions. The Eurasian otter is recorded in 8 districts in the Terai region and 13 districts in the hilly regions. The Smooth-coated otter is recorded in 10 districts in the Terai region and 2 districts in the hilly regions. All three species of otters are recorded in two lowland districts: Kailali and Kapilvastu (pers. comm.), D. Gaire (pers. comm.); Shrestha, 1997; Bhandari, 1998). This shows that the Smooth-coated otter is distributed mainly in the Terai region while the Eurasian otter is distributed both in the Terai and hilly regions of Nepal.

Eurasian Otter

The Eurasian otter mainly lives in streams and lakes. It shelters in hollows in rocks and boulders and below the roots of trees growing in moist areas near water bodies. It has been reported as occurring as high as 3600m in Nepal (Shrestha, 1997; Prater, 1971 in Ruiz-Olmo et al., 2008). During summer (April - June) in the Himalayas they may ascend up to 3,660m. These upward movements probably coincide with the upward migration of the carp and other fish for spawning. With the advent of winter the otters come down to lower altitudes (Prater, *opus cit*.). In most parts of its range, its occurrence is correlated with bank side vegetation, which shows the importance of vegetation to otters (Mason and Macdonald, 1986 in Ruiz-Olmo et al., 2008). Otters in different regions may depend upon differing features of the habitat, but to breed, they need holes in the riverbank, cavities among tree roots, piles of rock, wood or debris. The Eurasian otters are closely tied to a linear home range. Most of their activity is concentrated in a narrow strip on either side of the interface between water and land (Kruuk, 1995 in Ruiz-Olmo et al., 2008). Green et al., (1984) and Kruuk (1995) in Ruiz-Olmo et al. (2008) found that adult males spent most of their time along the main rivers, whereas adult females occupied tributaries or lakes, as they do in Austria (Kranz, 1995 in Ruiz-Olmo et al., 2008). Young animals usually occupy peripheral habitat. Green and Green (1983) in Ruiz-Olmo et al. (2008) found differences between immature and mature young males, the latter having access to all available habitat and the former restricted to marginal habitat, supplemented by visits to the main river when vacant, temporally or spatially.

Available presence records of Eurasian otters in Nepal come from the Annapurna Conservation Area, Makalu Barun National Park, Koshi Tappu wetland, Rara National Park, Bardia National Park, Ghodaghodi Lake Area, Saptari, Sunsari, Chitwan, Kapilvastu, Bara, Kailali, Kanchanpur, Bajhang, Bajura, Ilam, Panchther, Taplejung, Gorkha, Lamjung, Myagdi, Solukhumbu, Manang and Sankhuwasabha.

Smooth-coated Otter

The Smooth-coated otter selects the shores of lakes, large rivers, streams, and canals, and it even uses rice fields for foraging (Shrestha, 1997; Foster-Turley, 1992). Resting sites are commonly in burrows closely linked to the water's edge. Sometimes the species hunts in forests as a forest carnivore. The Smooth-coated otter is essentially a plains' species (Hussain et al., 2008). In mountainous areas of Nepal animals are present up to 1500m (Shrestha, 1997). The Smooth-coated otters prefer rocky stretches since these provide sites for dens and resting places. River stretches

with bank side vegetation and marshes are used in proportion to their availability especially in summer, as they provide ample cover while travelling or foraging. Open clayey and sandy banks are largely avoided as they lack cover for escape routes (Hussain 1993, Hussain and Choudhury, 1995, 1997 in Hussain et al., 2008). In rice fields and pond areas they prefer sites having a moderate diversity of vegetation. Rivers with moderate to slow or stagnant water and water bodies having a width of 10-40 m are preferred (Hussain et al., 2008).

This otter is the most widely distributed species in Nepal, present at least in the Annapurna Conservation Area, Bardia National Park, Chitwan National Park, Sukla Phanta Wildlife Reserve, Koshi Tappu Wildlife Reserve, Ghodaghodi Lake Area, Jagadishpur Reservoir, farmland in the Lumbini Area, Rani Lake in Kanchanpur, the Karnali river in Bardia, Beeshazari and associated lakes, Banke, Dang, Nawalparasi, Bardia, Kailali, Chitwan, Sunsari, Kapilvastu, Kanchanpur, Kaski, Lamjung and Saptari.

Asian Small Clawed Otter

The typical habitats of Asian small-clawed otter are freshwater swamps, forested rivers, meandering rivers, mangroves and tidal pools (Shrestha, 1997; Muller, 1839 in Hussain and de Silva, 2008). Like the Smooth-coated otter, the Asian small-clawed otter dislikes bare and open areas that do not offer any shelter (Melisch et al. 1996 in Hussain and de Silva, 2008). In Thailand, the rapid-flowing upper areas of the Huay Kha Khaeng were dominated by *L. lutra*, the slowly meandering river near the dam and the dam itself were used by *L. perspicillata* while the Asian small-clawed otter occurred mostly in the middle sections, but also in the upper reaches (Kruuk et al. 1994). In riverine systems it prefers moderate and low vegetation structure, though its presence was also observed on banks with poor vegetation cover. Neither in ponds nor in rice field areas did they show preference for any of the vegetation structure categories, though poor or bare structural conditions were the least favoured both in riverine and pond areas and along the rice fields (Hussain and de Silva, 2008). In Nepal, this species has been recorded up to about 1300m. Few localities are nowadays known for this otter, although it is present in Kailali and Kapilvastu.

When different otter species occurred in the same site there was evidence of difference in use of the habitats. Signs of the of small-clawed otter were found wandering further away from the river than the two other species, between patches of reeds and river debris where crabs were more likely to be found (Kruuk et al., 1994).

Otters in Pokhara valley lakes, Kaski District

The presence of the three otter species has been confirmed in Khola Besi, Bhangara, Talkhola and Simal Danda of the Rupa Lake area, but in this last site it has not been confirmed yet. Indeed, people from the Rupa Lake appear to have seen 33 otters over the last 12-15 years (Bhandari and GC, 2008). There was an unusual practice of hunting/killing otters in the Rupa lake area 20-25 years ago by hiring hunters from the Terai with the help of dogs. The major reason for such killing was the predation by otters on fish. Eurasian otters inhabit Rupa and Begnas Lakes, whereas the Vijaypur stream in Pokhara valley supports Smooth-coated otters (Acharya and Gurung, 1994).

Otters along the Karnali River and streams, Bardia District

Populations of Smooth-coated otter occur along the banks of the Grewa River, Khaura River, Batahani River, Orai River, Lamak Lake, Gola ghat area, Banjara ghat area and the Khaurahi stream in Bardia district. Based on spraint counts, Bhandari (2008), estimated that nearly 40 otters are present along the banks of Grewa River, Khaura and Batahani River in Bardia National Park within a 1.98 square kilometre area. But it is impossible to estimate otter population size, either in terms of number of individuals or relative abundance, since indices from spraint counts alone, using the number of spraints left by an otter, vary on a seasonal basis and studies evidence the lack of any relationship between the number of otters in an area, or their activity on a site, and the number of spraints found during otter surveys. However, the resulting otter density calculated from the data as interpreted by the author: 40 otters in 1.98 km^2 = 20.20 otters/km^2- could be correct when groups of 4-6 animals are present, but previous work on Smooth-coated otter densities record it as being a low density species, one of the lower of the world's otters. This shows that caution should be used in interpreting an author's work.

Thapa (2002) indicated the presence of the Smooth-coated otter in Damakantar, Banka, Bung ghat, Lalmati area, Danpur area, Gola ghat area and the Khaurahi stream in Bardia National Park; and estimated one Smooth-coated otter per km of river in a 35-km stretch of the Geruwa River in Bardia National Park. The data was from direct observations taken at different time and space intervals - not at the same time - along the whole of the study area. The observations were independent and likely to overestimate the real size, or to underestimate the real size if a part of the population was misidentified. The Orai River in Bardia is a potential habitat for otters (Joshi, 2009).

Otters in the Narayani River, Chitwan District

The Smooth-coated otter is believed to be common along the Narayani River within the Chitwan National Park of Nepal (Houghton, 1987). The significant number of signs in this area could indicate in some way the existence of a reasonable otter population in the area.

Otters in the Ghodaghodi Lake Area, Kailali

Kafle (2007) recorded the presence of Eurasian otter and Smooth-coated otter in the Ghodaghodi Lake area of Kailali district through interviews with a key informant.

MAJOR FACTORS PUTTING OTTERS AT RISK IN NEPAL

There is very little, and scattered, information from Asia on otters. It suggests that in many countries of Asia, there have been declines in numbers and reduction of ranges, and concern is expressed about the conservation of the species in many parts of the continent (Foster-Turley and Santiapillai, 1990; De Silva 1995; Conroy et al., 1998).

Like most *Lutra* species, fish is the major prey of Eurasian otters sometimes exceeding more than 80% of their diet (Erlinge, 1969; Webb, 1975; Ruiz-Olmo and Palazon, 1997 in Ruiz-Olmo et al., 2008). The range of fish in the diet of Smooth-

coated otters varies from 75% to 100% (Tiler et al., 1989; Foster-Turley, 1992; Hussain, 1993; Melisch et al., 1996; Hussain and Choudhury, 1998 in Hussain et al., 2008). The Small clawed otter feeds mainly on crabs, snails and other molluscs, insects and small fish such as gouramis and catfish (Pocock, 1941; Wayre, 1978 in Hussain and de Silva, 2008). They supplement their diet with rodents, snakes and amphibians as well (Hussain and de Silva, 2008). The otters supplement their diets with shrimp/crayfish, crab and insects, and other vertebrates such as frog, mudskippers, birds and rats. Any activities adversely affecting the diversity and population of fish and aquatic organisms can have enormous effects on otter populations in Nepal. Moreover, the degradation of wetland habitat can directly affect otter survival and reproduction. The aquatic habitats of Nepal are also vulnerable to human activities. The major factors putting Nepalese otter populations at risk are as follows:

Water Pollution and Loss of Prey: Discharges from the Gorkha Brewery and the Bhrikuti Paper and Pulp factory are the major source of pollution in the Narayani River. Due to comparatively high number of industries in the lowland Terai, many rivers and streams there are polluted by industrial waste. Different chemicals such as Phoret, Thiodan, Methyl parathion, Cypermethrin, Dieldrin, Aldrin, Endrin and chemical fertilisers are increasingly used by farmers to increase crop production. These toxins run off into water bodies to be absorbed by aquatic fauna. These pesticides are also used for poisoning birds (both to prevent crop predation and for use as food) and in fishing bait. Epizootic Ulcerative Syndrome (EUS), a disease caused by the fungus *Aphanomyces invadans* in the internal tissue of fish has been reported in Nepal since 1983. The deterioration of water quality in water bodies provides favourable environmental conditions for the growth of *A. invadans* in fish. Over 40 species of fish, mostly freshwater species, are reportedly susceptible to EUS with Catfish (*Wallago attu* and *Mystus* spp.), Snakeheads (*Channa* spp.) and Barbs (*Puntius* spp.) being the most susceptible. EUS has been reported in the Koshi Tappu wetland area since 1983, where it has caused high mortality of native fish, and from Ghodaghodi Lake since 1998 (IUCN Nepal, 2004). The number of fish species in the Bagmati River has declined from 54 to 7 within a decade as a result of the inflow of industrial sewage. The high concentration of organic matter and chemicals in effluents has killed fish and destroyed the plant life they depend on (Shrestha et al., 1979; Sharma and Pantha, 1992).

In Pokhara, water pollution and solid waste disposal problems have been greatly exacerbated by the establishment of tourist facilities along the shores of Phewa and Begnas lakes, and their water quality has deteriorated due to faecal contamination from the direct discharge of sewage via drains, including the overflow from septic tanks in hotels and restaurants. Washing of clothes by hotels, restaurants and households results in the discharge of over 100kg of soap and detergents daily into Phewa Lake (Oli, 1997).

The contamination of freshwater ecosystems with harmful chemicals can put otters at risk due to the adverse effects on their physiology. EUS can decrease the diversity and population of fish species thus affecting the dietary diversity of otters.

Hunting and Killing:

There are records of killing of otters for their pelt, meat and for the uterus that is thought to have medicinal value, but the effects of hunting on their populations remains unknown (IUCN Nepal 2004). Fishpond owners consider otters as a threat to fish farming as otters eat fish in their ponds at night. In Rupa Lake in the Pokhara valley in Nepal, otters used to be hunted by using dogs and specially trained hunters from India to prevent damage to fish populations – in private ponds and natural lake areas in the 1980s-90s. In 2004, one otter was killed by local people chasing it for the same reason (pers. obs.).

Loss of Wetland Habitat:

Lack of clear demarcation of wetland boundaries has increased wetland loss and degradation in Nepal. Encroachment on wetlands is primarily due to: (i) drainage for irrigation, reclamation, and fishing; (ii) filling-in for solid waste disposal, road construction and commercial, residential, and industrial development; (iii) conversion of sites for aquaculture; (iv) construction of dams, barrages, and other barriers to control water flow; (v) groundwater extraction using high-powered pumps, and digging ditches in sites where there is no inflow of water; (vi) discharge of sediments and pollutants from nearby areas; (vii) grazing; and (viii) removal of soil from the site (HMGN/MFSC, 2002). The lake shores in the Pokhara valley are being encroached for agricultural conversion (pers. obs.). This encroachment has resulted in a number of negative impacts, including reduction of wetland areas, deposition of silt and sediment, and eutrophication caused by agricultural runoff and/or industrial effluents. Construction of barrages in the Karnali and Narayani rivers lead to major changes in seasonal water availability, temperature regimes, water energy, bed and suspended material transport and oxygenation of the rivers themselves, as well as in associated vegetation and faunal communities. It has affected the breeding behaviour of a number of fish species and also the fish population (IUCN Nepal, 2008). Sedimentation is also one of the major problems in the lakes of Nepal, reducing the lake size and changing the water discharge pattern (pers. obs.). These activities and processes have degraded the wetland habitat for otters.

Limited research and awareness:

Most of the research and conservation efforts have been concentrated on large mammals within the protected areas. Several mammals including otters do not have priority in research and monitoring programmes either inside or outside the protected areas of Nepal. The degree of understanding among people, both the general public and wetland dwellers, is too low, given that many of them are unaware of the existence of otters (pers. obs.).

RESEARCH AND CONSERVATION IMPLICATIONS

Nepal supports 3 out of 5 of Asia's otter species, out of a total of 13 worldwise. This highlights the global importance of conserving otters in Nepal. However, the status of otters in Nepal has not been explored enough yet. Few studies have been carried out in the lowland Terai of Nepal on distribution, population of, and threats to otters. No

intensive studies on otters have been carried out in the wetlands of all the ecological zones of Nepal.

The following recommendations have been made for research and conservation of otters in Nepal:

Research on Basic Ecology of Otters:

The analysis shows that a preliminary status survey of otters has only been conducted in Kaski, Bardia and Chitwan districts, and only on some freshwater sites. Where presence/absence information on otters is available, intensive research focusing on the basic ecology of otters should be initiated. The wetlands in the Terai region of Nepal are the potential sites to initiate ecological research, as presence/absence information on otters is more available in this region than in the other ecological zones of Nepal. However, there are additional wetland sites in the Terai where presence/absence information is not available.

National Otter Survey: Nepal has 75 districts and the presence of otters has been confirmed in only 24 districts. In the other districts, surveys have not been carried out, so information on occurrence (presence/absence) of otters is generally unavailable. The presence/absence information on otters in several sites was documented decades ago based on participatory approaches, usually interviews with key informants. These gaps in knowledge emphasize the urgent need for a systematic field-based survey for otters, focusing on three ecological zones: the Terai, Hills and Mountains of Nepal.

Most of the information on the presence/absence of otters came from the protected areas and Ramsar sites of Nepal, which have conservation priority. Insufficient studies on freshwater ecosystems outside the protected areas highlight the information gap on the presence/absence data for otters. Based on the distribution range of the otters in South Asia and Nepal, it is possible that otters are present in additional districts of Nepal. Rupandehi district lies between Nawalparasi and Kapilvastu districts (the sites with otters), and is a potential site for occurrence of the Smooth-coated otter due to similar climatic and topographical conditions – hence priority sites for further study. Similar projection can be applied to Parsa, Rautahat, Sarlahi, Mahottari, Dhanusa, Siraha and Morang districts in eastern Nepal, which join the protected areas network with similar climatic and topographical conditions. The Middle Hills region has few protected areas in comparison to the lowland Terai and high mountain regions of Nepal. Information on wetlands distribution in the Middle Hills region is not available. In this context, the information on otters is very scanty except in the Pokhara valley. Considering the altitudinal range of distribution of the Eurasian otter in Nepal, it is highly possible that additional Middle Hill districts have freshwater ecosystems with otters. At least Dhading, Tanahun, Baglung, Parbat, Makawanpur, Jhapa and Dhankuta ,which border the sites with known presence of otters in the Middle Hills region, can be priority sites for preliminary assessment of otter presence/absence. In the initial stage, focus should be given to participatory approaches to collecting presence/absence information on otters. In-depth interviews with older people, fishermen and those living near wetlands can be the starting point for this. The basic information on presence/absence of otters can then be used for

designing and implementing intensive research programmes. It will also be a starting point for identifying Important Otter Areas or Hotspots in Nepal.

Integrated Wetland Management and Capacity Building:

Wherever otters are present, some sort of conflict exists between fish farmers and otters due to fish predation by otters. Wetlands in Nepal are negatively affected by human activities, and these threats have the potential to directly impact the survival of otters. The vast majority of Nepalese people know nothing of the existence of otters in the world in general and Nepal in particular. For these reasons, management programmes using otters as a key indicator species, that consider all the ecological aspects of these animals (i.e., habitat and diet preferences, importance in the ecosystems and conservation problems) can be very valuable to the people living in the vicinity of wetland habitats. These kinds of programmes can increase knowledge within the local community and fish farm owners about the existence and importance of otters, perhaps helping to reduce the antagonism against otters in Nepal. Otter survey components should be integrated within the conservation and management plans of wetlands. Integrated programmes on basin management can simultaneously reduce the threats to wetlands and, obviously, to otters as well.

Good educational material can be a useful resource for the well-trained teacher. Educational materials with an otter conservation message can help the general public to understand otter issues and importance so that they can gradually consider the otters as an integral part of freshwater ecosystems. Educational materials such as posters, information sheets and an otter booklet in the Nepali language should be prepared and distributed to the general public with appropriate guidance to increase their understanding of otter conservation in Nepal.

As the quality of information from research will depend on the knowledge and skill of the researchers, some sort of capacity building programmes, such as training, needs to be initiated in Nepal to build up interest on otter related issues.

CONCLUSION

Now is the time to begin these initiatives if we want to achieve otter conservation in Nepal. If timely intervention is not done, it is likely that otters will be on the verge of extinction in the country.

REFERENCES

Acharya, P. M., Gurung, J. B. (1994). A report on the status of common otter (*Lutra lutra*) in Rupa and Begnas Tal, Pokhara valley. *TigerPaper*, Vol **XXI**, No. 2: 21-22.

Bhandari, B. (1998). An inventory of Nepal's Terai wetlands. IUCN – The World Conservation Union, Kathmandu, Nepal.

Bhandari, J. (2008). Status, distribution of and threats to otters in Karnali river of Bardia National Park, Nepal. A BSc thesis submitted to Institute of Forestry, Pokhara, Nepal.

Bhandari, J., Bijaya, D. (2008). Preliminary survey and awareness for otter conservation in Rupa Lake, Pokhara, Nepal. *J. Wet. Eco*. **1**(1/2): 2.

Chaudhary, R.P. (1998). Biodiversity in Nepal - Status and Conservation. Tecpress Books, Bangkok.

Conroy, J., Melisch, R., Chanin, P. (1998). The distribution and status of The Eurasian otter (*Lutra lutra*) in Asia -A Preliminary Review. *IUCN Otter Spec. Group Bull.* 15(1): 15 – 30.

de Silva, P.K. (1995). The status of otters in Asia and south East Asia. In: Reuther, C., Rowe-Rowe, D. (eds.) Proc. VIth. Intern. Otter Coll. *Habitat* **11:** 33-35.

DOAD. (1992). National Fisheries Development Plan, 1992/93. Fisheries Development Division, Department of Agriculture Development, HMGN, Kathmandu, Nepal.

Foster-Turley, P. (1992). Conservation aspects of the ecology of Asian small-clawed and smooth otters on the Malay Peninsula. *IUCN Otter Spec. Group Bull*. 7: 26–29.

Foster-Turley, P., Santiapillai, C. (1990). Action plan for Asian otters. In: Foster-Turley, P., Macdonald, S.M., Mason, C.F. (Eds.) Otters: An Action Plan for Their Conservation. IUCN, Gland, Switzerland, pp. 52-63.

Green, J., R. Green, and D.J. Jefferies. (1984). A radio-tracking survey of otters *Lutra lutra* on a Perthshire river system. *Lutra* 27: 85 - 45.

Hagen, T. (1998). Nepal - The Kingdom in the Himalaya, 4th ed. Himal Books, Lalitpur, Nepal

HMGN/MFSC. (2002). Nepal Biodiversity Strategy. His Majesty's Government of Nepal, Ministry of Forests and Soil Conservation.

HMGN/ADB/FINNIDA. (1988). Master Plan for Forestry Sector Nepal. HMGN/ADB/FINNIDA, Ministry of Forest and Soil Conservation, HMGN, Kathmandu, Nepal (main Report).

Hodgson, B.H. (1839). Summary description of four new species of otter. *J. Asi. Soc. of Ben.* **8**: 319-320.

Houghton, S.J. (1987). The Smooth-coated otter in Nepal. *IUCN Otter Spec. Group Bull.* **2**: 5 – 8.

Hussain, S.A. (1993) Aspects of the ecology of smooth-coated Indian Otter *Lutra perspicillata* in National Chambal Sanctuary. *Ph.D. Thesis, Aligarh Muslim University, Aligarh*, 206 pp.

Hussain, S. A., Choudhury, B. A. (1997). Distribution and status of the smooth-coated otter *Lutra perspicillata* in National Chambal Sanctuary, India. *Biological Conservation* **80**: 199–206.

Hussain, S.A., de Silva, P.K. (2008). *Aonyx cinerea*. In: IUCN 2008. 2008 IUCN Red List of Threatened Species. [www.iucnredlist.org. Downloaded on 13 May 2009]

Hussain, S.A., de Silva, P.K., Mostafa Feeroz, M. (2008). *Lutrogale perspicillata*. In: IUCN 2008. 2008 IUCN Red List of Threatened Species. [www.iucnredlist.org. Downloaded on 13 May 2009]

IUCN Nepal. (2004). A review of the status and threats to wetlands in Nepal. 78+v .

Jha, P. K. (1992). Environment and Man in Nepal. Craftsman Press, Bangkok.

Joshi, D. (2009). Status of Smooth Indian otter (*Lutra perspicillata*) and conservation of freshwater ecosystem outside protected areas of Bardia National Park in Karnali River, Nepal. A report submitted to Rufford Small Grants Foundation, UK. [http://www.ruffordsmallgrants.org/rsg/projects/dipesh_joshi. Downloaded on 13 May, 2009]

Kafle, G. (2007). Status and conservation of Ramsar sites and associated biodiversity in Nepal with emphasis on Ghodaghodi Lake Area. A MSc thesis submitted to Institute of Forestry, Office of the Dean, Pokhara, Nepal.

Kafle, G. (2008). Otters in Nepal: Urgent need for action! *J. Wet. Eco*. **1**(1/2): 1.

Kruuk, H., Kanchanasaka, B., O'Sullivan, S., Wanghongsa, S. (1994). Niche separation in three sympatric otters *Lutra perspicillata, L. lutra* and *Aonyx cinerea* in Huai Kha Khaeng, Thailand. *Biological Conservation* **69**:115–120.

Mool, P. K., Bajracharya, S. R., Joshi, S. P. (2001). Inventory of glaciers, glacial lakes and glacial lake outburst floods: monitoring and early warning systems in the Hindu Kush-Himalayan region - Nepal. Kathmandu.

Oli, K. P. (ed.) (1997). Phewa Lake Conservation Action Plan. IUCN Nepal, Kathmandu, Nepal, 75p.

Ruiz-Olmo, J., Loy, A., Cianfrani, C., Yoxon, P., Yoxon, G., de Silva, P.K., Roos, A., Bisther, M., Hajkova, P., Zemanova, B. (2008). *Lutra lutra*. In: IUCN 2008. 2008 IUCN Red List of Threatened Species. [www.iucnredlist.org. Downloaded on 16 May 2009]

Scott, D.A. (ed) (1989). A Directory of Asian Wetlands. IUCN, Gland, Switzerland.

Sharma, S., Pantha, K. (1992). New Field and Issues in Fisheries Development in Nepal. In *Human Resource Development in Fisheries Research in Nepal*, pp 195-216. Proceedings of a workshop held in Kathmandu, Nepal, 1-3 April 1992, Fisheries Development Division, Department of Agriculture, Ministry of Agriculture, HMGN, Kathmandu, Nepal.

Shrestha, J. (2001). Taxonomic Revision of Fishes of Nepal. In Jha, P.K., Karmacharya, S.B., Baral, S.R., and Lacoul, P. (eds) *Environment and Agriculture: At the Crossroad of the New Millennium*, pp 171-180. Ecological Society (ECOS), Kathmandu, Nepal.

Shrestha, S. B., Shrestha, T. K., Pradhan, B.R. (1979). Report on the Study of Aquatic Ecology and the Potential of Fisheries Development in Bagmati River Project. A Report prepared for GTZ-Nepal, Kathmandu, Nepal (a report).

Shrestha, T.B., Joshi, R.M. (1996). Rare, Endemic and Endangered Plants of Nepal. WWF Nepal Program, Kathmandu, Nepal.

Shrestha, T.K. (1997). Mammals of Nepal-with reference to those of India, Bangladesh, Bhutan and Pakistan. Mandela Book. Point, Nepal.

Thapa, T. (2002). Survey of the Smooth Indian otter *Lutrogale perspicillata* in the Karnali River of Bardia National Park, Nepal. A report submitted to International Otter Survival Fund, Scotland. [http://www.otter.org/nepal.html. Downloaded on 13 May, 2009.

Wayre, P. (1978). The status of otters in Malaysia, Sri Lanka and Italy. Pp. 152–155 in Otters (N. Duplaix, ed.). Proceedings of the First Working Meeting of the Otter Specialist Group, International Union for the Conservation of Nature, Gland, Switzerland

RESUME

BILAN DES RECHERCHES ET DE LA CONSERVATION DES LOUTRES AU NÉPAL

Trois espèces de loutres ont été recensées au Népal : la Loutre d'Europe (*Lutra lutra*), la Loutre à pelage lisse (*Lutrogale perspicillata*) et la Loutre cendrée (*Aonyx cinereus*). La plupart des zones humides du pays ne présentent aucunes données relatives à ces diverses espèces. Les milieux constitués d'eau douce, généralement préférés des loutres, sont affectés négativement par des facteurs humains ou naturels. Cet article fournit donc un état des lieux actuel des recherches sur les loutres du Népal, les conclusions qui en découlent et les moyens à mettre en œuvre pour leur conservation.

RESUMEN

UNA REVISION DE LA INVESTIGACION Y LA CONSERVACION DE LAS NUTRIAS EN NEPAL

Tres especies de nutria, la Eurasiatica (*Lutra lutra*), la nutria lisa (*Lutrogale perspicillata*), y la nutria desgarrada Asiática (*Aonyx cinereus*) han sido registradas en Nepal, pero para la mayoría de los humedales del país la información básica de estas especies no se encuentra disponible. Los ecosistemas de agua dulce, que representan el hábitat preferido de las nutrias, han sido afectados negativamente por factores naturales y humanos. Este trabajo presenta una reseña de los estudios de nutrias en Nepal hasta la fecha, incluyendo los resultados principales de estos trabajos y las necesidades a futuro.

S H O R T N O T E

RECORDS FOR THE NEOTROPICAL RIVER OTTER IN LANDSCAPES OF THE RAMSAR SITE ALVARADO LAGOON SYSTEM, MÉXICO

Gilberto SILVA-LÓPEZ

Área Biología de la Conservación, Instituto de Investigaciones Biológicas, Universidad Veracruzana, e-mail: gsilva@uv.mx

(received 14th May 2009, accepted 11h June 2009)

Studies on the Neotropical river otter (*Lontra longicaudis annectens*, Major, 1897) and its habitat have increased in recent years in Mexico (e.g. Carillo-Rubio and Lafón, 2004; Gallo et al., 2008; Guerrero-Flores et al., 2007; Macías-Sánchez and Hernández, 2007; Maldonado and López-González, 2003), where the species is endangered (Semarnat, 2002). Together these and other observations (e.g. Briones-Salas et al., 2001; Casariego et al., 2002; Díaz-Gallardo et al., 2002; González, 1986), including studies on their feeding habits (Mundo-Hernández et al., 2007; Santiago-Plata et al., 2007), form part of broad surveys on the mammalian fauna of specific regions (e.g. González and Briones, 2002; Hernández et al, 2002; Navarro, 1982). Gallo (1997) made a summary of his personal observations and other studies (e.g. Hall and Dalquest, 1963; Ingles, 1958) conducted in some Mexican regions, including records and observations of the otter in localities of, or nearby, the Alvarado municipality. Aside from these records and a study on the organic pollutants present in the aquatic habitat of the species (López-Suárez and Silva-López, 2003; Silva-López et al., in prep.), no other specific study on this otter has been conducted in the area since this time. This paper reports personal observations on the otter, and the information provided by fishermen of the Alvarado Lagoon System (Sistema Lagunar Alvarado or SLA), which forms part of a long-term, ongoing study on the landscape ecology, biodiversity, and ecological characteristics of the area.

The SLA has been considered a high priority region for conservation (e.g. Arriaga-Cabrera et al., 1998; Conabio, 1998; Dugan, 1993), including recognition by the North American Wetlands Conservation Council (NWCCA), the International Council for Bird Preservation-Mexico Chapter (CIPAMEX), and Mexico's Commission on Biodiversity (CONABIO) (Ramsar Site Information Service data sheet, http://www.wetlands.org/rsis/, consulted: 28 July, 2008). The central point coordinates for the site are 18°39´ N and 95°51´ W. The SLA has been characterized as an estuarine complex comprising several coastal brackish lagoons, more than 100 interior lagoons and parts of the Papaloapan, Acula, Blanco, and Limon rivers. The site features representative and diverse ecosystems of Mexico´s Gulf coastal plain, such as coastal dunes, reed beds of *Cyperus spp*., cattail *Typha spp.*, palm forests of *Sabal mexicana*, *Scheelea liebmannii*, and *Acrocomia mexicana*, oak forest of

Quercus oleoides; apompales (*Pachira aquatica*), and a large mangrove forest. It encompasses an area of 267,010 ha, of which 28,468 ha are covered by water. Portilla-Ochoa et al. (1998) and Silva-López and Portilla-Ochoa (1999) distinguished 15 landscape units (LU) in the area. LU were first differentiated as areas disturbed by agricultural activities, areas disturbed by cattle ranching, and areas where human intervention is not yet considerable, such that natural vegetation still is the landscape dominant element. Each LU was described in terms of land use, seasonal flooding, vegetation cover (i.e. primary and secondary), predominant exploitation systems, the physical medium (i.e. substrate origin and soil type), hydrologic characteristics, and other data (e.g. human settlements, main roads, and observations on deforestation, urban and rural infrastructure, and industrial development).

Three observations of adult otters hunting and eating in lagoons and rivers of the area were made, together with records on otter tracks and feces at another site (Table 1; Figure 1). In addition, an adult otter skin was found in a fisherman's house in November 2002 (Figure 2), where informants said the otter was hunted that year. All of these records were made in three of the most conserved LU of the system, which include an area of 60,708 ha, encompassing more than 22.7 % of the SLA´s total area (Table 2).

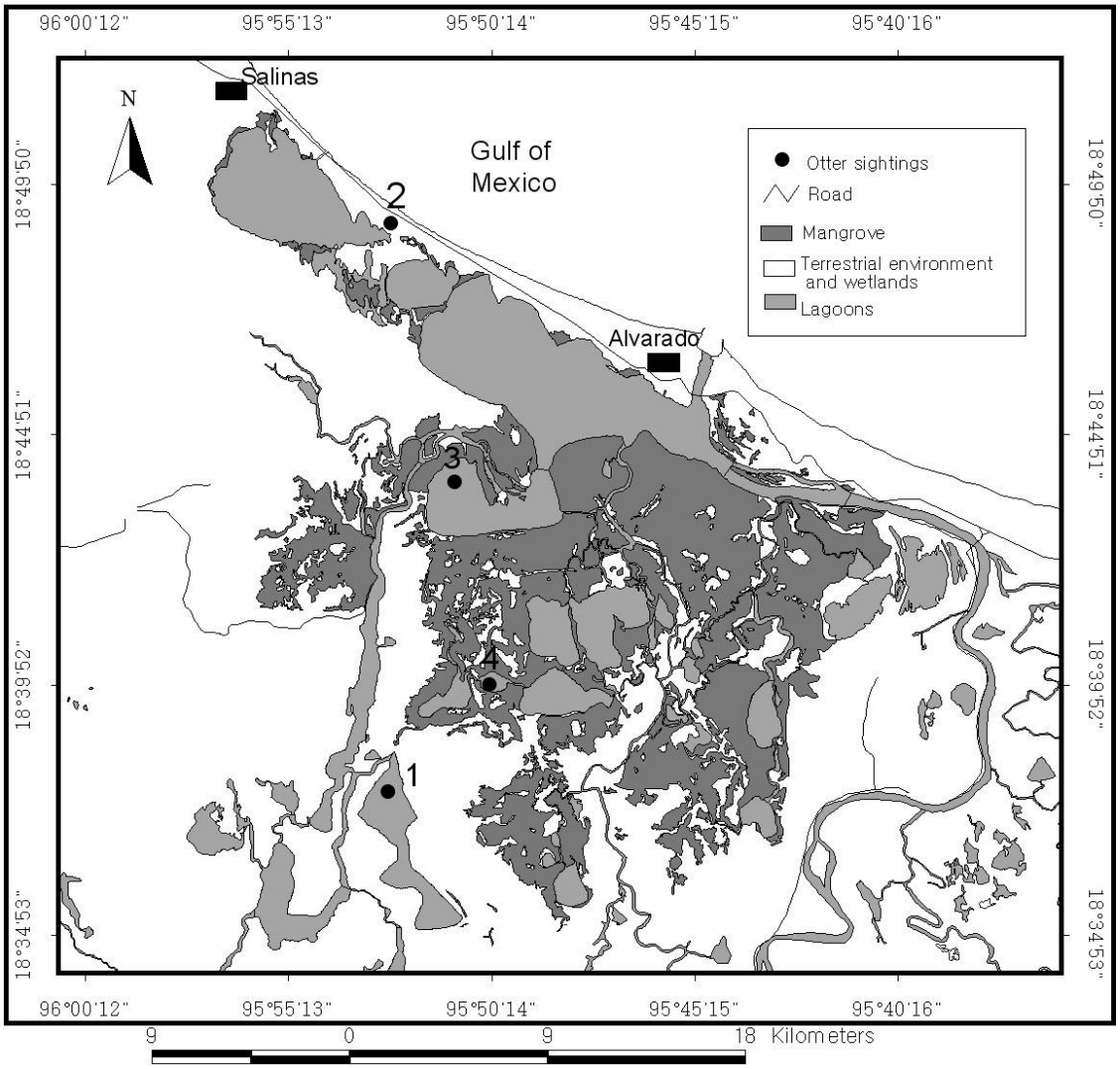


Figure 1. Ramsar site Sistema Lagunar de Alvarado (Alvarado Lagoon System) in Mexico.

Table 1. Observations, records, and localities.

Observations and records (number on map)	**Description of localities and information available on landscape units (LU)** (Martínez-Garza, 2006; Oliva-Rivera, 1998; Sauceda-Rodríguez, 1998), Sauceda-Rodríguez and Juárez-Eusebio, 1998; Silva-López and Portilla-Ochoa, 1998; Silva-López et al., 1999)
1. Adult otter swimming on its back, with a clam (probably the almeja gallo *Rangia cuneata*, Mactridae) on its belly.	18º 36' 50"N, 95º 52' 44" W, Popuyeca Lagoon (944.1 ha) Vegetation and plant species: Popal (*Thalia geniculata*), tular (*Cladium* spp.), espadinal (*Cladium jamaicense),* and other aquatic and semi aquatic plants (*Eichhornia crassipes, Pistia stratiotes, Nelumbo lutea, Cyperus articulatus, C. giganteus, Typha latifolia, T. dominguensis, Pachira aquatica, Pontederia sagitaria, Canna* spp., *Saggitaria latifolia, Ruppia maritima, Ceratophyllum demersum,* and *Vallisneria* sp.) Trees found in the adjacent introduced grassland: *Sabal mexicana*, and *Pithecellobium dulce*. Aquatic fauna: *Macrobrachium acanthurus, Callinectes rathbunae, C. sapidus, Cichlasoma gadovvii* and *C. urophtalmus.* LU: PO (Popal-espadinal; 21,767.8 ha). Lagoons of the interior represent 33.3% of the area. Rivers account for 6.7% of the LU. The popal, tular, and espadinal, are the main vegetation types in the LU terrestrial and river shore habitat (close to 93.3%). Other vegetation types present are mangrove (3.9%) and cultivated grassland (1.7 %). Fishing is the main productive activity in the LU.
2. Feces and tracks of otters in the sand along the river shore.	18º 50' 3" N, 95º 52' 40" W, La Camaronera locality and river. Vegetation and plant species: Mangrove (*Rhizophora mangle, Avicennia germinans Conocarpus erecta,* and *Laguncularia racemosa),* secondary growth, and introduced grassland. La Camaronera river is the only site were the presence of the mangrove species *Conocarpus erecta* has been recorded in the entire lagoon system thus far. Aquatic fauna: *Poecilia latipunctata, Cichlasoma* sp., *C. urophtalmus, C. gadovii, Dormitator maculatus, Astyanax* sp., *Ictalurus meridionales, Gobiomorus dormitor, Oreochromis mossambicus, Arius felis, Centropomus parallelus,* and others. LU: M1 (Disturbed mangrove; 8,598.6 ha). The Alvarado, Buen País, and Camaronera lagoons are the main water bodies of the system, representing more then 76.8% of the area. Mangrove (47.52%) and cultivated grassland (44.1%) are the main terrestrial vegetation types, followed by coastal dunes (3.7%) and oak forest (of *Quercus oleoides,* 1.5%). Cattle ranching is the main productive activity in the LU).
3. Adult otter eating in a espartal (*Spartina alterniflora*) - mangrove edge (remains of *Callinectes sapidus* were identified on site).	18º 44' 2" N, 95º 51' 6" W, Property (ranch) Rincón de Lechería, at Talixcoyan Lagoon (1192.84 ha). Vegetation and plant species: Mangrove (*Rhizophora mangle, Avicennia germinans, and Laguncularia racemosa),* espartal (*Spartina alterniflora*), and mangrove-espartal and mangrove-introduced grassland (*Stenotaphrum secundatum*) edges (*Randia aculeata, Acacia cornigera, Senna* sp., *Jacquinia aurantiaca, Malvaviscus arboreus, Capparis* sp., *Pithecellobium* sp.) LU: M2 (Conserved mangrove; 30,343.7 ha). Lagoons and rivers represent 22.6 % (rivers: 5.9%) of the area, while the mangrove habitat accounts for 77.4%. Fishing and some cattle ranching predominate as the primary productive activities.
4. Adult otter. "Playing" in the water (diving and emerging repeatedly).	18º 39' 19" N, 95º 50' 15" W, Tacosta Lagoon (86.21 ha). Vegetation and plant species found: Mangrove (*Rhizophora mangle, Avicennia germinans, and Laguncularia racemosa)* and other vegetation (*Rhabdadenia biflora, Solanum tampicense, Mymeco phyllatibicinis, Brassavola nodosa,* and *Butis marítima).* LU: M2 (Conserved mangrove; described above). Data on nearby, interconnected El Salado, Tensonapa, Clavellinas, Las Guaras, and La Secreta lagoons suggest the presence of the following crustacean and fish species at Tacosta: Crustaceans: *Penaeus aztecus, Callinectes rathbunae* and *C. sapidus.* Fish: *Arius melanopus, Centropomus parallelus, Dorosoma petenense, Cichlasoma urophthalmus, Petenia splendida.* Water parameters (August and December): mean air temperature: 32.5° and 16°C. Salinity: 0 and 7 ppt. Dissolved oxygen: mean reduction of 3.1 to 1.2 mg/l. pH: neutral to slightly alkaline, with a CO_2 concentration of approximately 27 mg/l.)

Note to Table 1: *Penaeus* sp., *Macrobrachium acanthurus*, *Callinectes sapidus*, *Cichlasoma* sp., *Poecilia* sp., *Cichlasoma* sp., *Dormitator maculatus*, *Astyanax* sp., *Ictalurus* sp., *Gobiomorus dormitor*, and *Oreochromis* sp. were reported by Gallo (1997) as part of the otter's diet.

Figure 2. Skins of an otter (*Lontra longicaudis annectens*) and a tejón (*Nasua narica*) found in a fisherman´s house at the Papaloapan river in November, 2002.

These observations and records, along with comments made by other Alvarado fishermen, suggest the species still occupies a vast extent of the SLA complex and wetlands, and emphasizes the need to conduct more detailed surveys and studies to determine the present status and ecology of the "perro de agua" (as it is locally known) and its habitat.

References

Arriaga Cabrera, L., Vázquez Domínguez, E., González Cano, J., Jiménez Rosenberg, R., Muñoz López, E., Aguilar Sierra, V. (coordinadores). 1998. Regiones Marinas Prioritarias de México. Comisión Nacional para el Conocimiento y uso de la Biodiversidad. México.

Briones-Salas, M., Cruz, J., González, G. 2001. Abundancia relativa de la nutria Neotropical (*Lutra longicaudis annectens*) en el río Zimatán en la costa de Oaxaca, México. Resúmenes del V Congreso de la Sociedad Mesoamericana para a Biología y la Conservación. 15-19 de Octubre, 2001. San Salvador, El Salvador. P. 88.

Carillo-Rubio, E., Lafón, A. 2004. Neotropical river otter micro-habitat preference in West-Central Chihuahua, Mexico. *IUCN Otter Spec. Group Bull.* **21**: 10-15.

Casariego, M. A., Ceballos, G. J., Gamboa, E. 2002. Análisis de la abundancia y alimentación de la nutria de río en la costa de Oaxaca, México. Memorias del VI Congreso Nacional de Mastozoología. Oaxaca, Oaxaca. 21-25 Octubre, 2002.

Conabio. 1998. La Diversidad Biológica de México: Estudio de País. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. México.

Díaz-Gallardo, N. E., Iñiguez-Dávalos, L. I., Santa-Carrión, E. 2002. La nutria (*Lontra longicaudis*) en el Río Auyuquila, Jalisco. Memorias del VI Congreso Nacional de Mastozoología. Oaxaca, Oaxaca. 21-25 Octubre, 2002.

Dugan, P. (ed.). 1993. Wetlands in Danger: A World Conservation Atlas. IUCN-The World Conservation Union. Oxford University Press, USA.

Gallo, J. P. 1997. Situación y distribución de las nutrias en México, con énfasis en *Lontra longicaudis annectens* Major, 1897. *Revista Mexicana de Mastozoología*, **2**: 10-32.

Gallo-Reynoso, J. P., Ramos-Rosas, N. N., Rangel-Aguilar, O. 2008. Depredación de aves acuáticas por la nutria neotropical (*Contra longicaudis annecetens*), en el río Yaqui, Sonora, México. *Revista Mexicana de Biodiversidad*, 79: 275-279.

González, A. 1986. Las nutrias de la Sierra de Santa Marta, Ver. Memorias del IV Simposio de Fauna Silvestre. Facultad de Medicina Veterinaria y Zootecnia, UNAM. México. Pp. 219-226.

González, G., Briones, M. 2002. Conocimiento y uso de los mamíferos silvestres en tres comunidades indígenas de la Sierra Juárez de Oaxaca. Memorias del VI Congreso Nacional de Mastozoología. Oaxaca, Oaxaca. 21-25 Octubre, 2002.

Guerrero-Flores, J. J., Macías Sánchez, S., Méndez Sánchez, F. 2007. Evaluación del hábitat de la nutria (*Lontra longicaudis*) en Tres Ríos de Tamascaltepec, Estado de México, México. *Mesoamericana*, **11**: 111.

González, A. 1986. Las nutrias de la Sierra de Santa Marta, Ver. Mem. IV Simp. Fauna Silvestre, Facultad de Medicina Veterinaria y Zootecnia, UNAM. Pp. 219-226.

Guzmán-Guzmán, S. 1998. Anfibios y reptiles del humedal de Alvarado, Veracruz, México. In: Conservación y Manejo Sustentable de Recursos Naturales en Unidades del Paisaje del Humedal de Alvarado, Veracruz. **Portilla-Ochoa, E., Silva-López, G.** (Coordinators). Reporte Académico al U.S. Fish and Wildlife Service (14-48-98210-97-G082). Universidad Veracruzana. México.

Hall, E. R., Dalquest, W. W. 1963. The Mammals of Veracruz. *University of Kansas Publications, Museum of Natural History*, 14: 165-362.

Hernández, C., Chávez Tapia, C. B., García Collazo, R. 2002. Mamíferos medianos del Parque Nacional Huatulco, Oaxaca. Memorias del VI Congreso Nacional de Mastozoología. Oaxaca, Oaxaca. 21-25 Octubre, 2002.

http://www.otterspecialistgroup.org/Species/Lontra_longicaudis.html (consulted: July 29, 2008)

Ingles, L. G. 1958. Notas acerca de los mamíferos mexicanos. *Anales del Instituto de Biología, Serie Zoológica*, 29: 379-408.

López-Suárez, G., Silva-López, G. 2003. Presencia de estireno, þ-xileno, etanol, etilbenceno y benzofenol en lagunas de Alvarado, Veracruz, México, hábitat de la nutria *Lontra longicaudis annectens*. *Mesoamericana*, **7**: 76

Macías-Sánchez, S., Hernández, A. 2007. Distribución y abundancia de la nutria Neotropical *Lontra longicaudis* en el Río Santiago, Nayarit, México. *Mesoamericana*, **11**: 93.

Maldonado, J. R. E. and López-González, C. A. 2003. Recent records for the neotropical river otter (*Lontra longicaudis*) in Guerrero, Mexico. *IUCN Otter Spec. Group Bull.* **20**: 65-68.

Martínez-Garza, S. E. (2006). Evaluación del efecto de borde entre el manglar-espartal y el manglar-pastizal. Tesis de Licenciatura en Biología. Universidad Veracruzana. 72 pp.

Mundo-Hernández V., Monroy-Vilchis O., Macías-Sánchez S. 2007. Determinación de la dieta de la nutria Neotropical *Lontra longicaudis* en Temascaltepec, estado de México, México. *Mesoamericana*, **11**, 66.

Navarro, D. 1982. Mamíferos de la Estación de Biología Tropical "Ls Tuxtlas", Veracruz. Tesis de Licenciatura. Facultad de Ciencias, Universidad Nacional Autónoma de México. 128 pp.

Oliva-Rivera, H. 1998. Flora regional de los humedales de Alvarado, Veracruz. Conservación y manejo sustentable de recursos naturales en unidades del paisaje del humedal de Alvarado, Veracruz (E. Portilla-Ochoa y G. Silva-López, coordinadores). Reporte Académico al U.S. Fish and Wildlife Service (14-48-98210-97-G082). Xalapa, Ver., México.

Portilla-Ochoa, E., Silva-López, G., García Campos, H., Ramírez-Salazar, M. 1998. Paisajes amenazados en el complejo lagunar de Alvarado. In: Silva-López, G., Vargas-Montero. G., Velasco-Toro, J. (Eds.). De Padre Río y Madre Mar: Reflejos de la Cuenca Baja del Papaloapan, Veracruz. Editora del Gobierno del Estado de Veracruz-Llave, Veracruz, México. Vol. II, pp. 257-263.

Santiago-Plata, J. M., Valdez-Leal, J. D., Pacheco-Figueroa, J. C., Pérez-Garduza, F., Gordillo-Chávez, E. J., Moguel-Ordoñez, E. 2007. Hábitos alimentarios de la nutria *Lontra longicaudis* en la Veleta, Laguna de Términos, Campeche, México. *Mesoamericana*, **11**: 45.

Sauceda-Rodríguez, D. A. 1998. Ictiofauna de los cuerpos de agua próximos a Costa de la Palma, Alvarado, Ver.: distribución, diversidad e importancia económica. Tesis de Licenciatura. Universidad Veracruzana. México. 123 p.

Sauceda-Rodríguez, D. A., Juárez-Eusebio, A. 1998. Ictiofauna presente en el cultivo de *Callinectes rathbunae* y *Callinectes sapidus* en un encierro rústico en el humedal de Alvarado. Memorias del VI Congreso Nacional de Ictiología. Tuxpan, Veracruz, México. 21-24 October, 1998.

SEMARNAT. 2002. Norma Oficial Mexicana NOM-059-ECOL-2001. Diario Oficial de la Federación. Secretaría del Medio Ambiente y Recursos Naturales. México, D.F. Marzo 6, 2002.

Silva-López, G., Portilla-Ochoa, E. 1998. Conservación y Manejo Sustentable de Recursos Naturales en Unidades del Paisaje del Humedal de Alvarado, Veracruz, México. Reporte Académico al US Fish & Wildlife Service (14-48-98210-97-G082). Universidad Veracruzana. México.

Silva-López, G., Portilla-Ochoa, E., Sánchez-Hernández, A. I., Galán-Amaro, F., Pérez-Bello, A. I., Cortés-Balderas, A. D., Flores-Romero, C.I. 1999. Clasificación y Evaluación de Paisajes Amenazados: Jerarquización de Prioridades de Conservación y de Protección en el Humedal de Alvarado, Ver., México. Reporte Técnico Final del Proyecto B4-97-23 al Fondo Mexicano para la Conservación de la Naturaleza, A. C. Instituto de Investigaciones Biológicas, Universidad Veracruzana. México. 190 pp.

RESUME

DONNÉES RELATIVE À LA LOUTRE DE RIVIÈRE SUD-AMÉRICAINE SUR LE LAGON ALVARADO, SITE RAMSAR AU MEXIQUE

Les recherches sur la Loutre de rivière sud-américaine *Lontra longicaudis annectens* menées ces dernières années au Mexique se sont multipliées notamment à travers des études sur sa répartition, son régime ou sur la pollution organique des habitats. Ce travail est porté sur un site de conservation prioritaire au niveau international, le complexe estuarien du Lagon d'Alvarado. Il recueille les observations de 3 adultes accompagnées d'empreintes et d'épreintes sur des sites différents ainsi que la découverte d'une peau chez un pêcheur en 2002. Ces données suggèrent que la Loutre, ici appelée Chien d'eau, occupe une aire de répartition étendue et que cela mériterait d'engager une étude approfondie sur sa distribution et sur les habitats fréquentés.

RESUMEN

REGISTROS DE LA NUTRIA DE RIO NEOTROPICAL EN PAISAJES DEL SITIO RAMSAR SISTEMA LAGUNAR DE ALVARADO, MEXICO.

En esta nota se reportan tres observaciones de nutrias adultas y un registro de heces y huellas de la especie, en tres unidades del paisaje (UP) del Sistema Lagunar de Alvarado (SLA), Veracruz, México, un sitio RAMSAR desde el 2003 cuya conservación es considerada prioritaria. Las UP están caracterizadas por la presencia principal de manglar, así como otros tipos de vegetación. Se proporcionan datos sobre el medio acuático, especies presa reportadas como parte de la dieta de las nutrias y actvidades productivas predominantes en cada UP. Las observaciones realizadas y características del sitio sugieren que la nutria o perro de agua todavía ocupa una vasta extensión del SLA y enfatizan la necesidad de conducir más estudios sobre el estado de conservación y la ecología de la especie en el área.

A R T I C L E

USING SIGHTINGS FOR ESTIMATING POPULATION DENSITY OF EURASIAN OTTER (*Lutra lutra*): A PRELIMINARY APPROACH WITH ROWCLIFFE et al's MODEL

Pablo GARCÍA[1*], Valentín ARÉVALO[2], Isabel MATEOS[3]

[1]* *Corresponding author: Society for the Conservation of Vertebrates (SCV). Ave. Los Pinos, 17; 5ºA. 28914 Leganés, Madrid, Spain.*
e-mail: garciap@usal.es
[2] *Pza. de la Iglesia, 2. 47230 Matapozuelos, Valladolid, Spain*
[3] *C/ Los Transportistas, 15; 4ºA. 37006 Salamanca, Spain*
* *corresponding author*



(received 17th April 2009, accepted 10th May 2009)

Abstract: Because of the crucial importance for otter ecology and conservation, estimating population size (or standardizing it in density) is one of the major fields of research. However, the behaviour of the species makes estimates complicated. The vast majority of methods rely on the study of signs (mainly spraints, but also tracks), but this is insufficient for density measurements, or too costly. Other techniques with proven results use visual counts of otters, but they also have some faults and involve a disproportionate sampling effort. The encounter-based method of population estimation, proposed by Rowcliffe et al. (2008), has been applied to otter sightings in two sites of different habitat with known otter density, and under different survey designs. This provisional check appears to confirm that the method results in adequate population estimates, also when employing samples at random intervals of time and space. Moreover, it involves lower effort, and the census can be tackled by a reduced number of researchers. It is strongly suggested that this methodology be widely tested, to ascertain its performance under different sampling and environmental conditions.

Keywords: central Spain, density, encounter-based model, spatial ecology, survey method.

INTRODUCTION

Estimating density of wild populations of the Eurasian otter (*Lutra lutra*) is very difficult, because of its cryptic and mainly nocturnal habits (Mason and Macdonald, 1986, 1987; Kruuk, 1995, 2006; Wilson et al., 1996; Wilson and Delahay, 2001; Chanin, 2003; Long et al., 2008). In the past, therefore, abundance data have been obtained from spraint (otter faeces) numbers or, more roughly, from the number of positive sites, i.e. with spraints and/or tracks, registered during surveys (Mason and

Macdonald, 1986, 1987, 2004; Kruuk, 1995, 2006; Reuther et al., 2002; Chanin, 2003; Gruber et al., 2008; Roberts et al., 2008). However, there is an considerable amount of evidences that criticises the use of faeces for this purpose (Kruuk et al., 1986; Kruuk and Conroy, 1987; Kruuk, 1992, 1995, 2006; Reuther et al., 2002; Gallant et al., 2007; Roberts et al., 2008). Criticisms are based on data indicating that the number of spraints produced by an otter varies on a seasonal basis, and sign quantities in a particular place are nor indicative of neither animal abundance nor of activity there (see references above).

Recently, Guter et al. (2008) have tried to demonstrate that spraint counts correlated with activity of an otter in a given site, but their results are questionable for several reasons. Gruber et al. (2008) have built a maximum likelihood model to estimate daily activity rates from the presence of aged and/or fresh signs, although this has not been tested yet.

Several methods have been developed and tested to accurately measure otter density, using counts from infra-red machines or with DNA-based identification of hairs and spraints (Hung et al., 2004; Waits and Paetkau, 2005; Garcia et al., 2006; Kalz et al., 2006; Prigioni et al., 2006a; Arrendal et al., 2007; Lanszki et al., 2008; Hájková et al., 2008). These methods, although being useful, are expensive and they are likely to have some disadvantages (Chanin, 2003; Waits and Paetkau, 2005; Kruuk, 2006).

In coastal environments, Kruuk et al. (1989), and Yoxon (2003), aproximate the number of otters occurring in an area by counting den sites ("holts"), which relate to population size. This is not useful in freshwater ecosystems, as the number of den sites can be misidentified if one does not use radio-tracking (Kruuk et al., 1998).

Northern areas of the north hemisphere have snow cover during long times of the year, and snow-tracking is a "standard" method for successfully estimating otter populations (Sidorovich and Macdonald, 2001; Chanin, 2003; Arrendal et al., 2007; Sulkava, 2007; Sulkava and Liukko, 2007; Hájková et al., 2008).

It is obvious that the most accurate way for studying otter populations is by using direct observations (Kruuk and Moorhouse, 1991; Kruuk, 1995, 2006; Ruiz-Olmo, 1995; Wilson et al., 1996; Bravo et al., 1998; Ruiz-Olmo et al., 2001; Wilson and Delahay, 2001; Saavedra, 2002; Chanin, 2003). This method requires otters to be active in daylight, and needs individual identification of animals. The occurrence of a certain degree of diurnal activity of the otter in the Mediterranean basin enables censuses from direct, visual observations (Ruiz-Olmo, 1995; Bravo et al., 1998; Ruiz-Olmo et al., 2001; Saavedra, 2002). However, the fact that otters do not have individually distinctive markings in this area (Kruuk, 1995, 2006; but see a possibility in Gilkinson et al., 2007) makes this kind of study more complex, and for the procedure (Ruiz-Olmo, 1995), it is necessary to mobilize a large quantity of resources, and the use of inexperienced volunteers (Bravo et al., 1998), to simultaneously cover the study area.

This methodology has produced good estimates of the number of otters in a locality (Ruiz-Olmo, 1995; Bravo et al., 1998; Ruiz-Olmo et al., 2001; Saavedra, 2002), but visibility of the animals may be a problem (Walsh et al., 2009), and a good view of the sampling area is necessary. Often, riparian woodland affects the detection of individuals, but this can be corrected by increasing the number of people taking part in the work.

The aim of the present study is to test the effectiveness of this method based on direct observations, but without involving considerable logistic effort.

MATERIAL AND METHODS

Study areas

To test the adjustment of the design (see below), two sites with quite different environmental attributes were selected in the province of Salamanca (central Spain). In those two areas the climate is continental Mediterranean, with cold and wet winters but warm and dry summers. Both sites show degraded environmental characteristics, as a consequence of uncontrolled human activity.

The first area is the Riolobos reservoir, an enclave in the steppe of the province of Salamanca (41º 0' 24.38'' N 5º 18' 12.93'' W, 833 m.a.s.l., extent: about 0.20 km^2; Rouco, 2006). This dam was built in the 90's and has been used since 2000, being colonized by otters in recent times, in 2005 (Rouco, 2006). The shape of this reservoir is approximately circular, with some peninsulas making the profile somewhat complex. The muddy and sandy shores of Riolobos lack any vegetation cover, with an arid band from the water over three to six meters. Riolobos reservoir is the only area holding permanent water during winter in this area, thus surveys were focused here.

Riolobos has been one of the most important areas for aquatic birds in Central Spain and the most important in Salamanca (Rouco, 2006), but because of the management of fisheries in the reservoir by the regional administration, nowadays the Riolobos' biodiversity has been largely lost (Rouco, 2006). For Eurasian otters, human pressure on the water complexes of the area, nearly all from fishermen, is the key factor limiting the establishment of a population (own data).

The second locality is the river Tormes where it runs through the city of Salamanca (40º 57' 23.25'' N 5º 39' 40.59'' W, 800 m.a.s.l., about 1.49 km^2). This is a linear habitat, with banks covered with a thick riparian forest, sometimes rather thin as a consequence of the recreational activities of people in the riverine area. The river is wide, maximally about 400 m, with many islands, and low gradient (< 2 %). Several small tributaries are also present. The river is highly polluted, although this does not appear to affect the occurrence of otters.

The presence of otters in these areas is seasonal, restricted to winter and/or fall (Rouco, 2006; García et al., 2009; own data). For more details on these sites see Rouco (2006), García (2008), García and Mateos (2009), and García et al. (2009).

Otter surveys

The basic technique consists in the observation of a water surface from an elevated point, with binoculars and telescope, for a given time looking for otter activity. These observations were carried out at dusk and dawn, when it is more likely that otters are active. The basic unit of sampling effort is one hour per observer.

In Riolobos, because of its shape and small area, the entire water surface can be monitored from only two points, one on the wall of the dam, and another one an elevated point along the shore (Ruiz-Olmo, 1995; Ruiz-Olmo et al., 2001). From January to February 2009, ten periods of observations were carried out at this site, when the entire surface was monitored simultaneously by the observers. Due to the absence of neighbouring water bodies, the movements of otters seem to be restricted to this site.

The river Tormes in Salamanca is different. The lineal structure of the habitat, and the relative high forest cover in some sites, reduces the probabilities of encounters, and the area must be monitored by a larger number of observers. Here, the model (briefly described down here; Rowcliffe et al., 2008) was checked for another objective: to confirm if it is possible to estimate the density of otters from a relatively high number of independent sampling sites, not covering the entire area all at the same time.

Fourteen sites were defined for this purpose (mostly on bridges), from which the observations were made, and monitoring was repeated at least three times. Stretches were surveyed from January to February 2009, on days selected randomly. Evidences show that otters also use the available streams in the area, so this habitats were also sampled.
Length of the sites surveyed was setted in a minimum of 10 km following the recommendation of Ruiz-Olmo (1995), allowing a representative sample of the population abundance.
The number of observations during each period were divided by the units of sampling effort (one hour per observer) for standardizing the results.
Independently, the population of otters was estimated, for the dates when the studies were carried out, from two widely used methods and in the same surface sampled through sightings. In Riolobos, as the environmental conditions allow this, animals were censused from direct observations at dawn and daybreak. Additionally, other population size estimate came from mud fresh tracks found in the ten sessions, after carrying out the vigils (esimation by measuring some track parameters and analysed by one-way ANOVA and discriminant analysis; see further details in: Ruiz-Olmo et al., 2001a; Saavedra, 2002; Mercier and Fried, 2003; Gusset and Burgener, 2006; García, 2008). In Salamanca, otter population was estimated also from this kind of mud and snow tracking following the same guidelines for analysis.
Sampling the same surfaces at the same time with different population size estimation techniques allow for testing the fitness of the methods.

RFTC model and estimation of parameters
Rowcliffe et al. (2008) developed a model (hereafter, RFTC model), that estimates carnivore density from encounter rates of animals by camera traps, and this is potentially suitable for application to otter sightings. An observer with adequate equipment works in a similar way to camera traps, covering a surface of the water body with the shape of a part of a circle, the detection area (Figure 1). Thus, this detection area could be defined by its radius (r) and the angle of observation (θ) (Figure 1; Rowcliffe et al., 2008). Density with this formula is defined in relationship with the observation rate (number of observations, y, per unit of time effort, t; see down here):

$$D \text{ (animals/km}^2) = y/t \; \pi/vr(2 + \theta)$$

being v the velocity of the movements (km/h) of animals during the sampling period. This speed was measured from the observations obtained in the field work, 1.96 km/h in Salamanca and 1.67 km/h in Riolobos. Other available calculations of this parameter (Kruuk, 1995, 2006; Ruiz-Olmo, 1995; Saavedra, 2002; Garcia et al., 2006; Prigioni et al., 2006b) were not employed, given that it varies within the range of the otter, and it is better to use data from the populations studied. This value is easy to obtain from the visual censuses or deriving from parsimonious approximations (Tremblay et al., 2009).
The radius (r) and the angle (θ) of the detection area were estimated on aerial photographs from the sites. The radius (expressed in kilometers) was defined as the maximum length that can be viewed from a point. As there are two, left and right, radia, both were measured and the mean value used. The effective angle (radians) of detection was calculated from aerial photographs using ImageJ software (http://rsbweb.nih.gov/ij/).

If otters were watched during a large time, an independent observation (as defined previously for the model) was considered each 20 minutes (Rowcliffe et al., 2008).
The density of otters for Riolobos was independently measured for the ten surveys, and calculated by summing the density obtained by the observers. For Salamanca the design and the analysis were different. As samples were taken at random intervals, both in time and space, the density (otters/km^2) was also estimated independently for each of the 14 sites sampled. After that, a mean otter density from this data was calculated (see procedures in the next section), and the population size simply estimated by multiplying this mean density for the total surface studied.

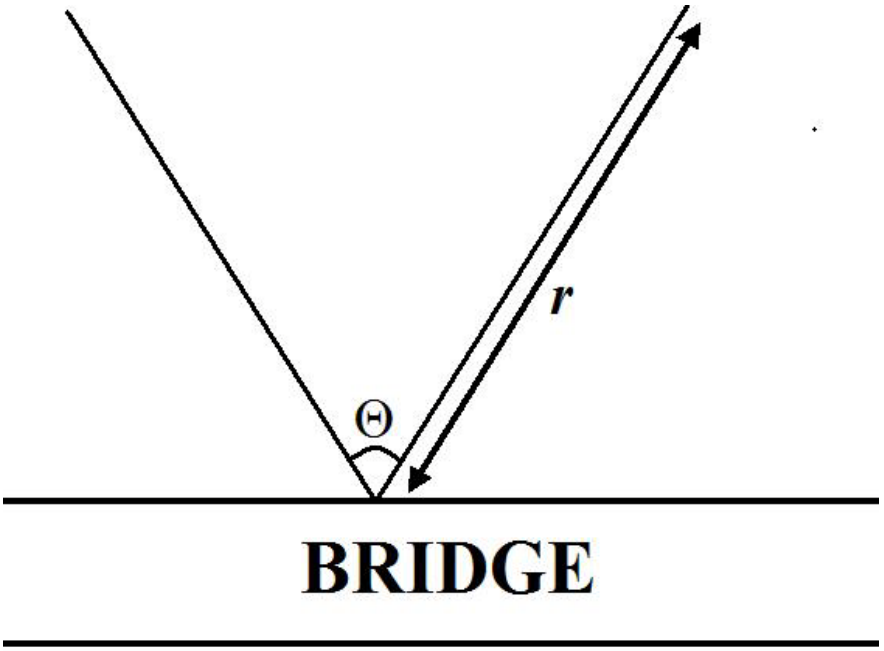


Figure 1. An example of the design and measurement of parameters employed in the RFTC formula: (*r*): radius; (θ): angle of observation.

Statistical analysis
Bootstrap is a resampling method used for assessing the descriptive parameters of a sample with an unknown statistical distribution, working well with animal density estimations (Stephens et al., 2006). A bootstrap procedure was employed for estimating the mean and deviation parameters of the density estimators, considering in Riolobos two subsamples of five sets of observations, and two subsamples with seven localities in Salamanca. In both cases, 5000 replicates were employed for the bootstrap. In Riolobos, this was used for estimating the otter population density from visual counts and with the RFTC model, whilst for Salamanca it was used for estimating the mean surveyed site RFTC otter density.
The estimates from direct counts, mud tracking and from the RFTC equation in Riolobos were correlated using the non-parametric Spearman rank (R_S). All statistical calculations were carried out with S-PLUS 8.0 and MyStat 12.0.

RESULTS

The numbers of Eurasian otters inhabiting Salamanca and Riolobos, as estimated, respectively, from tracking and visual census, were two animals for both sites, an abundance of 0.14 and 0.20 otters/km of bank.

For the area of Riolobos, the otter density derivated from the RFTC equation compares well with the visual count and mud tracking data, and the correlation is statistically highly significant (Visual counts vs. RFTC model: R_S = 0.99, *d.f.* = 9, *P*=0.0001; Mud tracking vs. RFTC model: R_S = 0.98, *d.f.* = 9, *P*=0.0001). The bootstrap density estimates assessed from these methods are similar [expressed in otters/km^2; direct census (mean ± SE, 95% CI): 0.40 ± 0.57, lower: 0.00, upper: 0.80; RFTC density (mean ± SE, 95% CI): 0.40 ± 0.56, lower: 0.00, upper: 0.79).
For the locality of Salamanca, the mean RFTC bootstrapped estimate for the 14 river stretches sampled was 1.41 ± 0.12 otters/km^2 (mean ± SE; 95% CI: lower: 1.33, upper: 1.50 otters/km^2), similar to, or perhaps a little higher, than the value from tracking, nearly 1.34 otters/km^2. The overall population size in Salamanca was 1.92 from the RTFC model and two otters from tracks.

Table 1. Parameters measured for the RFTC equations in the two areas studied.

Locality	Otter velocity (km/h)	Mean *r* (km)	Mean θ (radians)
Riolobos	1.67	0.55	0.89
Salamanca	1.96	0.34	0.61

DISCUSSION

The results presented here appear to confirm that the RFTC model is a useful way for estimating populations of otters, as well as making the census easier.
The method has a lot of potential advantages compared to those widely used for studying otters: i) it provides a reliable approximation of the otter populations in different environments; ii) it corrects the potential biases due to a lack of visual sightings (Walsh et al., 2009) by considering only the surface of the area watched, and not assuming that the probability of detection is always equal; iii) it is a cost-effective technique that does not require the help of a high number of personnel (sometimes inexperienced); and iv) the most interesting and outstanding aspect of the RFTC, as appears in the analysis, is that it is possible to take independent samples, in time and space, of the area of interest by the same researcher. Last but not least, the density estimate compares well with the actual status.
These properties are not so clearly defined in the alternative methods for censusing otter populations. Spraint-based analysis, probably including molecular scatology, has numerous faults and/or it costs too much, nearly €60 / $80.40 and around 12 hours/person of work for each spraint, including those that do not give positive results (Mason and Macdonald, 1986, 1987; Kruuk et al., 1986; Kruuk and Conroy, 1987; Kruuk, 1992, 1995, 2006; Reuther et al., 2002; Chanin, 2003; Hung et al., 2004; Waits and Paetkau, 2005; Garcia et al., 2006; Kalz et al., 2006; Prigioni et al., 2006a; Arrendal et al., 2007; Gallant et al., 2007; Gruber et al., 2008; Hájková et al., 2008; Lanzski et al., 2008; Roberts et al., 2008).
Snow and sand/mud tracking can fail in particular situations (probably corrected by increasing and improving the quality of the sample and the robustness of statistical analysis; Ruiz-Olmo et al., 2001; Sidorovich and Macdonald, 2001; Chanin, 2003; Stephens et al., 2006; Arrendal et al., 2007; Sulkava, 2007; Sulkava and Liukko, 2007; García, 2008; Gruber et al., 2008; Hájkova et al., 2008). Visual counts (Ruiz-Olmo, 1995), in spite of enabling researchers to get quality ecological and abundance data (Bravo et al., 1998; Ruiz-Olmo et al., 2001; Saavedra, 2002), need a large

number of observers (at least 20 people for 10 km of river) during several hours, without any guarantee of success. These drawbacks seem to be, at least partially, removed when applying the RFTC formula.

The major constraint of the RFTC method, shared with direct census (Ruiz-Olmo, 1995; Ruiz-Olmo et al., 2001; Saavedra, 2002), is its dependence on diurnal activity of otters. Otters are mainly nocturnal, but in the Mediterranean basin the activity pattern contains a certain degree of daylight movements (Ruiz-Olmo, 1995; Ruiz-Olmo et al., 2001; Saavedra, 2002), making counts possible. Perhaps this does not happen in all populations (but see Kruuk and Moorhouse, 1991; Kruuk, 1995, 2006), and it is advisable to carry out a pilot study in advance of the main fieldwork, to evaluate the presence of dusk and dawn activity. Increasing the number of visits to a sampling site will improve the precision of the results.

As demonstrated by our results, the RFTC equation appears to constitute a valuable option for estimating otter populations. However, it should be pointed out that this is only an initial check of this model for this specific goal, and our sample size is small. Indeed, more calibrations are needed in otter populations of known size (Wilson et al., 1996; Wilson and Delahay, 2001). Some provisional data in other localities in central Spain tend to confirm the present observations (own data).

We strongly encourage to further tests of the RFTC effectiveness, improving its efficiency and correcting faults, as well as exposing its robustness (Wilson et al., 1996; Wilson and Delahay, 2001; Long et al., 2008). Specially, one needs to acquire insights into its precision and biasses when using independent samples at given time intervals (Stanley and Royle, 2005). If necessary, further factors (e.g., correction coefficients for the diurnal activity, or for the time intervals of sampling; Stanley and Royle, 2005) and changes may be usefully introduced in the formula.

It is also possible that the method becomes an option for other otter species with daylight activity (Kruuk, 2006), and in marine populations of the Eurasian otter (Kruuk and Moorhouse, 1991; Yoxon, 2003).

Acknowledgements - Thanks to L. Pérez, D. Díaz, P. García and C. Ayres for their help and support in various ways. We also want to greatly acknowledge the comments of the reviewer and his help with the English speaking. On 9th April 2009, an otter cub was found dead as a road casualty near to Riolobos reservoir; in the first year that otters bred in the area. It is very probable, as suggested in our results (see also Rouco, 2006, for birds), that the disturbance by fishing people in an area without enough den sites, requires otters to disperse to an adequate site for rearing cubs, because in the area fish are abundant, and therefore not likely to limit numbers of breeding otters, as happens in the Mediterranean basin. As the problems caused by fishing people are a consequence of an unfortunate, debatable decision by the local environmental administration, we want to dedicate this work to the animals inhabiting Riolobos, which are surviving against the odds.

References

Arrendal, J., Vilà, C., Björklund, M. (2007). Reliability of noninvasive genetic census of otters compared to field censuses. *Conserv. Genet.* **8**: 1097-1107.

Bravo, C., Bueno, F., Sánchez-Aguado, F. (1998). I Censo visual de nutria (*Lutra lutra*) y visón americano (*Mustela vison*) en el Parque Natural de las Hoces del Duratón (Segovia). *Galemys* **10**: 89-96.

Chanin, P. (2003). Monitoring the otter *Lutra lutra*. *Conserving Natura 2000 Rivers Monitoring Series* **10:** 1-43.

Gallant, D., Vasseur, L., Bérubé, C.H. (2007). Unveiling the limitations of scat surveys to monitor social species: a case study on river otters. *J. Wildl. Manag.* **71**: 258-265.

Garcia, C., Forman, D.W., Davies, S., Thomson, A. (2006). Non-intrusive monitoring of otters (*Lutra lutra*) using infrared technology. *J. Zool.* **270**: 677-684.

García P. (2008). Abundance of the Eurasian Otter *Lutra Lutra* (Linnaeus, 1758) in two areas from Central Spain (province of Salamanca, river Tormes). *IUCN Otter Spec. Group Bull*. **25**: 32-37.

García, P., Mateos, I. (2009). Evaluation of three indirect methods for surveying the Least weasel (*Mustela nivalis*) in a Mediterranean area. *Small Carniv. Conserv.* **40**: 22-26.

García, P., Ayres, C., Mateos, I. (2009). Seasonal changes in American mink (*Neovison vison*) signs related to Eurasian otter (*Lutra lutra*) presence. *Mammalia* **73**: in press.

Gilkinson, A.K., Pearson, H.C., Weltz, F., Davis, R.W. (2007). Photo-identification of sea otters using nose scars. *J. Wildl. Manag.* 71(6): 2045-2051.

Gruber, B., Reineking, Calabrese, J.M., Kranz, A., Poledníkova, K., Poledník, L., Klenke, R., Valentin, A., Henle, K. (2008). A new method for estimating visitation rates of cryptic animals via repeated surveys of indirect signs. *J. Appl. Ecol.* **45:** 728-735.

Gusset, M., Burgener, N. (2006). Estimating larger carnivore numbers from track counts and measurements. *Afr. J. Ecol.* **43:** 320-324.

Guter, A., Dolev, A., Saltz, A., Kronfeld-Schor, A. (2008). Using videotaping to validate the use of spraints as an index of Eurasian otter (*Lutra lutra*) activity. *Ecol. Indic*. **8**: 462-465.

Hájková, P., Zemanová, B., Roche, K., Hájek, B. (2008). An evaluation of field and noninvasive genetic methods for estimating Eurasian otter population size. *Conserv. Genet.* DOI 10.1007/s10592-008-9745-4.

Hung, C.M., Li, S.-H., Lee, L.-L. (2004). Faecal DNA typing to determinate the abundance and spatial organisation of otter (*Lutra lutra*) along two stream systems in Kinmen. *Anim. Conserv*. **7**: 301-311.

Kalz, B., Jewgenow, K., Fickel, J. (2006). Structure of an otter (*Lutra lutra*) population in Germany – results of DNA and hormone analyses from faecal samples. *Mamm. Biol*. **71**: 321-335.

Kruuk, H. (1992). Scent marking by otters (*Lutra lutra*): signaling the use of resources. *Behav. Ecol*. **3**: 133-140.

Kruuk, H. (1995). Wild otters: predation and populations. Oxford University Press, Oxford, UK.

Kruuk, H. (2006). Otters. Ecology, behaviour and conservation. Oxford University Press, Oxford, UK.

Kruuk, H., Conroy, J.W.H., Glimmerveen, U., Ouwerkerk, E.J. (1986). The use of spraints to survey populations of otters *Lutra lutra*. *Biol. Cons.* **35**: 187-194.

Kruuk, H., Conroy, J.W.H. (1987). Surveying otter *Lutra lutra* populations : a discussion of problems with spraints. *Biol. Conserv.* **41**: 179-183.

Kruuk, H., Moorhouse, A. (1991). The spatial organization of otters (*Lutra lutra* L.) in Shetland. *J. Zool.* **224**: 41-57.

Kruuk, H., Moorhouse, A. & Conroy, J.W.H., Durbin, L., Frears, S. (1989). An estimate of numbers and habitat preference of otters *Lutra lutra* in Shetland, UK. *Biol. Cons.* **49**: 241-254.

Kruuk, H., Carss, D.N., Conroy, J.W.H., Gaywood, M.J. (1998). Habitat use and conservation of otters (*Lutra lutra*) in Britain: a review. In: **Dunstone N., Gorman M**. (Eds.), Behaviour and ecology of riparian mammals. Cambridge University Press, Great Bretain, pp. 119-134.

Lanszki, J., Hidas, A., Szentes, K., Révay, T., Lehoczky, I., Weiss, S. (2008). Relative spraint density and genetic structure of otter (*Lutra lutra*) along the Drava river in Hungary. *Mamm. Biol*. **73**: 40-47.

Long, R., MacKay, P., Ray, J., Zielinski, W. 2008. Noninvasive survey methods for carnivores. Island Press, 400 pp.

Mason, C.F., Macdonald, S.M. (1986). Otters, conservation and ecology. Cambridge University Press, Cambridge, UK.

Mason, C.F., Macdonald, S.M. (1987). The use of spraints for surveying the otter *Lutra lutra* populations: an evaluation. *Biol. Cons*. **41**: 167-177.

Mason, C.F., Macdonald, S.M. (2004). Growth in otter (*Lutra lutra*) populations in the UK as shown by long-term monitoring. *Ambio* **33:** 148-152.

Mercier, L., Fried, G. (2003). Preliminary study of otter (*Lutra lutra*) prints in captivity as a tool for field research. In: **Conroy, J.W.H., Gutleb, A.C., Ruiz-Olmo, J., Yoxon, G.M.** (Eds). Proceedings of the European Otter conference "Return of the otter in Europe – where and how?". Journal of the International Otter Survival Fund no. 2. Isle of Skye, 30th June – 5 Jule 2003. IOSF.

Prigioni, C., Remonti, L., Balestrieri, Sgrosso, S., Priore, G., Mucci, N., Randi, E. (2006a). Estimation of European otter (*Lutra lutra*) population size by fecal DNA typing in southern Italy. *J. Mammal.* **87**: 855-858.

Prigioni, C., Remonti, L., Balestrieri, A. (2006b). Otter *Lutra lutra* movements assessed by genotyped spraints in souther Italy. *Hystrix, It. J. Mammal*. **17**: 91-96.

Reuther, C., Dolch, D., Green, R., Jahrl, J., Jefferies, D., Krekemeyer, A., Kucerova, M., Madsen, A.B., Romanowski, J., Röche, K., Ruiz-Olmo, J., Teubner, J., Trindade, A. (2002). Surveying and monitoring distribution and population trends of the Eurasian Otter (*Lutra lutra*).

Guidelines and evaluation of the standard method surveys as recommended by the European Section of the IUCN/SSC Otter Specialist Group. *Habitat* **12**: 1-148.

Roberts, N.M., Crimmins, S.M., Hamilton, D.A., Gallagher, E. (2008). An evaluation of bridge-sign surveys to monitor river otter (*Lontra canadiensis*) populations. *Am. Midl. Nat.* **160**: 358-363.

Rouco, M. (2006). Las aves del azud de Riolobos (y de su entorno). SEO/BirdLife-Grupo Local SEO-Salamanca. Fundación Germán Sánchez-Ruipérez, Peñaranda de Bracamonte, Spain.

Rowcliffe, J.M., Field, J., Turvey, S.T., Carbone, C. (2008). Estimating animal density using camera traps without the need for individual recognition. *J. App. Ecol*. **45:** 1228-1236.

Ruiz-Olmo, J. (1995). Visual census of Eurasian otter (*Lutra lutra*): a new method. *Habitat* **11**: 125-130.

Ruiz-Olmo, J., Saavedra, D., Jiménez, J. (2001). Testing the surveys and visual and track censuses of Eurasian otters (*Lutra lutra*). *J. Zool*. **253**: 359-369.

Saavedra, D. (2002). Reintroduction of the Eurasian Otter (*Lutra lutra*) in Muga and Fluvià basins (North-Eastern Spain): viability, development, monitoring and trends of the new population. Tesis doctoral. Universidad de Girona, Girona, Spain.

Sidorovich, V., Macdonald, D.W. (2001). Density dynamics and changes in habitat use by the European mink and other native mustelids in connection with the American mink expansion in Belarus. *Neth. J. Zool.* **51:** 107-126.

Stanley, T.R., Royle, J.A. (2005). Estimating site occupancy and abundance using indirect detection indices. *J. Wildl. Manag.* **69:** 874-883.

Stephens, P.A., Zaumyslova, O.Y., Miquelle, D.G., Myslenkov, A.I., Hayward, G.D. (2006). Estimating population density from indirect sign: track counts and the Formozov-Malyshev-Pereleshin formula. *Anim. Conserv*. **9**: 339-348.

Sulkava, R. (2007). Snow tracking: a relevant method for estimating otter *Lutra lutra* populations. *Wildlife Biol*. **13**: 208-218.

Sulkava, R., U.M. Liukko, U.M. (2007). Use of snow-tracking methods to estimate the abundance of otter (*Lutra lutra*) in Finland with evaluation of one-visit census for monitoring purposes. *Ann. Zool. Fenn,* **44**: 179-188.

Tremblay, Y., Robinson, P.W., Costa, D.P. (2009). A parsimonious approach to modeling animal movement data. *PLoS ONE* **4:** 1-11.

Waits, L.P., Paetkau, D. (2005). Noninvasive genetic sampling tools for wildlife biologists: a review of applications and recommendations for accurate data collection. *J. Wildl. Manag.* **69:** 1419-1433.

Walsh, D.P., Page, C.F., Campa, III, H., Winterstein, S.R. (2009). Incorporating estimates of group size in sightability models for wildlife. *J. Wildl. Manag.* **73(1):** 136-143.

Wilson, G.J., Delahay, R.J. (2001). A review of methods to estimate the abundance of terrestrial carnivores using field signs and observations. *Wildl. Res.* **28(2)**: 151-164.

Wilson, D.E., Rusell, F., Nichols, J.D., Rudran, R., Foster, M.S. (1996). Measuring and monitoring biological diversity. Standard methods for mammals. Smithsonian Institution Press, Washington D.C.

Yoxon, P. (2003). Otter surveys of north west Scotish islands. In: **Conroy, J.W.H., Gutleb, A.C., Ruiz-Olmo, J. and Yoxon, .G.M. (Eds).** Proceedings of the European Otter conference "Return of the otter in Europe – where and how?". Journal of the International Otter Survival Fund no. 2. Isle of Skye, 30th June – 5 Jule 2003. IOSF.

RESUME

UTILISATION DES OBSERVATIONS VISUELLES POUR ESTIMER LA DENSITÉ DE POPULATION DE LA LOUTRE D'EUROPE (*Lutra lutra*): ÉTUDE PRÉLIMINAIRE À L'AIDE DU MODÈLE DE ROWCLIFFE et al.

En raison de son importante capitale pour l'écologie et la conservation de la Loutre, l'estimation de la taille d'une population (ou la standardiser sous forme de densité) est l'un des meilleurs champs d'investigation actuel. Cependant, le comportement de cette espèce fait que cela devient très compliqué. La plupart des méthodes utilisent l'étude des traces (principalement les épreintes, mais aussi les empreintes) qui ne sont pas toujours suffisamment fiables ou alors trop coûteuses pour les mesures de densités. D'autres techniques montrent de bons résultats en utilisant le recensement

visuel mais elles présentent des biais et requièrent un effort d'échantillonnage disproportionné. La méthode d'estimation de dénombrement d'une population proposée par Rowcliffe et al. (2008) a été appliquée aux observations directes de loutres sur deux sites d'habitats bien différents et de densités connues et ce avec plusieurs modèles. Les résultats préliminaires semblent confirmer l'efficacité de la méthode en obtenant une estimation similaire à la population connue, même en usant d'échantillons à des intervalles de temps et d'espace totalement aléatoires. Par ailleurs, le déploiement logistique est inférieur et le recensement peut être réalisé par un nombre réduit d'enquêteurs. Il est enfin recommandé de tester cette méthodologie de façon plus étendue afin d'en prouver les performances dans des conditions environnementales et des échantillons bien différents.

RESUMEN

EMPLEO DE OBSERVACIONES PARA ESTIMAR LA DENSIDAD POBLACIONAL DE LA NUTRIA PALEÁRTICA (*Lutra Lutra*): UNA EVALUACIÓN PRELIMINAR UTILIZANDO EL MODELO DE ROWCLIFFE et al.

Debido a su crucial importancia para la ecología y conservación de la nutria, estimar el tamaño poblacional (o estandarizarlo en densidad) es uno de los mayores campos de investigación. Sin embargo, el comportamiento de la especies hace que esto sea muy complicado. La mayor parte de los métodos dependen del estudio de los rastros (principalmente excrementos, pero también huellas), que no son siempre lo suficientemente robustos para mediciones de densidad, o bien son muy costosos. Otra técnica con buenos resultados demostrados utiliza censos visual de nutrias, pero tiene algunos fallos y requiere un esfuerzo de muestreo desproporcionado. El método basado en encuentro propuesto por Rowcliffe et al. (2008) ha sido aplicado a las observaciones directas de nutrias en dos sitios con diferente naturaleza y densidad de nutrias conocida, así como con diferentes diseños de muestreo. Esta revisión preliminar parece confirmar que este diseño permite obtener estimas de población adecuadas, incluso empleando muestras en intervalos al azar, tanto en el tiempo como en el espacio; además, el despliegue logístico es inferior, y el censo puede realizarse por un número reducido de investigadores. Se recomienda evaluar esta metodología ampliamente para establecer el rendimiento del método en condiciones ambientales y de muestro variables.

C O N G R E S S A N N O U N C E M E N T

- XIth International Otter Colloquium (September 1-5 2010, Pavia, Italy)

XIth INTERNATIONAL OTTER COLLOQUIUM
September 1-5 2010
Pavia, Italy

Dear Colleagues

We are glad to announce the first circular of the XI International Otter Colloquium. The meeting will be hosted by the University of Pavia from 1st to 5th September 2010. It will bring together scientists, practitioners and policy makers from all parts of the world. The circular is also downloadable at the web site of the University of Pavia http://www-1.unipv.it/webbio/iucn11otter.pdf.

These are both exciting and challenging times for conservationists and we expect XI IOC to be an event that will remembered as a milestone for otter conservation!

Anna Loy and Claudio Prigioni
Organizers

L I T E R A T U R E

Borman, A.M., Simpson, V.R., Palmer, M.D., Linton, C.J., Johnson, E.M. (2009). Adiaspiromycosis due to *Emmonsia crescens* is widespread in native British Mammals. *Mycopathologia*, DOI 10.1007/s11046-009-9216-6, [Andy.Borman@uhBristol.nhs.uk]

Gallant, D., L. Vasseur, M. Dumond, E. Tremblay, C.H. Bérubé (2009). Habitat selection by river otters (*Lontra canadensis*) under contrasting land use regimes. *Canadian Journal of Zoology* **87**: 422–432. [Daniel.Gallant@uqar.qc.ca]

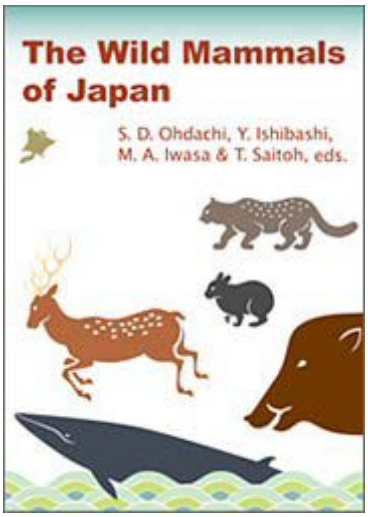
SIMPSON, V.R., TOMLINSON, A.J.F., MOLENAAR, M. (2009). Prevalence, distribution and pathological significance of the bile fluke *Pseudamphistomum truncatum* in Eurasian otters (*Lutra lutra*) in Great Britain. *Veterinary Record*, **164**: 397-401. [wildlife.vic@rmplc.co.uk]

NEW BOOKS

THE WILD MAMMALS OF JAPAN

S.D.Ohdachi, Y. Ishibashi, M.A. Iwasa and T. Saitoh (Eds.)

https://www2.nacos.com/shokado/mammal/index_e.php



This is the first English book of Japanese mammals, and is published during July 2009.
This book is published as Memorial project to IMC 9 by the Mammalogical Society of Japan.
Basic information on 170 species of Japanese mammals including the Eurasian otter is presented by 63 scientists.
Special price JPY 3,600 (normal price JPY 5.600) + shipping cost JPY 2,000
Hardcover: 544 pages (full color), A4
Publisher: SHOUKADOH Book Sellers,
ISBN: 978-4-87974-626-9

CALL FOR INFORMATION

Genetics of Latin American Otters

Dear colleagues,

My name is Cristine S. Trinca and I'm a PhD. student from Federal University of Rio Grande do Sul, Brazil. Since 2005 I've been working on genetic diversity and phylogeographic patterns of the Neotropical otter (Lontra longicaudis) using different molecular markers. Besides, our lab is able to work on non-invasive samples, such as hair and scats. The inclusion of this kind of material has increased significantly the availability of otter's samples and has been important to the best knowledge about the genetic diversity of this species.

Until now, we obtained a good number of biological samples of this species, mostly from the Brazilian territory. Although the geographic distribution of Neotropical otter comprises almost all Latin America, obtaining samples from other regions has been a big challenge. For better results, I intend to cover the entire distribution of this species trough international collaboration in Latin America, either by sending samples or performing the molecular analysis at your own lab.
For that, I was hoping that through OSG I could get any help from all members interested in collaborate with the project, aiming to best represent the geographic distribution of this otter.
Many thanks in advance and I look forward to hearing from you.
Best regards,

Cristine S. Trinca

Federal University of Rio Grande do Sul, Porto Alegre/Brazil,
Pontifícia Universidade do Rio Grande do Sul,
Laboratory of Genomic and Molecular Biology
cristine.trinca@gmail.com
Phone number: +55 51 3320-3500 ext. 4727