NOTE FROM THE EDITOR

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Dear Friends, Colleagues and Otter Enthusiasts!

The IUCN OSG Bulletin seems to be quite unique as we have several issues open at the same time. Not only have we recently finished the two issues for 2012, but at the same time more articles have been added to the Proceedings from Frostburg, Hwacheon and Pavia and one of the remaining issues was digitalized. If you are not aware it may be good to know that all articles are also uploaded to the Directory of Open Access Journals (DOAJ) and can be searched within this huge database of free articles (http://www.doaj.org/). We will try to get all new articles online as soon as possible but please be patient if this takes some weeks as we have several issues open in parallel.

During the recent years we have put lots of efforts into improving our reviewing process. Our editorial board and the reviewers that are chosen for your articles are of excellent quality. It would definitely be of help for the future of the IUCN OSG Bulletin if you consider including references from the IUCN OSG Bulletin for your articles published in other peer reviewed journals.

There have been several meetings related to otters in the last year and we have already some dates for conferences in 2013 that you can find on the last pages of issue 29/2. Please also check regularly the website of the OSG where updates will be published whenever new events come up.

We are in urgent need of good photos of otters for which you have the copyright as we need them for the title page. If you are the copyright holder feel free to send them either to me or to Lesley. We may choose one of them for the title page of the forthcoming issues!

In 2012 Lesley has not only spend lots of time for the website and the membership committee but also uploaded two complete issue of the IUCN OSG Bulletin, while working in parallel on the three open issues of the Proceedings and still had time to prepare one of the few remaining old issues for the website. Lesley, thanks for all your continuing support.

R E P O R T

ACTIVITY PATTERN, BEHAVIOURAL ACTIVITY AND INTERSPECIFIC INTERACTION OF SMOOTH-COATED OTTER (*Lutrogale perspicillata*) IN NATIONAL CHAMBAL SANCTUARY, INDIA

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Abstract: The activity pattern, behavioural activity and interspecific interactions of smooth-coated otter (*Lutrogale perspicillata*) with crocodilians viz. gharial (*Gavialis gangeticus*) and mugger (*Crocodylus palustris*) was examined by monitoring four radio-implanted otters in the National Chambal Sanctuary, India. Based on the percentage of active telemetry recordings, the observed overall activity patterns of otters were in the form of a bimodal curve in which two periods of high activity were separated by a period of relative inactivity. In summer, the relative period of inactivity was greater than the winter and monsoons. Otters were more diurnal during winter than in summer or monsoon. Travelling and grooming were the most prevalent activities recorded during 422 sightings. Though the habitats and the diet of otters overlapped with gharial and mugger, their diurnal activity pattern was different and spatially they maintained a mutually agreeable strategy to avoid conflicts in sharing resources for basking and grooming.

Keywords: smooth-coated otter; *Lutrogale perspicillata*; behavior; activity pattern; interspecific interactions; *Gavialis gangeticus*; *Crocodylus palustris*

INTRODUCTION

Otters being the topmost predators of the aquatic systems, its presence indicate the health of the wetland ecosystems. The relationship of otters and their prey appears to be similar to most other carnivores, but otters have to bear unusual costs for their foraging trips in the huge energetic requirements of keeping warm while fishing. This implies that otters will be able to sustain themselves only if they are able to consume their food quickly with the least foraging expense, which would otherwise be extremely high (Kruuk, 1995). Synchrony of activity phasing between predators and prey has been found in many carnivores. For example, seasonal foraging patterns in spotted-necked otter reflected a correlation between activity of the prey and hunting

success of the otters (Perrin and Carranza, 2000). Food resource abundance and dispersion affecting foraging patterns and social behaviour has also been reported for several carnivores (Schaller, 1972, Kruuk and Hewson, 1978; Macdonald and Mason, 1983; Bekoff et al., 1984; Mills, 1989).

The smooth-coated otter (*Lutrogale perspicillata*, Geoffroy) (Figure 1) is distributed throughout southern Asia from Indonesia, through southeast Asia, and westwards through southern China and India, with an isolated population *L. p. maxwelli* in the marshes of Iraq (Mason and Macdonald, 1986; Foster-Turley and Santiapillai, 1990; Hussain et al., 2008). On the Indian subcontinent, the smooth-coated otter is distributed from the foothills of Himalayas southward to southern India (Pocock, 1949; Prater, 1971, Hussain 1993; Hussain and Choudhury, 1997; Hussain, 2002; Nawab and Hussain, 2012a) occurring along the major rivers with other aquatic carnivores such as crocodiles (Prater, 1971). The smooth-coated otter is a large otter, weighing around 8-11 kg, distributed throughout South and Southeast Asia. It is a semi-aquatic social carnivore found in large groups (Foster-Turley, 1992; Hussain, 1993; 1996), with the basic family group consisting of an adult female and her offspring, the father and older siblings often joining the group (Lekagul and McNeely, 1988; Hussain, 1996). It is considered an endangered species and is listed in Schedule I of the Indian Wildlife (Protection) Act, 1972, "Vulnerable" in IUCN Red List (Hussain et al., 2008) and Appendix II of CITES. In spite of its wide distribution, very few studies address the ecology and behaviour of smooth-coated otter. Because of the limited knowledge about these otters, especially the Asian species, practical conservation measures have not been developed. Therefore, the Wildlife Institute of India undertook a project to study the ecology of smooth-coated otters in National Chambal Sanctuary. This paper describes the activity pattern, behavioural activities and its interaction with crocodilians along the Chambal River in National Chambal Sanctuary, India.

Figure 1. Smooth-coated otter with cubs (Photo credit: Bivash Pandav)

STUDY AREA

The Chambal is a clear and fast flowing river that originates from the Singar Chouri peak in the Vindhya Range, central India. Lying between 24°55'–26°50'N and 75°34'–79°18'E, it flows northeast and joins the Yamuna River to form the greater Gangetic drainage system (Figure 2). A 600 km stretch of the Chambal river has been protected as the National Chambal Sanctuary for the conservation and management of gharial (*Gavialis gangeticus*, Crocodylia) (Hussain, 1990; 1999; 2009). The area lies within the semi-arid zone of northwestern India at the border of Madhya Pradesh and Rajasthan states. The temperature of the area ranges from 2 °C to 46 °C. The annual precipitation largely depends on the southwestern monsoon which lasts from the third week of June until late September with 500–600 mm of rainfall. The natural vegetation of much of the Sanctuary area is ravine thorn forest (Champion and Seth, 1968). Evergreen riparian vegetation is completely absent. The severely eroded river banks and adjacent ravine lands have sparse ground cover (Hussain, 1993). Apart from the gharial (Figure 6b) and smooth-coated otter, the fauna of the Sanctuary includes the marsh crocodile or mugger (*Crocodylus palustris*, Figure 6a), seven species of freshwater turtles, Ganges river dolphin (*Platanista gangetica*), and 78 species of wetland birds (Hussain, 1993). The intensive study area lies along a 17 km stretch of the Chambal River (Figure 2). In this stretch the habitat consisted of rocky, clay, and sandy river banks often interspersed with marsh, dominated by *Typha*, and bankside vegetation, dominated by *Tamarix* spp. (Hussain, 1993; Hussain and Choudhury, 1995).

Unlike other rivers of the greater Ganges drainage system, the Chambal River is relatively unpolluted (Hussain and Singh, 1999). The water quality exhibited very low suspended solids with low biological oxygen demand (BOD) and high dissolved oxygen (DO). There was no indication of organic matter discharge or eutrophication in the river as the value of chemical oxygen demand (COD), ammonia (NH_4), and phosphate (PO_4) were below the detection limits. The essential cations (Ca, Mg, Na, and K) were also within the range to support aquatic organisms. On the basis of standards set by the Central Pollution Control Board, Government of India, the Chambal River water can be considered as `A' category. By comparing the water quality parameter with ranges given by Allen (1989), the Chambal River is considered clean.

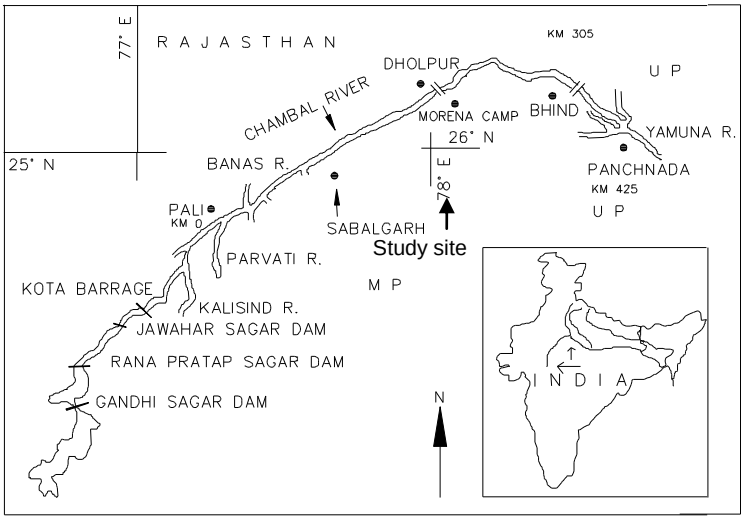

Figure 2. Study site for radio-tagged smooth-coated river otters within the National Chambal Sanctuary, India.

METHODS

During February 1990 and March 1992, I captured and monitored the activity of four smooth-coated otters in National Chambal Sanctuary. I used Tomahawk live traps and leghold traps to capture the study animals. I immobilized them with a combination of ketamine and xylazine hydrochloride (Hussain et al., 1996) and surgically implanted them with radio-transmitters (Model - IMP 400 VHF; Telonics, Arizona, USA). After holding the otters in a squeeze cage to ensure their surgical sites were properly healed, I released them at the capture sites, five to six days after surgery. I monitored activity of the otters for a period of 11 to 22 months (Table 1). On the basis of size and skin texture, the captured otters were classified into juveniles, sub adults, and adults (Table 1). I radio-tracked the otters once daily and recorded their locations on a 1:50,000-scale map with 250-m grids laid over the river. Activity of instrumented otters was recorded based on changes in signal volume and by direct observations. The intensity of the signal was regular when the animal was resting and irregular when it was moving (Voight and Tinline, 1979). I obtained 1048 radio-locations and 422 sightings of the otters during a period of 24 months (for details see Hussain and Choudhury, 1995).

I determined diurnal activities such as foraging, feeding, travelling, and social behaviour by visual observations of instrumented and non-instrumented otters. A 24-hour monitoring effort was conducted once in every two weeks with otter locations and activity recorded at one-hour intervals.

Table 1. Approximate age (months) of instrumented otters at the beginning and end of tracking in National Chambal Sanctuary, India.

Otter	Approximate age (months)	Last contact	Tracking duration (months)
Juvenile Female (JFM50)	>06 but <12	25 Dec. 1991	22
Subadult Male (SAM30)	>12 but <24	01 Sep. 1992	11
Juvenile Male (JM10)	>06 but <12	14 Mar. 1992	11
Juvenile Female (JFM10)	>06 but <12	14 Mar. 1992	11

The following criteria were used to classify activity and behavior:

1) *Telemetry*
   a) Active : Any type of movement leading to a change in signal direction.
   b) Inactive: No change in signal volume or direction.
2) *Visual observations*
   a) Foraging: Searching for and consuming food.
   b) Travelling: Intentional movement from one location to another.
   c) Grooming: Rolling on sand or other related activities.
   d) Marking: Defecating, urinating, or inspecting such sites.
   e) Resting: Sleeping at day time.
   f) Social: Any type of behavioural interaction between two or more individuals.
   g) Others: Any type of physical activity (play, territorial, digging).

During the radio monitoring period whenever otters were seen, I recorded the kind of river bank nearest to sighting locations, number of otters seen, and their distance from other aquatic fauna if present. At each sighting, a note on the behaviour of the other aquatic fauna also was made. I also monitored the basking behaviour of crocodilians to document peak haul-out and retreat times. Nests of crocodilians and turtles within the home range of otters at the radio-tracking site were monitored to see if they were disturbed by otters.

During the study, I collected 553 spraint samples from a 195 km stretch of the Sanctuary. Collections were made from the entrance of dens, communal sprainting sites adjacent to dens, and feeding areas. Only one sample was collected from each site. Attempts were made to collect fresh spraints, but during the monsoon all spraints were collected. I recorded date and location for each spraint at the time of collection and sun dried the samples, which were stored in paper bags, at the camp. The samples were later soaked in water and mixed with a detergent for 5-6 hours. After washing in running tap water over a 1-mm sieve, the cleaned samples were dried in shade and kept in plastic bags for sorting of prey remains. I sorted prey remains from cleaned spraints by using a hand lens or a compound microscope. All remains were identified by comparison with references of prey parts made during the study. Effort was made to identify the prey to species level but this was not always possible, hence some prey remains were identified only to genus level. Similarly, 25 scat samples of mugger (*Crocodylus palustris*) were collected from the study site during November 1989 to April 1990 and analysed using similar methods.

RESULTS

Activity patterns

After release, all the instrumented otters remained together during the radio-tracking period, thus the activities recorded were group activities. Based on the percentage of active telemetry recordings, the annual activity pattern of smooth-coated otters in the National Chambal Sanctuary was in the form of a bimodal curve, in which two periods of high activity were separated by a period of relative inactivity. The first active period started after midnight and continued until late morning (10:00-11:00 hours), then there was a second active period which continued from approximately 16:00-17:00 hrs until 01:00 hrs (Figure 3a). The period when inactivity was most distinct was during 09:00–17:00 hours during summer (Figure 3b). On a seasonal basis, activity patterns during winter were different from those of summer or monsoon. In winter the pattern of activity was trimodal, with the peak activity occurring between 06:00 to 08:00, 16:00 to 17:00 and 21:00 to 23:00 hours (Figure 3d). Difference was also found between daytime and nighttime activities in different seasons (Figure 3b,c,d). This indicated that the otters were nocturnal in their behaviour. Otters were more diurnal during winter than in the summer or monsoon. Seasonally the smooth-coated otter were more active during winter (36.1%) and progressively less active in summer (29.2%) or monsoon (34.7%).

Behavioural activities

Behavioural activity was recorded during 422 sightings made at the time of radio-tracking the otters. Of the nine types of behaviours I identified, more than one type was observed during each sighting (Table 2). Thus, I recorded 561 behavioural activities during the study (Table 2). These activities were observed during different months and at different times of the day. Travelling was recorded in 46% of the visual observations and it constituted 34.6% of the otters' activity. Travelling was often on land. Most travels were between den and foraging sites. Foraging was recorded during 20% of the visual observations period. Most of the foraging activities involved either probing along the water edge, singly or in groups, or along rapids, moving upstream in semi-circles. Twice otters were observed attempting to catch blue rock pigeon (*Columba livia*) on land.

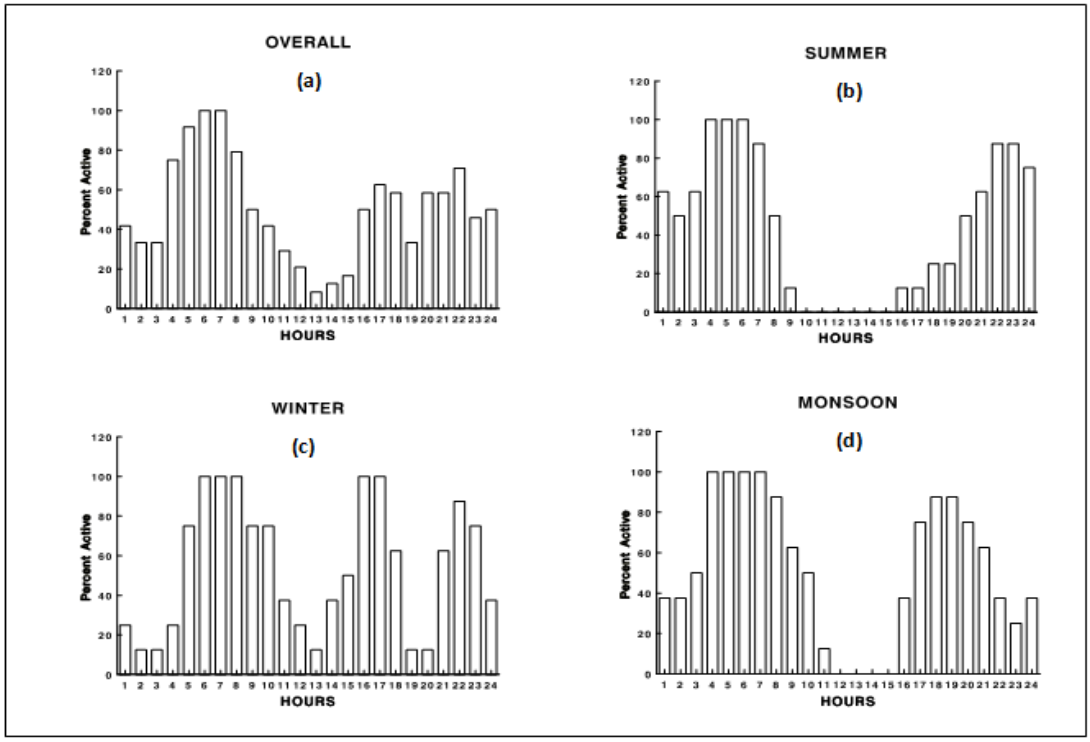

Figure 3. Activity patterns of radio-tagged smooth-coated otters in National Chambal Sanctuary, India, 1990–1992.

Figure 4. Marking smooth-coated otter (Photo credit: Anoop, K.R.)

Table 2. Types of behaviour recorded during 422 observations of radiotagged otter in National Chambal Sanctuary, India

Types of behaviour	Occurrence	%[a]	%[b]
Travelling	194	34.60	46.00
Grooming	147	26.20	34.83
Foraging	83	14.80	19.70
Marking	89	15.90	21.10
Resting	16	2.85	3.80
Playing	19	3.38	4.50
Social	7	1.24	2.87
Territorial	3	0.53	0.71
Digging	3	0.538	0.71

a: percentage based on 561 identified types of behaviour. b: percentage based on 422 sightings

Most of the grooming behaviour was self grooming. This consisted of rolling on sand for five to fifteen minutes with intermittent dips in water and drying by rolling. Grooming was observed 147 times and constituted 35% of the total sightings. It was the second most prevalent activity of otters. Marking by defecation and urination or otherwise occurred mostly adjacent to dens, at grooming sites, along the usual travel routes and near the foraging sites (Figure 4). Marking often occurred in groups while otters were grooming or foraging. It appeared that marking by one individual induced this behaviour among other members of the group. Males sniffed and examined the area before marking. Resting behaviour was observed mostly during winter. Otters were seen sleeping on sand or on rocks adjacent to the entrance of dens or were lying idle and often gazing into the water. Play behaviour comprised 4.5% percent of the sightings. This included juveniles chasing each other on land or in water and wrestling while the rest of the group was engaged in self grooming. Of the seven observations of social behaviours (except foraging), three involved transferring young ones from one den to another; and the remainder involved sniffing each other when two or more otters of same size met. Digging was observed during evening hours in the month of November (Table 2). Digging was observed to be done by one otter of the group while the rest were engaged in auto grooming. Evidence of digging silt from natural caves was detected in October, which is the littering season.

Dietary overlap of smooth-coated otter and marsh crocodile

The smooth-coated otter is primarily a fish eater (Hussain and Choudhury, 1998; Nawab and Hussain, 2012b). In this study the relative frequency of occurrence of prey remains in otter spraints was 93.8% fish, 3.8% invertebrates, and 2.4% amphibians and birds (Figure 5). Three percent of fish remains and 0.9% of birds could not be identified from the spraints. Apart from these, 46 occurrences of molluscs, 12 of vegetative matter (grassroots or grass) and seven occurrences of mammalian hair were also recorded. All the mammalian hairs were identified as otter hair, which might have been ingested by the otters while grooming. Mollusc shells and vegetative matter were ingested as secondary items, which were later confirmed by analysing gut contents of a major prey *Rita rita*. It was not clear whether the insects consumed were direct or due to secondary ingestion. Analysis of mugger droppings revealed that 94% of the marsh crocodile's diet consisted of fish, 3% birds, 2.6% turtles and 1.5% invertebrates like crab and insects (Figure 5). Of the fish diet, 74% was composed of unidentified Cyprinidae, 22% unidentified Bagaridae and 4% unidentified fish. The gharial is reported to be an exclusive fish eater (Bustard, 1984), preferring lesser carps. Along the Chambal River, gharials were observed eating cat fish (*Mystus* spp.) during field work.

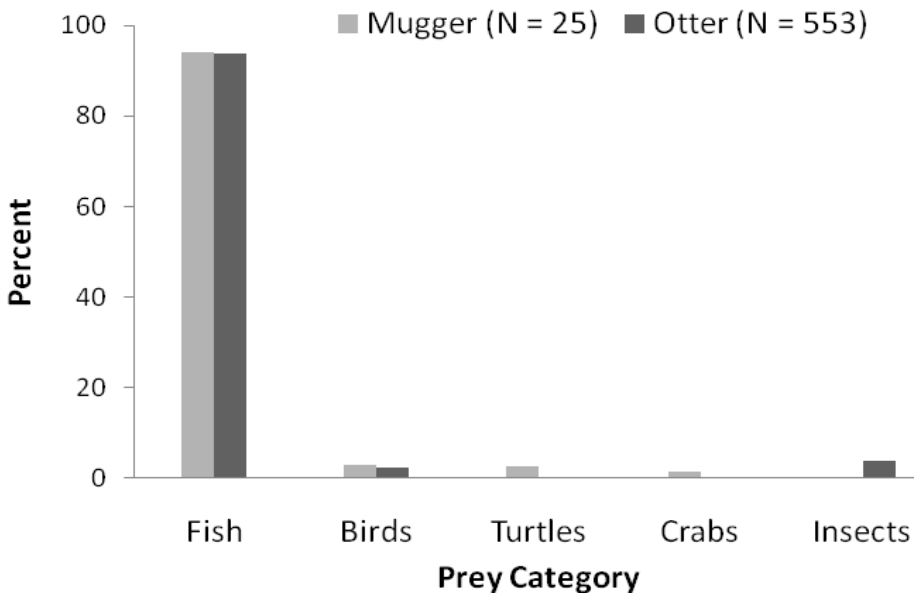

Figure 5. Comparison of diet of smooth-coated otter and mugger crocodile in National Chambal Sanctuary, India. The prey remains were measured as percent frequency of occurrence.

Spatio-temporal relationship between smooth-coated otter and other species

Interspecific interaction was the most important behaviour observed in the resident adult male, which chased a large gharial (2.5–3.0 m) on two occasions. Apart from this, yearlings were seen chasing two basking turtles (*Kachuga kachuga*) from their regular grooming sites. The number of gharial and marsh crocodile seen during the study period at the radio-tracking sites between km 160 to 175 is presented in Table 3. Both the gharial and mugger populations in the radio-tracking site were found to be increasing at the rate of 4% percent per annum (Hussain, 1990; 1999). Although breeding was recorded, no increase in the group size of otters or in the number of otter dens was recorded from this site. During the intensive monitoring of otters using radio-telemetry, 80% of the gharial sightings were on sandy banks/substrata and 19% were on rocky banks/substrata. In contrast, 68.9% of the sightings of mugger was on rocky banks/substrata and 10.4% and 6.7% on clay banks/substrata and sandy banks/substrata, respectively. Sandy and rocky substratums were used extensively by otters for grooming and marking. However, only 2.6% of the radiolocations for tagged otters were observed on sandy banks, while 77.9% were observed on rocky banks and 19% were on river bank with dense vegetation.

Table 3. Number of radio-locations of instrumented smooth-coated otters in different habitats, and the number of sightings of gharial and mugger crocodiles at the radio-tracking sites in National Chambal Sanctuary, India

Habitat category	Radio-locations		Number of sightings for crocodiles			
	No.	%	gharial		mugger	
			No.	%	No.	%
Rocky river bank	816	77.9	51	19.0	133	68.9
River bank with vegetation	199	19.0	0	0	3	1.8
Sandy river bank	27	2.6	216	80.0	17	10.4
Claye river bank	6	0.57	3	1.1	11	6.7
Total	1048		270		164	

DISCUSSION

Many animal species exhibit an endogenous rhythm of activity that approximates a diel cycle or twenty-four hour period (Harker, 1964; Eisenberg, 1981). The question is whether such a rhythm is present in a semi-aquatic carnivore like otters, and if yes, what are the factors that influence it? Variations in the pattern of activity of carnivores is largely influenced by numerous factors such as periodicity resulting from physiological changes (Sollberger, 1965), synchrony in diel activity between predator and their prey (Melquist and Hornocker, 1983), climatic conditions of the area, the types of habitats in which they live, and the degree of human interference. By conducting a four year study on North American river otters *Lontra canadensis*, Melquist and Hornocker (1983) concluded that it was difficult to determine the role of innate physiological rhythms of river otters, because activity rhythms of river otters were influenced by numerous factors, any one of which may have had an overriding effect on others. However, in my study, I demonstrated the smooth-coated otters exhibited pronounced rhythmic activity all through the year, which was stronger in the summer and monsoon than in winter.

Some otters are thought to be nocturnal (Macdonald and Mason, 1983; Chanin, 1985), while others may be diurnal (*e.g.* European otter on the Shetland coast, Kruuk, 1995 on the Scottish west coast; river otters in Idaho, Melquist and Hornocker, 1983). The nocturnal behaviour of smooth-coated otters in this study in a tropical, semi-arid environment of the Chambal River might be an adaptation for exploitation of prey, avoidance of disturbance, and limiting exposure to tropical heat. In this study the activity of fish was mostly restricted to the dark period (night)(personal observation). In American river otter in Idaho (Melquiest and Hornocker, 1983) and in European otters along the Shetland coast (Kruuk, 1995) this phenomenon was explained as that fish those are slow moving in their nature often hide under stones and weeds during day time, they are easy to catch by otters, then while they are active at night. Martin et al. (2010) reported similar observations for river otter in Canada, where otters were active throughout the day but with bimodal peaks during late evening and early morning hours. The spotted-necked otter (*Lutra maculicollis*) was found active when its efficiency in detecting its fish prey by sight was high, which was during daylight and moonlight in the Natal Drakensberg, South Africa (Perrin and Carranza, 2000).

Apart from fish activity as a factor in otter activity, the tide also has an important effect on almost all coastal life including otters (Kruuk, 1995). Because otters have a rapid gut-passage time (Mason and Macdonald, 1986), one might expect periods of active foraging bouts at regular intervals. However, I did not observe this for smooth-coated otters. The otters were mostly inactive throughout the day in summer and monsoon. This indicates that apart from the availability of prey, other factors such as temperature and anthropogenic disturbances influence activity patterns.

Figure 6. Mugger or Indian marsh crocodile (a) and gharail (b) in National Chambal Sanctuary, India

Functional classification of behavioural elements is important to categorize behaviour into physiologically related groups (Eisenberg, 1981). In the case of otters, if this sequence of behavioural acts are identified and grouped, this will help in understanding behavioural responses by semi-aquatic carnivores to external stimuli. From the behavioural activity I recorded during this telemetric study, it was difficult to conclude the importance of physiologically-related activity to otters because there was sighting bias due to nocturnal behaviour and the secretive nature of the species.

Travelling and grooming were the most prevalent activities recorded during 422 sightings. Grooming was recorded as the second important activity of otters because it plays an important role in its physiology. It increases insulation and blood circulation, decreases heat loss, and helps in maintaining general health of otters. In a study along the Shetland coast, Nolet and Kruuk (1989) found that, compared to sea otters, Eurasian otters spent up to 4.5 times less effort per day hunting but devoted the same time per day to grooming. Foraging was found to be the second prevalent activity but this again appears to be biased. Habitat and diet of smooth-coated otters overlapped with muggers; however no threat through interspecific competition was visualized. The degree of overlap in the utilization of fish may not be critical as fishing is banned in the Sanctuary. Interaction with other aquatic fauna such as crocodiles and turtles illustrate the behavioural flexibility, adaptive ability, and positive selective significance of this species.

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RÉSUMÉ

PROFIL D'ACTIVITES, COMPORTEMENTS ET RELATIONS INTERSPECIFIQUES DE LA LOUTRE A PEAU LISSE (*Lutrogale perspicillata*) DANS LE SANCTUAIRE NATIONAL DE CHAMBAL, INDE

Le profil d'activité, les comportements et les relations interspécifiques de la Loutre à poil lisse (*Lutrogale perspicillata*) avec les crocodiliens que sont le Gavial (*Gavialis gangeticus*) et le Crocodile des marais (*Crocodylus palustris*) ont été étudiés en suivant quatre loutres implantées de transmetteurs dans le Sanctuaire National de Chambal en Inde. A partir des pourcentages d'activités enregistrés, la tendance globale se présente sous forme d'une courbe bimodale dans laquelle apparaissent deux périodes de forte activité séparées par une période de relative inactivité. En été, la période de relative inactivité est supérieure à celle de l'hiver et de la mousson. Les loutres sont plus diurnes en hiver qu'en été ou à la mousson. Les déplacements et le toilettage sont les activités les plus courantes enregistrées sur 422 observations. Bien que les habitats et le régime alimentaire de la Loutre chevauchent ceux du Gavial et du Crocodile des marais, leurs activités diurnes sont différentes dans le temps et dans l'espace maintenant ainsi une cohabitation acceptable. Ceci permet d'éviter les conflits en assurant le partage des ressources et sécurisant siestes et toilettages.

RESUMEN

PATRONES DE ACTIVIDAD, ACTIVIDAD COMPORTAMENTAL E INTERACCIONES INTERESPECÍFICAS DE LA NUTRIA LISA (*Lutrogale perspicillata*) EN EL SANTUARIO NACIONAL CHAMBAL, INDIA

Se examinaron los patrones de actividad, actividad comportamental e interacciones interespecíficas de la nutria lisa (*Lutrogale perspicillata*) con crocodílidos -el gharial *Gavialis gangeticus* y el cocodrilo de las marismas *Crocodylus palustris*; monitoreando cuatro nutrias radio-implantadas en el Santuario Nacional Chambal, India. En base al porcentaje de registros telemétricos activos, los patrones globales de actividad de las nutrias adoptaron la forma de una curva bimodal, en la cual dos períodos de alta actividad estuvieron separados por un período de relativa inactividad. En verano, el período de relativa inactividad fue mayor que en invierno y en los monzones. Las nutrias fueron más diurnas en invierno que en verano o en los monzones. Las actividades más prevalecientes registradas durante 422 avistajes, fueron el desplazamiento y el acicalamiento. Aunque los hábitats y la dieta de las nutrias se superpusieron con los del gharial y el cocodrilo de las marismas, su patrón diario de actividad fue diferente, y especialmente mantenían una estrategia mutuamente armoniosa, para evitar conflictos con recursos compartidos (para asoleamiento y acicalamiento).

R E P O R T

THE STATUS OF IRAQ SMOOTH-COATED OTTER *Lutrogale perspicillata maxwelli* Hayman 1956 AND EURASIAN OTTER *Lutra lutra* Linnaeus 1758 IN IRAQ

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Abstract: Since the 1960s field expeditions, there has been little more knowledge acquired about the mammals of Iraq. There were also no previous surveys dedicated to assessing the status and presence of the two otter species described in Iraq: The Eurasian otter (*Lutra lutra*) and the Iraq smooth –coated otter *(Lutrogale perspicillata maxwelli*, an endemic subspecies). Historically, both species thrived among suitable habitats of Iraqi wetlands and were named by Iraqis "Chlaeib Al M'ai" meaning "The waterdog". Both species' populations have declined substantially 1991-2003 due to hunting and habitat destruction. During 2005-2012, intensive in situ field research has been done aimed at revealing the status of otters in Iraq. Different types of habitat at 21 sites across nine Iraqi provinces were visited and information about both species has been recorded. The smooth-coated otter (the endemic subspecies *maxwelli)* has proven by current research to be thriving in the southern Iraqi marshes with an additional remarkable sighting in northern Iraq (Kurdistan Region). Our research describes for the first time the geographical distribution, threats, and conservation status of both of these otter species in Iraq.

Keywords: Carnivores, *Lutra lutra, Lutrogale perspicillata maxwelli*, Mammals, Endemic, Eurasian otter, Marshes, Otter, smooth–coated otter.

INTRODUCTION

Iraq is situated at the northern range of the Arabian Peninsula and has a variety of suitable aquatic habitats for otters and other aquatic-associated species. The Tigris and Euphrates Rivers form the southern Iraqi marshland, which is one of the unique

aquatic landscapes in the Middle East. The mountains of Zagros and Hasarost extend to the north and northeast while western and southwestern Iraq are mainly desert and semi desert. The marshes of southern Iraq are crucial ecosystems, which influence, and also are influenced by many natural forces and human activities. These marshes are very important as incubators for fish and invertebrates, and play a vital role as habitat for the majority of wildlife in the region (Al-Saad et al., 2010).

Two otter species exist in Iraq: The Eurasian or Common otter (*Lutra lutra*) and the endemic Iraqi subspecies of the smooth-coated otter (*Lutrogale perspicillata maxwelli*). The Eurasian otter is known to occupy permanent rivers, lakes, and marshes throughout Iraq. Ainsworth (1838) reported the Eurasian otter from the Tigris and Euphrates Rivers. Later, Danford and Alston (1877) reported that otters were "not uncommon in Asia Minor, especially in the trout streams of the Taurus". They suggested that the species ranges through all of the major waterways in Iraq from the Arabian Gulf to the northern frontiers; Cheesman (1920) listed a specimen from Amara (Mayssan province); and Sanborn (1940) reported an individual from Qalat Salih near Amara. Hatt (1959) recorded two specimens; one from the Tigris near Al Zuhour Royal Place in Baghdad which was presented to the Iraq Natural History Museum by King Faisal II on December 1954, and another obtained from Mosul market as a trade skin. Hatt (1959) stated that otters occur at the Hindiya Barrage on the Euphrates where fishermen catch many otters, which were apparently numerous at the time because of an abundance of prey fish, and were also attracted by extensive fish netting in the river. Specimens of Eurasian otter collected from the southern shore of Hor Al-Hammar, west of Basra and Abusakhair, 35 miles south east of Amara on 29th of November 1956 are in the British Museum (Hayman, 1957; Harrison, 1968). The historical distribution of the Eurasian otter in northern Iraq is uncertain. Otters were not documented in mountain streams, but the remains of many partially eaten crabs reported from the Tigris River tributaries at Sarsank (Duhok province) indicate the possibility that one or both species once occupied the area (Hatt, 1959).

The Iraq smooth-coated otter is only known from the marshes of southern Iraq. Hayman (1956), in describing *Lutrogale perspicillata maxwelli* raised doubts about the reliability of earlier reports of otters from Iraq. Hayman said that Gavin Maxwell, when he returned from a journey with Major Wilfred Thesiger in the marshes of southern Iraq, brought to London two otter skins and one live cub which was about eight months old. The larger of the skins and the live cub undoubtedly represented the Smooth-coated otter, while the smaller skin was that of a Eurasian otter. The Iraq smooth-coated otter skin was from an apparently adult male (without skull) purchased on February 29th 1956 at the village of Abusakhair of Faraijat tribe, 35miles south east of Amara on Tigris, and presented to British museum by Mr. Maxwell (Hayman, 1956). The live cub was probably obtained from a tumulus island village called Daub, 12 miles North West of Al-Azair, west of the Tigris (Hayman, 1956; Maxwell, 1957, 1960; Harrison, 1968). Both Maxwell (1957) and Thesiger (1964) saw otters on a number of occasions, and describe them as common around Hor Az Zikri in the Central Marshes and at Hor Al -Hawizeh. However, otters (presumably of both species) were heavily persecuted for their skins in the 1950s (Thesiger, 1964).

Two specimens, a female and an immature male, were additionally recorded from the Tigris River near the vicinity of Al-Azair of Amara by Hatt (1959) who stated that the recognition of a second species of otter in the marshes of Iraq is a matter of great interest. Both species were mentioned by George and Mahdi (1969) in their list of the Iraqi mammals but without giving further details.

During the period of 1991 -2003, wide areas of reed beds and lakes of southern Iraqi marshes were ditched and drained by the previous Iraqi regime for political reasons. Scott and Evans (1993) concluded that drainage of the wetlands of Lower Mesopotamia would almost certainly result in the global extinction of the Iraq smooth-coated otter. The destruction and drainage of the Iraqi marshes affect the wildlife of southern Iraq (Richardson and Hussain, 2006). Hussain et al. (2008) suspected that the global population of the Smooth-coated otter has declined by >30% over the past 30 years due to large-scale hydroelectric projects, reclamation of wetlands for settlements and agriculture, reduction in prey biomass, poaching and contamination of waterways by pesticides. Due to hunting and habitat destruction there has been a marked decline in both species population especially of the endemic Iraq smooth-coated otter (Al-Sheikhly, 2012).

During 2005-2012, an intensive wildlife monitoring program was established by Canada-Iraq Marshland Initiative CIMI, Nature Iraq, and the Iraqi Ministry of the Environment (IMoE). The surveys were focused on monitoring and assessing the status of wildlife all over Iraq. One of the program objectives was to survey and monitor the aquatic wildlife in the southern Iraqi marshlands. It was essential to determine the status of otters in general as they have a role as bio-indicators to measure the health of the aquatic ecosystem. In addition, the Iraq smooth-coated otter represents a flagship and endemic species to the Iraqi marshes and its current status and distribution in Iraq was not fully recognized. The monitoring surveys aimed to ensure the following objectives:

- proving the permanence presence of the Iraq endemic Smooth-coated otter in the southern Iraqi marshlands;
- evaluating the status (occurrence and distribution) of the Iraq endemic smooth-coated otter;
- evaluating the status (occurrence and distribution) of the Eurasian otter;
- determining the main habitats and landscapes which are suitable for both species of otter, and which are currently used by those animals;
- determining the main threats and their impact on both species and on their habitats, in order to address the most proper and effective actions to conserve both species.

STUDY AREA

We collected data pertaining to the presence of Eurasian otter and the endemic Iraq smooth –coated otter during in situ field surveys along the Tigris and Euphrates River drainages, tributaries, big lakes and reservoirs, seasonal and permanent streams, mountain water courses, and from the southern Iraqi marshlands**.** In southern Iraq the survey efforts covered the southern part of Tigris and Euphrates basin and their tributaries. Three main big Iraqi marshes (marsh = Hor in Arabic) situated in three Iraqi provinces, known as the Central Marshes, Hammar Marshes (Hor Al-Hammar), and Hawizeh Marshes (Hor Al -Hawizeh), were surveyed (Fig. 1). In addition the coastline of Fao at the extreme southern end of Iraq, near the national borders with Kuwait and Iran, have also been covered by the southern surveys.

Figure 1. Left: *Lutra lutra* and *Lutrogale perspicillata maxwelli* overlapping area in southern Iraq delineated in yellow. Right: The dense reed beds and waterways of Hor Al-Hammar a typical landscape for Iraq smooth-coated otter © Omar F. Al-Sheikhly 2008

In central Iraq, many lakes, permanent and seasonal shallow pools, and marshy streams in the drainage of the Tigris and Euphrates rivers, situated in three Iraqi provinces, were covered by the current survey. Hor Al-Dalmaj, Tigris River and its branches at Tarmiya and Al-Alam Areas, Samara Lake, and Himreen Lake were the main localities surveyed in central Iraq. The main Euphrates waterway in western Iraq, mainly near the Haditha and Khan Al- Baghdadi marshes of Anbar province, was surveyed. In Northern Iraq (Kurdistan region), the survey covered mountains streams, the upper Tigris basin and its tributaries, and big lakes and reservoirs situated in two provinces in northern Iraq (Table 1).

MATERIALS AND METHODS

The data were collected during in situ field surveys and from additional notes obtained from personal field observations made by the authors in 2005-2012. We examined 21 sites throughout Iraq biannually from late November 2005 to early April 2012 or when access was possible. The records were derived from direct visual observations of live animals in the wild or in captivity, dead specimens due to hunting or trapping, and examination of skins or mounted specimens, tracks, scats, and field signs and otter calls or vocalization. Hunters', anglers', and local peoples' reports, pictures, and interviews were also considered. The Iraq Natural History Research Center and Museum, zoos, and local animals markets were visited. Records documented by photographs produced by provisional EOS Canon cameras, camera traps, and video recordings in order to gain more detailed information about the identification and actual status of otters in Iraq.

RESULTS

We found evidence of Eurasian otter and Iraq smooth –coated otters at 21 sites (Table 1) (Fig. 2). Earlier Iraqi historical records in Hatt (1959), Harrison (1968), and Harrison and Bates (1991) were the main guidelines used to decide otter hot spots for detailed surveying. In December 2005, three Iraqi provinces in southern Iraq were covered by CIMI and Nature Iraq fieldwork. One of the main challenges for the surveying team was to prove the permanence presence of Iraq endemic smooth-coated otters in the southern marshes. The areas where Iraq smooth-coated otter was

described by Hayman (1956) and Maxwell (1960) have been drained by the previous Iraqi political regime during 1990s and changed to barren semi-desert areas. Habitat destruction and shortage of prey were observed in many areas of the southern marshes in 2005 and 2006. During the survey in Rass Al-Beisha south of Fao in Basra province, an interview with local hunters indicated the presence of the "Waterdog" near the marshy ponds of Rass Al-Beisha in December 2005. The hunters spoke of otters swiftly sneaking among tall and dense reed beds and being occasionally seen preying on fish; also they described otters as having small sized bodies, black-gray coloration, rounded heads, and flattened tail, and such a description is very close to the forma description of the Iraq smooth-coated otter. In January 2006, a fresh skin of an adult male obtained by local fisherman was examined at Abu Al-Khasib (to the south east of Basra). The fisherman said that the otter was accidently killed by his electro-fishing device when he was fishing at night. The area of Umm Al-Rassas, which is situated to the south of Abu Al-Khasib Township, is a unique mixture of date palm orchards and dense reed beds extends along river banks. The identification of the skin as an Iraq smooth-coated otter comprised the first indication of permanence occurrence of this subspecies in southern Iraq. In February 2008, hunters and fishermen reports from Al-Ebra Umm Al Sijian south of Hor Al - Hammar indicated active nocturnal movement of otters. Al-Ebra mainly consists of open shallow water with thick reed vegetation and muddy shores. In addition the site providing abundant prey, mainly fish such as *Barbus luteus and Liza abu* and crabs. Hunters of Al-Ebra said that otters were occasionally seen lying down on small muddy islands before they dive when agitated by human presence. Many suitable habitats, tracks, and feeding remnants found at the site.

In ThiQar province, otters were reported from three localities. Local reports indicated the presence of otter in Al - Baghdadiya Lake in Chebaeish in January 2009, and Hor Abu Zirig in the vicinity of Al-Isalah (in the Central Marshes west of ThiQar province) on December 2007. The open lakes lined with dense reed beds and submerged aquatic vegetation with muddy platforms are the main habitats in both sites. Local reports of two fresh killed otters and one preserved skin indicated the presence of otters in Chebaeish; the skin was obtained from the lake of Al - Baghdadiya. Another adult male otter was shot by a local hunter near Abu Ajaj to the west of Hor Al-Hammar on August 2008. The examination of the Abu Ajaj preserved skin confirmed the presence of the endemic Iraq smooth-coated otter at northern side of Hor Al-Hammar. In Mayssan province, both otter species were recorded from four localities.

In January 2008, two fresh skins of a recently killed adult male Eurasian otter and an adult male Iraq smooth-coated otter were obtained from a local animal trader at the old city of Amara (Fig. 3). The trader indicated that the Eurasian otter was killed in Al-Musharah River (one of Tigris tributaries in Mayssan), and the Smooth-coated otter was killed in Umm Al- Na'aj (the core lake of Hor Al-Hawizeh) and that both otters were killed by electrocution. The skin of the Hor Al-Hawizeh otter showed remarkable features and measurements. The total length (L: 1000mm) and the tail length (T: 370.5 mm) closely resembled Hatt's (1959) measurements of an adult female Iraq smooth–coated otter obtained from Al-Azair on the Tigris (Harisson, 1968). The tail of the Iraq smooth –coated otter provides the principle distinguishing feature, being dorso-ventrally flattened, lacking the cylindrical shape of that of the Eurasian otter, and covered with short dense hair. The shape of the head and muzzle were somewhat less flattened than in the Eurasian otter. The eyes were small and situated more anteriorly than in the Eurasian otter, so that the distance between the

eye and rhinarium is shorter and that between eye and ear is relatively longer in Iraq smooth-coated otter. The dorsal coloration of the head and the back was uniformly chocolate–brown; the under parts were slightly paler; the side of the neck, head, and muzzle were buffish; the throat was iron-grey.

The presence of otters has been noted at Hor Al-Dalmaj which is an isolated wetland situated in Qadissiya province. Hunters of Dalmaj reported dark and pale furred otters, but that they were rarely seen (Salim, M., pers. comm.).

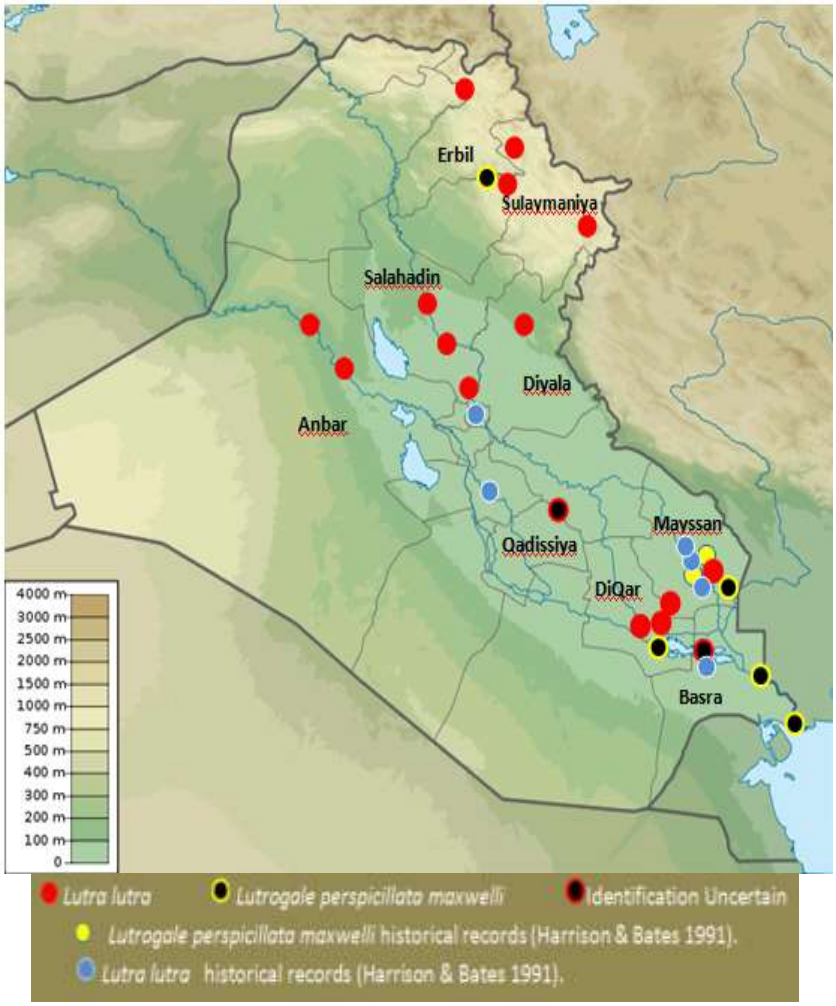

Figure 2. Iraq Map shows the historical and recent sightings of *Lutra lutra* and *Lutrogale perspicillata maxwelli*

Figure 3. Fresh otter skins obtained from Amara city in Mayssan province south of Iraq. © Mukhtar K. Habba.

The status of otters in central and western Iraq was unclear, represented by a few notes and observations made by Harrison (1968). Otters have been recorded from six sites situated in Salahadin, Diyala, and Anbar provinces. An adult male Eurasian otter had been shot by local hunter in Tarmiya north of Baghdad in April 2009 and it was presented to Iraq Natural History Research Center and Museum. Interviews with local hunters in Samara reported that an adult male was killed in May 2011 by electrocution at Samara Lake south east of Salahadin province in central Iraq. In May 2012, adult male and female Eurasian otters were shot by a local hunter on the Tigris shore of Al-Alam near Tikrit. River banks, with muddy and gravelly shores lined with dense vegetation of *Tamarix* sp., *Populus sp*., *Ziziphus sp., Albizia sp., Salix* sp. and scattered *Phragmites* sp. and *Typha* sp. beds are the main habitat type in the areas where the otters were killed. In April 2012, a live specimen of adult female Eurasian otter was trapped by a local hunter at Himreen Lake in Diyala province; it later died due to injuries caused by trapping (Fig. 4).

Five sites distributed in two northern Iraqi provinces (Kurdistan region) have witnessed the presence of otters. The Little Zab River, a Tigris tributary, was one of the main otter hot spots in northern Iraq. Adult male and female otters were killed by local fisherman by electrocution at Little Zab near TaqTaq in Erbil province in March 2007 and their skins were collected by authors (Fig. 4). The killed otters examined by Al-Sheikhly and Dr. Mukhtar K. Haba and they were identified as Smooth-coated otters rather than Eurasian otters. Nature Iraq carried out an expedition to monitor the habitat and to locate live specimens to reveal the status of TaqTaq otters. Afterwards, DNA analysis on one of the TaqTaq otters confirmed the identification as Lutrogale perspicillata, which is marked range extension of more than 500km north, with the intervening area having poorly known otter species (Omer et al., in press). Apart from these TaqTaq otters, all other northern Iraq records were of Eurasian otters. Interviews with local hunters and fishermen indicated the presence of otters at the big lakes of Dukan and Derbendikhan in Sulaymaniya province, but no specimens obtained. On June 2010 otter scats and tracks were observed near Koi Sanjaq along the little Zab River, and later on two Eurasian otters were flashed by torchlight during a night survey on the Rezan River in the Barzan Area, Mergasour district, Erbil, northern Iraq on May 2011.

DISCUSSION

Monitoring wildlife and any related field work was not fully acknowledged by the previous Iraqi regime during 1990s; therefore little was known about the wildlife of Iraq in general and otters specificly. The marshland landscape of southern Iraq was totally drained and <10% of the area remained as functioning marshland by the year 2000. The only remaining marsh of any size was the northern portion of Hor Al-Hawizeh, which straddles the border between Iraq and Iran. The other two marshes, Central and Hor Al-Hammar, were virtually destroyed by 2000. The remaining Hor Al-Hawizeh was only 35% of its 1977 size of 3076 km^2 by 2000 (Richardson and Hussain, 2006). In 2003 the Iraqi authorities in cooperation with locals of the marshes "Marsh Arabs" broke the dikes and embankments that were constructed during previous Iraqi regime in order to block the water of Tigris and Euphrates from passing into the marshes of southern Iraq. 40% of these Iraqi marshes have been inundated during 2003 – 2006 (Richardson and Hussain, 2006). Hawizeh Marsh is the only Iraq Ramsar site and is one of the biggest marshes in southern Iraq. It is situated in the southeast of Iraq, east of Mayssan province, and extends beyond Iraq's southern national borders into Iran where it is known as the Al-Azem marshland. Hor Al-

Hawizeh was not drained completely during the 1990s but only 35% of its 1977 size of 3076 km^2 by 2000 (Richardson and Hussain, 2006) (Fig. 1). It is believed that Hor Al-Hawizeh was the last refuge for the endemic Iraq smooth-coated otter population and the skin found at of Umm Al- Na'aj was distinctive evidence of this.

Figure 4. Left: Adult female *Lutra lutra* trapped in Himreen Lake of Diyala. © Omar F. Al-Sheikhly 2012. Right: Dead *Lutrogale perspicillata maxwelli* in TaqTaq examined by author © Mukhtar K. Haba, 2007.

The data from southern Iraq indicates that Hor Al-Hammar and Hor Al-Hawizeh are overlapping areas of two otter species. The Iraq Smooth-coated otter seems to be restricted to deep fresh water lakes with dense and tall reed beds in remote areas of extreme southern Iraq along the Iranian borders, or resident in small patches of western and southern Hor Al-Hammar. The Eurasian otter, which is the more abundant species, thrives in the tributaries, streams, and estuaries of the Tigris and Euphrates rivers in southern Iraq.

The identification of the Al-Ebra Umm Al Sijian otter in Basra was uncertain. The site is close to Hatt's (1959) previously recorded Eurasian otter, and our current observations at Al-Ebra Umm Al Sijian are of animals resembling this species, but further research and sampling from Al-Ebra Umm Al Sijian is needed to be certain.

The reports of otters in Hor Al-Dalmaj most likely indicate Eurasian otters because of the habitat and the large distance from any other observation of smooth-coated otters (Hayman,1956), but more sampling is required from Dalmaj to reveal the identity of otters present there.

The situation in northern (Kurdistan Region) and central Iraq was similar to southern Iraq: Most sites such as big lakes and main river tributaries were restricted as far as civilian activity goes during 1980s - 1990s. Very few reports related to wildlife in general and mammals in particular are known from northern and central Iraq. Only permitted hunters were allowed limited access to certain areas in central and western

Iraq, and these were the only source of information from that part of Iraq during 1980s - 1990s.

The remarkable observation of an Iraq smooth-coated otter in TaqTaq, Erbil in northern Iraq was a matter of interest. The general landscape in the site was ideal for Eurasian otters, which is the species originally suspected to have been observed, and which thrive at the site. It was surprising that the DNA analysis of the two otters obtained from TaqTaq indicated Lutrogale perspicillata since the next firm identification of this specfies is about 500km further south (Omer et al., in press). Consequently, further sampling and research is recommended in TaqTaq.

Hunting and trapping are the main threats impacting wildlife in Iraq, because of weak implementation of currant hunting laws and legislations. Thesiger (1964) noted that otters *(Lutra spp.)* were widely hunted for their skins, and mentioned one person who shot 40 otters in the space of two months. The hunting impact and the absence of scientific knowledge about endemic Iraqi species among many of the local hunters and fishermen has led to a worrying decline in many species' populations (Al-Sheikhly, 2012). Otters are targeted by local hunters and fishermen all over Iraq wherever and whenever possible. The local hunters of the southern marshes used to collect otter cubs during early March and mid-April each year in order to be raised as pets by marsh Arabs "Ma'dan" or to be trained by fishermen to chase and catch large fishes (Fig. 5). Today, adults of both species are trapped by submerged cages, traps and nets mainly for their fur. The fur is sold to smugglers along the borders of Iraq with prices ranging from $100 to $300 each. Otter skins are used as waterproof sacs, filled with contraband and inserted inside the gasoline tanks of the smuggling cars. The otter fur sac prevents the contraband from getting wet or damaged (Al-Sheikhly, 2012). Otter hunting was a famous profession during the 1980s and 1990s in certain places in central Iraq, especially near Samarra Lake. Otters were trapped using handmade submerged cages called "Fakhatt Al M'ai" which were set up near reed beds or lakes outlets, and were sold in the old bazaars of Tikrit (Al-Azawi, H., pers. comm.).

Figure 5. A very rare photograph of the Marsh Arab "Ma'dan" of southern Iraq shows one of the local hunters holding otter cub obtained from Mayssan marshes. The picture was obtained from local hunter collection and presented in M.Sc thesis of M. Al-Hilli from 1950s. Photo of photo © Omar F. Al-Sheikhly.

The conflict between otters and fishermen is producing a marked effect on the otter population in Iraq. Most of the otter specimens examined during the research were killed accidently by local fishermen via electro-fishing devises. Electrocution cased serious damage to the otter's nervous system as they get temporally paralyzed, and they start to float or drown as soon as they come in contact with the electricity waves. Most of the fishermen have no or little experience with stunned otters; they get terrified when they see the shocked otters and they try to kill them immediately. Some fishermen use their boat paddles to hit the otters on the head, while others continued shocking the water with high voltage waves at the spot where the otter was stunned the first time in order to ensure the otter's death.

Table 1. Otter sightings in Iraq 2005-2012. No. sp. =Number of Specimens; Sp. =Species; Sc. = Scat; Tr. =Tracks; Re. =Remnants; In. =Interview; Sk. =Skin; Ds. =Dead specimen; Ls. =Live specimen.

Site		Province	Coordinates	No. sp.	Sp.	Sc	Tr	Re	In	Sk	Ds	Ls
Southern Iraq	Fao – Rass Al-Beisha	Basra	N 29°56' E 48°32'		*Lutrogale*				+			
	Al-Ebra Umm Al Sijian – South of Hor Al – Hammar		N 30°41' E 47°12'		uncertain			+	+			
	Abu Al-Khasib and Umm Al Rassas Island		N 30°26' E 48° 6'	1♂	*Lutrogale*				+	+		
	Abu Ajaj –Hor Al-Hammar	ThiQar	N 30°49' E 46°36'	1♂	*Lutrogale*						+	
	Al – Baghdadiya Lake Chebaeish-Central Marshes		N 31° 3' E 47° 2'		*Lutra*				+			
	Hor Abu Zirig – vicinity of Al-Isalah-Central Marshes		N 31° 1' E 46°41'		*Lutra*				+			
	Umm Al- Na'aj lake-Hawizeh Marshes	Mayssan	N 31°37' E 47°35'	1♂	*Lutrogale*				+	+		
	The vicinity of Al-Maimona		N 31°25' E 46°59'		*Lutra*				+			
	Al-Musharah River		N 31°51' E 47°15'	1♂	*Lutra*				+	+		
	Hor Al-Dalmagj	Qadissiya	N 32°11' E 45°25'		uncertain				+			
Central Iraq	Tarmiya Area	Salahadin	N 33°43' E 44°24'	1 ♂	*Lutra*					+		
	Al-Alam Area		N 34°42' E 43°40'	2♀, ♂	*Lutra*				+		+	
	Samarra Lake		N 34°12' E 43°49'		*Lutra*				+			
	Himreen Lake	Diyala	N 34° 9' E 45° 1'	1♀	*Lutra*				+			+
Western Iraq	Khan Al-Baghdadi Marshes	Anbar	N 33°52' E 42°31'		*Lutra*				+			
	Haditha Marshes		N 34°10' E 42°23'		*Lutra*				+			
Northern Iraq (Kurdistan Region)	Darbendikhan Lake	Sulaymaniya	N 35° 7' E 45°44'		*Lutra*				+			
	Dukan Lake		N 35°58' E 44°57'		*Lutra*				+			
	little Zab River		N 35°51' E 44°47'		*Lutra*	+	+					
	Rezan River- Barzan Area	Erbil	N 36°55' E 44° 0'	2	*Lutra*		+					+
	Taq Taq		N 35°54' E 44°36'	2♀, ♂	*Lutrogale*	+	+		+		+	

CONCLUSION

The Eurasian otter and Iraq smooth–coated otter are still thriving in the wetlands of Iraq. We worked from 12 samples obtained from 21 sites all over Iraq in addition to confident reports and field observations. The Iraq smooth–coated otter was recorded from five specimens from five localities in four Iraqi provinces. The Eurasian otter was the most common species recorded by seven specimens obtained from five localities in four Iraqi provinces in northern, central and western Iraq. The Eurasian Otter is restricted to dense vegetated river banks, stationary rain puddles, mountain streams, and reservoirs of Tigers and Euphrates basin. The Iraq smooth–

coated otter prefers dense, tall reed beds, marshy lakes and ponds in southern Iraqi marshes with one interesting observation at a mountain river in TaqTaq. The range extension of Iraq smooth-coated otter ca. 500km to the north of its described range is a subject of great interest and further investigation. Two overlapping areas between both species occur in southern Iraq: the Hor Al-Hawizeh and Hor Al-Hammar Marshes. The presence of both species in one area is a matter of further research especially when Hor Al-Hammar has faced a marked ecological devastation and secondary ecological succession during 1990s which might lead to a re-distribution of the fauna of the site. A great deal of advice has been given to the Iraqi authorities, and huge efforts proposed in order to conserve and protect the last few populations of otters in Iraq. In addition, enforcing the Implementation the existing hunting legislation will be essential in order to reduce the hunting impact on both species especially at a time when Iraq is currently discussing becoming a signatory state to the Convention on International Trade in Endangered Species of Fauna and Flora (CITES).

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RÉSUMÉ

STATUT DE LA LOUTRE A POIL RAS *Lutrogale perspicillata maxwelli,* Hayman 1956 ET DE LA LOUTRE D'EUROPE *Lutra lutra* Linnaeus 1758 EN IRAK

Depuis les expéditions sur le terrain de 1960, il existe peu de données sur les mammifères d'Irak. Il n'y a d'ailleurs pas de sondages destinés à évaluer le statut et la présence des deux espèces de loutres décrites en Irak; La Loutre d'Europe (*Lutra lutra*) et la Loutre à poil lisse d'Irak (*Lutrogale perspicillata maxwelli*; une sous-espèce endémique). Historiquement, les deux espèces nommées «Chlaeib Al M'ai» par les Irakiens ce qui signifie «chien d'eau», ont prospéré dans les habitats favorables qu'étaient les zones humides irakiennes. Les deux populations ont diminué de manière substantielle à cause de la chasse et la destruction des habitats entre 1991 et 2003. Durant la période 2005-2012, un vaste programme de recherche sur le terrain visait à définir les statuts des loutres en Irak. Différents types d'habitats répartis sur 21 sites des neuf provinces irakiennes ont été visités et les deux espèces ont été enregistrées. La Loutre à poil lisse est en pleine progression dans les marais du sud où elle est actuellement suivie, et elle est présente de façon remarquable dans le nord du pays (Kurdistan). Nos recherches décrivent pour la première fois la répartition géographique, les menaces et l'état de conservation de ces deux espèces de loutres en Irak.

RESUMEN

STATUS DE LA NUTRIA LISA *Lutrogale perspicillata* Hayman 1956, Y DE LA NUTRIA EUROASIÁTICA *Lutra lutra* Linnaeus 1758, EN IRAQ

Desde las expediciones de los 1960s, se ha agregado poca información sobre los mamíferos de Iraq. Asimismo, no había prospecciones previas dedicadas a evaluar el status y presencia de las dos especies de nutrias registradas en Iraq: la nutria euroasiática (*Lutra lutra*) y la nutria lisa de Iraq (*Lutrogale perspicillata maxwelli* - una subespecie endémica). Históricamente, ambas especies prosperaron en hábitats aptos en los humedales de Iraq, y han sido nombradas por los Iraquíes "Chlaeib Al M'ai", que significa "el perro de agua". Las poblaciones de ambas especies han declinado sustancialmente debido a la caza y la destrucción de hábitats, entre 1991-2003. Entre 2005-2012 se hizo una investigación de terreno intensiva, dirigida a revelar el status de las nutrias en Iraq. Se visitaron diferentes tipos de hábitat distribuidos en 21 sitios, en nueve provincias de Iraq, y se registraron ambas especies. La nutria lisa (subespecie endémica *L. p. maxwelli*), como lo demostró esta investigación, está prosperando en las marismas del sur de Iraq, con el agregado de un avistaje notable en el norte (Región de Kurdistan). Nuestra investigación describe por primera vez la distribución geográfica, amenazas, y status de conservación de estas dos especies de nutria en Iraq.

الخلاصة

منذ البعثات الحقلية التي أجريت في ستينيات القرن الماضي لم يتوفر سوى القليل من المعلومات حول الثديات في العراق. كما لا توجد هنالك مسوحات حقلية مكرسة لتقيم حالة وتواجد النوعين من كلاب الماء " القضاعات" الموصوفة والمسجلة من العراق وهما : كلب الماء " القضاعة" الأوراسية (*Lutra lutra*) وكلب الماء " القضاعة" ملساء الفراء العراقية, الضرب المستوطن *(Lutrogale perspicillata maxwelli*) . في السابق ,كان كلا النوعين يؤمان العديد من الموائل الملائمة في الاراضي الرطبة العراقية ويعرفان من قبل السكان المحليين باللغة العامية العراقية ب " جليب الماي" والتي تعني " كلب الماء".تعرضت المجاميع السكانية لكلا النوعين الى انحدار مستمر نتيجة لعمليات الصيد الجائر وتدمير الموائل خلال الأعوام 1991-2003. تم خلال الاعوام من 2003-2012 دراسة حقلية مستفيضة تهدف الى معرفة وايضاح حالة القضاعات في العراق . تم زيارة العديد من الموائل المختلفة ل 21 موقعاً موزعاً ضمن تسعة محافظات في انحاء العراق وتم تسجيل كلا النوعين خلال المسوحات الحالية.

أن بقاء تواجد الضرب المستوطن من كلب الماء " القضاعة" ملساء الفراء العراقية في الاهوار الجنوبية العراقية , يترافق مع تسجيل بقعة تواجد وانتشار مميزة له في كوردستان شمال العراق تم اثباته خلال المسوحات الحالية. ان البحث الحالي يصف ولأول مرة الأنتشار الجغرافي , المهددات, وحالة صون كلا النوعين من القضاعات في العراق.

R E P O R T

DENTAL ANOMALIES IN *Lontra longicaudis* (CARNIVORA: MUSTELIDAE) COLLECTED IN SOUTHERN BRAZIL

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Abstract: This study describes the occurrence of dental anomalies in a specimen of *Lontra longicaudis* from the extreme south of Brazil. The specimen examined (MCNU-1584) underwent radiographic and macroscopic analysis of the dental number, shape and structure. Anomalies were observed in the alveoli of the right PM1 and PM2, which were obstructed by bone tissue and tooth loss was possibly due to trauma or pathogenesis. The presence of a supernumerary tooth, not erupted, inclined and incisiform, was also observed on the midline of the palate. Its position and null functionality suggest that it originated because of the hyper development of the dental lamina.

Key words: Maquiné; neotropical otter; Rio Grande do Sul; supernumerary teeth

Interference during tooth development may lead to anomalies in number (supernumeraries, agenesis), morphology (microdontia, macrodontia, twinning, merger, dens in dente) and structure (amelogenesis imperfecta, enamel hypoplasia)

that become evident at any moment during the life of an organism (Graipel et al., 1997; Costa et al., 2003; Castilho et al., 2004; Fernandes et al., 2005; Silva et al., 2005; Bezerra et al., 2007; Miziara et al., 2008). These changes may result from external factors such as environmental, traumatic and nutritional causes, or may have a genetic origin (Beaver et al., 1981; Ten Cate, 1994).

Dental anomalies are widely covered in case studies involving humans (Costa et al., 2003; Castilho et al., 2004; Fernandes et al., 2005; Silva et al., 2005; Bezerra et al., 2007; Miziara et al., 2008). Studies related to mammals are sporadic (Drehmer et al., 2009) and mainly due to agenesis which, excluding pathogenic or traumatic causes, is reflected by the absence of teeth (Bezerra et al., 2007), and hyperdontia, in which permanent supernumerary teeth may or may not erupt in any part of the mouth (Bezerra et al., 2007). These phenomena have been described in Didelphidae (Takahashi, 1974; Moraes et al., 2001), Phyllostomidae (Ramírez-Pulido and Müdespacher, 1987; Rui and Drehmer, 2004), Felidae (Pocock, 1940; Graipel et al., 1997), Otaridae (Drehmer and Ferigolo, 1996; Braunn and Ferigolo, 2004; Drehmer et al., 2009) and Mustelidae, including the subfamily Lutrinae (Burt, 1954; Hauer, 2002; Polechla et al., 2002).

In this study, we report the occurrence of dental anomalies in a specimen of *Lontra longicaudis* found dead on 15 November 2008 in Morro Alto, Maquiné, state of Rio Grande do Sul, Brazil (29°73'/50°16'). The specimen was a male in the adult stage of development, since the cranial sutures are completely fused and dentition is definitive. The dental anomalies were noted by macroscopic examination of the skull. The occlusal radiograph was performed to complement the assessment of the anomalies. The following conventions were adopted: I (incisor), C (canines), PM (premolars) and M (molars), followed by the number indicating the position of the upper teeth.

Different degrees of bone obstruction were detected in the alveoli of the right PM1 and PM2, besides the presence of a supernumerary tooth, not erupted, located posterior to the incisor foramens in the midline of the palate (Figure 1). The absence of incisors and of the left PM1 is due to loss that occurred during the cleaning procedures of the bone material deposited in the collection of mammals at the Museum of Natural Sciences of the Universidade Luterana do Brasil (MCNU-1584).

Radiographs of the occlusal surfaces of the maxilla showed that the supernumerary tooth is incisiform and is inclined relative to the position of the original series. It is also possible to note that root fragments are present within the obstructed alveoli of the right PM1 and PM2, which discards agenesis and suggests that the loss of dental crowns is the result of trauma or pathogenesis. The obstruction of the alveoli indicates an advanced stage of resorption of root residuals and consequent replacement by bone tissue.

Any tooth that surpasses the typical number of deciduous and permanent teeth is considered supernumerary (Heluy et al., 1993; Abreu-Lima et al., 2002). This type of abnormality is usually related to genetic atavism (Drehmer, 2006) or hyper-development of the dental lamina (Shafer et al., 1987; Ursi et al., 1988; Stuani et al., 1999; Cal Neto et al., 2002; Neville and Damm, 2004).

Considering atavism, characters present in ancestral lineages arise at low frequencies in a population of individuals (Drehmer, 2006). However, dental modifications in the Lutrinae ancestors are related to the form and function of the molar series and not to the case study presented herein. A tendency toward a cutting function is observed in the narrow molars of the more primitive forms, while derived

forms, such as the genus *Lontra*, show a tendency toward maceration, with rounded cusps and wide post-carnassials (Vaughan et al., 2000).

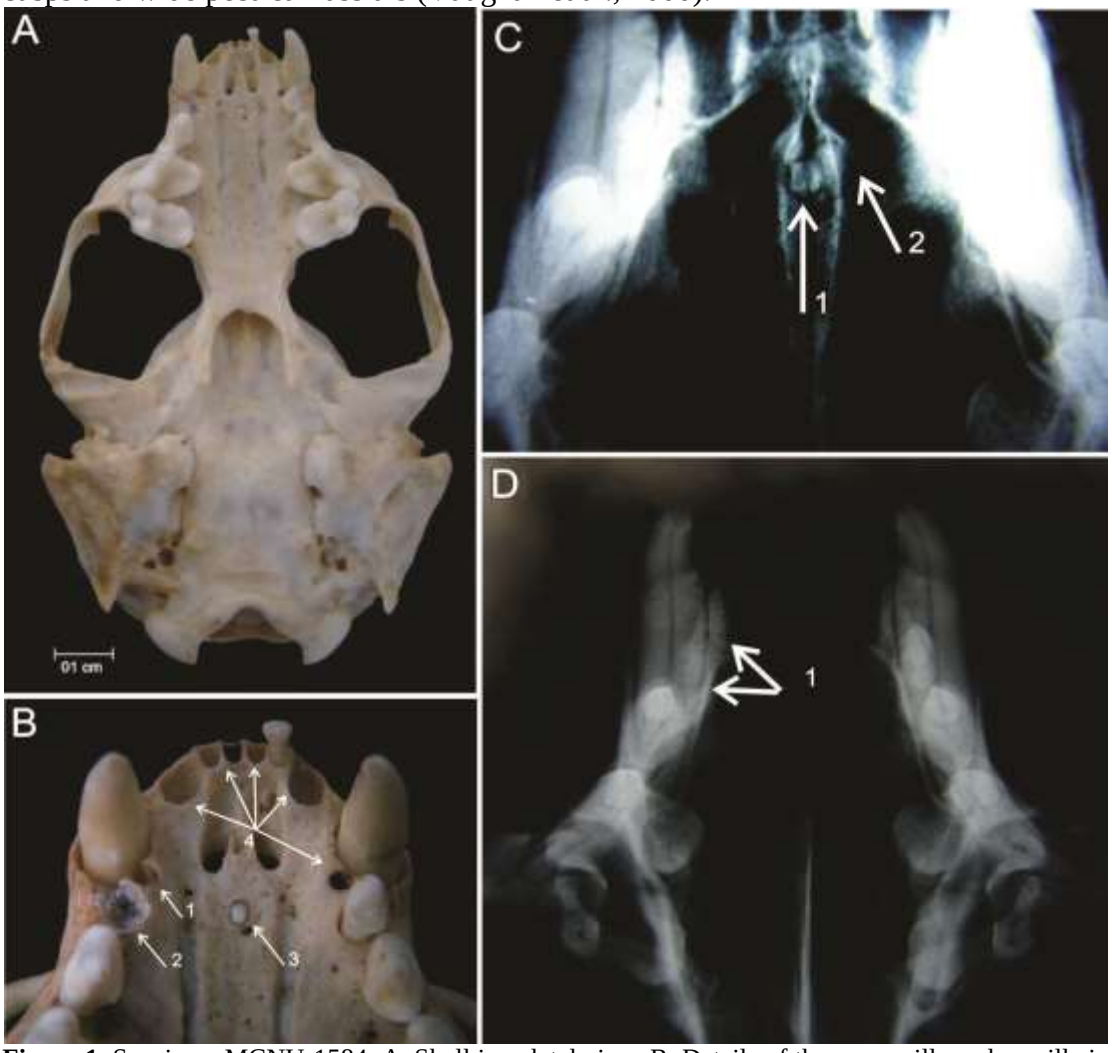

Figure 1. Specimen MCNU-1584. A. Skull in palatal view. B. Details of the premaxilla and maxilla in palatal view: 1 - absence of the right PM1 and internal region of the alveolus partially obstructed; 2 - absence of the right PM2 and totally obstructed alveolus; 3 - incisiform supernumerary tooth, not erupted, in the midline of the palate; 4 – open alveoli, showing the presence of teeth in life and their loss during cleaning and preparation of the bone material. C. Detail of the maxilla showing the inclination of the supernumerary tooth: 1 - crown of the supernumerary tooth; 2 - root of the supernumerary tooth. D. Radiograph of the palatal region of the skull: 1 - root fragments inside the alveoli of PM1 and PM2. Photo: Felipe B. Peters.

The supernumerary incisor results from continued proliferation of the permanent or deciduous dental lamina, which forms a third tooth germ (Stuani et al., 1999). It can be considered ectopic and its development in the palatine region is common (Castilho et al., 2004). In this case study, the supernumerary tooth is displaced posteriorly relative to the line of the incisors, with characteristics similar to a supplemental mesioden with a short root (Abreu-Lima et al., 2002; Shafer et al., 1987; Stuani et al., 1999). As observed in the specimen MCNU-1584, most mesiodens do not erupt and can be impacted in various positions (Stuani et al., 1999; Lobato et al., 2002). The eruption of a mesioden may cause discomfort such as inflammation of the tongue and buccal mucosa, as well as pain, numbness and localized swelling (Heluy et al., 1993; Abreu-Lima et al., 2002). If it does not erupt, it can inadvertently

remain in the jaw, not causing any serious alteration to the organism (Silva et al., 2005).

The study of Hauer (2002) showed that the occurrence of deviations in the dental pattern of Eurasian otters (*Lutra lutra*) is low, affecting only 10% of the individuals analyzed (n = 1037). This phenomenon is related to instabilities that occur during the ontogenetic development of individuals, which may reflect on their behavior when alive. Specifically regarding this case study, the advanced state of root absorption of the right PM1 and PM2 and the non-eruption of the mesioden did not prevent the analyzed specimen from sustaining its predatory activity, which allowed us to dismiss these anomalies as the cause of death.

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RÉSUMÉ

ANOMALIES DENTAIRES D'UNE LOUTRE *Lontra longicaudis* (CARNIVORA: MUSTELIDAE) DECOUVERTE DANS LE SUD DU BRÉSIL

Cette étude décrit les anomalies dentaires présentes sur un spécimen de *Lontra longicaudis* découverte à l'extrême sud du Brésil. Le cadavre examiné (MCNU-1584) a été soumis à une analyse radiographique et macroscopique des dents, de leurs formes et de leurs structures. Les anomalies ont été observées dans les alvéoles des PM1 et PM2 de droite, qui ont été obstruées par du tissu osseux. La perte de dents quant à elle était peut-être due à un traumatisme ou une pathologie. La présence d'une dent surnuméraire, non éclatée, inclinée et incisiforme, a également été observée sur la ligne médiane du palais. Sa position et son absence de fonctionnalité suggèrent que son origine serait due à l'hyper-développement de la lame dentaire.

RESUMEN

ANOMALÍAS DENTARIAS EN *Lontra longicaudis* (CARNIVORA: MUSTELIDAE) COLECTADAS EN EL SUR DE BRASIL

Este estudio describe la ocurrencia de anomalías dentarias en un especimen de *Lontra longicaudis* del extremo sur de Brasil. Al especimen examinado (MCNU-1584) se le practicaron análisis radiográficos y macroscópicos del número, forma y estructura dentaria. Se observaron anomalías en los alveolos de PM1 y PM2 derechos, que estaban obstruidos por tejido óseo, y la pérdida del diente posiblemente se debió a trauma o patogénesis. También se observó la presencia de un diente supernumerario, no erupcionado, inclinado e incisiforme, en la línea media del paladar. Su posición y nula funcionalidad sugieren que se originó en un hiper-desarrollo de la lámina dental.

RESUMO

ANOMALIAS DENTÁRIAS EM *Lontra longicaudis* (CARNIVORA: MUSTELIDAE) COLETADA NO EXTREMO SUL DO BRASIL

Este trabalho descreve a ocorrência de anomalias dentárias em um espécime de *Lontra longicaudis* proveniente do extremo sul do Brasil. O espécime examinado (MCNU-1584) passou por análise macroscópica e radiográfica do número, forma e estrutura dental. Foi observada anomalia nos alvéolos do PM1 e PM2 direito, os quais apresentavam obstrução por tecido ósseo, sendo a perda dentária proveniente possivelmente de trauma ou patogenia. Também foi verificada a presença de um dente supranumerário, não erupcionado, inclinado e incisiforme na linha média do palato, cuja posição e funcionalidade nula remetam a origem ao hiperdesenvolvimento da lâmina dentária.

S H O R T N O T E

SEIZURE OF LIVE OTTERS IN BANGKOK AIRPORT, THAILAND

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On 22 January, 2013, TRAFFIC reported that the Royal Thai Customs officers working at the Wildlife Checkpoint of Bangkok's Suvarnabhumi International Airport discovered 11 live otters when they scanned a bag that had been left at the oversized luggage area of the airport (TRAFFIC website, 2013). The otters, six Smooth Otters *Lutrogale perspicllata* and five Oriental Small-clawed Otters *Aonyx cinereus* were all juveniles and are suspected to have been smuggled out of Thailand, bound for Japan to be sold as exotic pets.

The bag bore no tags and nobody claimed it, and therefore no arrests were made. Officials of Thailand's CITES Management Authority, Department of National Parks, Wildlife and Plants and Royal Thai Customs Stated in a press conference that they are investigating the case under Section 27 of Customs Law B.E.2482, Section 16-17 of Customs Law B.E.2469 and Section 23 of Customs Law 2482, as well as the Wild Animal Reservation and Protection Act, B.E 2535 and Animal Epidemics Act, B.E 2499.

While there are frequent seizures of live animals at the airport, this is the first involving otters. The otters will undergo health checks before being handed over to the Huay-Ka-Kaeng Breeding Center in Uthai Thani for care.

Both species are considered Vulnerable by IUCN in the Red List of Threatened Species (IUCN, 2012) and are listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Both species are threatened largely due to degradation and loss of habitat. The scale and impact of hunting and capture for commercial trade in some parts of Southeast Asia was once thought to be minimal (Melisch et al., 1996), however, more recently perhaps, poaching for otter skins in many parts of Asia has become a severe threat (Meena, 2002; Poole, 2003; Duckworth and Hill, 2008). More research and monitoring is required to better gauge the current extent of the trade in otters in Southeast Asia and the impact such trade is having on wild populations. Efforts to reduce the poaching and illegal trade are urgently needed.

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TRAFFIC. Eleven live otters found in airport luggage – 22 Jan. 2013 - http://www.traffic.org/home/2013/1/22/eleven-live-otters-found-in-airport-luggage.html Downloaded 23 February 2013.

RÉSUMÉ

SAISIE DE LOUTRES A L'AEROPORT DE BANGKOK, THAILANDE

Le 22 Janvier 2013, TRAFFIC a signalé que les agents des douanes royales thaïlandaises travaillant au check-point de la faune sauvage de l'aéroport international Suvarnabhumi de Bangkok, avaient découvert 11 loutres vivantes lorsqu'ils ont scanné un sac laissé dans la zone des bagages surdimensionnés. Les loutres, six loutres à pelage lisse *Lutrogale perspicillata* et cinq loutres cendrées *Aonyx cinereus* étaient toutes juvéniles et étaient probablement destinées à quitter clandestinement la Thaïlande, sans doute en partance pour le Japon pour être vendus comme animaux exotiques de compagnie. Le sac ne portait aucun étiquetage et personne ne l'a réclamé. Par conséquent, aucune arrestation n'a été faite. Les loutres feront l'objet d'examens sanitaires avant d'être remises au Centre de reproduction et de soins de Huay-Ka-Kaeng à Uthai Thani.

RESUMEN

DECOMISO DE NUTRIAS VIVAS EN EL AEROPUERTO DE BANGKOK, TAILANDIA

El 22 de enero de 2013, TRAFFIC informó que los funcionarios de la Real Aduana Thai que trabajan en el Puesto de Control de Fauna en el Aeropuerto Internacional de Suvarnabhumi, Bangkok, descubrieron 11 nutrias vivas cuando escanearon una valija que había sido dejada en el área del aeropuerto destinada a equipaje excedido en tamaño. Las nutrias, seis nutrias lisas *Lutrogale perspicillata* y cinco nutrias asiáticas de uñas pequeñas *Aonyx cinereus*, eran todas juveniles y se sospecha que estaban siendo contrabandeadas hacia fuera de Tailandia, destinadas a Japón para ser vendidas como mascotas exóticas. La valija no tenía etiquetas, nadie la reclamó, y por lo tanto no se hicieron arrestos. Las nutrias van a pasar por chequeos de salud para luego ser entregadas al Centro de Reproducción Huay-Ka-Kaeng, en Uthai Thani, para su cuidado.

S H O R T N O T E

PUBLIC PARTICIPATION AS AN AID TO CONSERVE LITTLE KNOWN SPECIES: THE CASE OF THE NEOTROPICAL OTTER *Lontra longicaudis* (OLFERS, 1818) IN CENTRAL MEXICO

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Abstract: Public participation is often disregarded during conservation projects despite the potential benefits as it can help to determine priority areas for conservation in highly fragmented landscapes or to increase knowledge of little known species. However, there is no information about its potential application in Central Mexico. We undertook a preliminary assessment based on 30 interviews preformed between December 2011 and May 2012 with hunters aimed to determine the presence, feeding habits, reproduction periods, and –threats of the neotropical otter (*Lontra longicaudis*) in a fragmented landscape in the Sierra Madre Oriental. Twenty three of the interviewed hunters indicated that the species is rare and considered to be solitary however, they have observed cubs and pregnant females feeding mainly on fish and crustaceans were made. Pollution, shortage of prey, habitat disturbance, and hunting were the main threats on the species. We verified the presence responses of the neotropical otter through field work and the life history information was obtained by doing a literature review. We concluded that public participation can be confidently incorporated in conservation plans of the neotropical otter in the Sierra Madre Oriental.

Key Words: Puebla, Sierra Norte, communities, public monitoring

INTRODUCTION

Despite the broad knowledge that local communities have on their environments and factors affecting species within their surroundings (Danielsen et al., 2003), public

participation in conservation projects has not been considered widely in conservation research (Brook and McLachlan, 2008). It is now acknowledged that public participation can be useful to generate information of little known or secretive species. Public participation can be useful to determine species presence and corridor viability (Zeller et al., 2011), to map important factors for conservation along the landscape (Kingston et al., 2000), and to understand some ecological patterns of species such as preferred prey items (Gallo-Reynoso, 1989).

The neotropical otter (*Lontra longicaudis*) is a data deficient species, lacking information in most countries of its range (Waldemarin and Alvarez, 2008; Gallo-Reynoso, 1989). In Mexico it is known to be a widely distributed species, however, most related studies focused on its feeding habits and distribution (Casariego-Mandorell et al. 2006; Gallo-Reynoso et al. 2008; Monroy-Vilchis and Mundo, 2009). Therefore, public participation could be useful in the conservation of the neotropical otters specially as they can live in areas which have a certain level of human activities (Larivière, 1999), increasing the potential number of people that can provide information about the species.

Neotropical otters can be considered as a bio-indicator, selecting well-preserved areas (Casariego-Madorell et al., 2006). The mountain range known as Sierra Madre Oriental is highly fragmented in some areas (Evangelista et al., 2010), but has the potential to serve as a corridor for some species (Ramirez-Bravo et al., 2010). However, current information on neotropical otters along Sierra Madre Oriental is punctual and refers mostly to its geographical distribution (Gallo-Reynoso, 1989). Thus, available information can be used to test if public participation could supplement with -basic information for *Lontra longicaudis* management in Sierra Madre Oriental.

We undertook interviews with hunters and farmers from local communities within a portion of Sierra Madre Oriental in the Sierra Norte of Puebla to assess their knowledge on neotropical otters. The Sierra Norte, is located in the state of Puebla, in central Mexico; where only a few number of otters have been recorded (Ramírez-Bravo, 2010). Sierra Norte has great altitudinal and climatic variation, resulting in high habitat diversity that ranges from tropical rainforest in the lowlands to temperate moist forest in high grounds (Ramírez-Pulido et al., 2005). We concentrated our efforts in a 141.21-km^2 area, within the Cozoltepec River Canyon and its tributaries (Fig. 1).

We did a total of 30 interviews between December 2011 and May 2012. We selected fishermen and farmers who conducted agricultural activities close to tributaries of the rivers Cuichat and Zempoala in the municipalities of Tuzamapan de Galeana, Cuetzalan del Progreso, Huehuetla, Olintla, and Xochitlán de Vicente Suárez. We created a set of 24 questions aimed at determining the presence of the species, habitat description, threat impacts, and human activities in the area, and their influence on otters.

Most of the surveyed people are in the field all year round (23) and indicated that sightings are raren which could be due to the low population densities in the region as in other areas further south (Casariego-Madorell et al., 2006). We recorded a total of 22 otter sightings, 13 in summer (June-August) and nine in spring (March-May) Interviewees reported otters being solitary, which behavior agrees with findings related to the ecology of the species in other parts of Mexico (Gallo-Reynoso, 1989). Most sightings correspond to resting individuals (12), which is also the most reported activity in captive otters (Green, 2000), followed by swimming (7) and feeding (7). Interviewees disclosed that otters feed mainly on “fish” or “crustaceans” (without

giving further information on species); such behavior also agrees with reports related to otter feeding habits reports in other areas (Casariego-Madorell et al., 2006; Gallo-Reynoso et al., 2008; Monroy-Vilchis and Mundo, 2009).

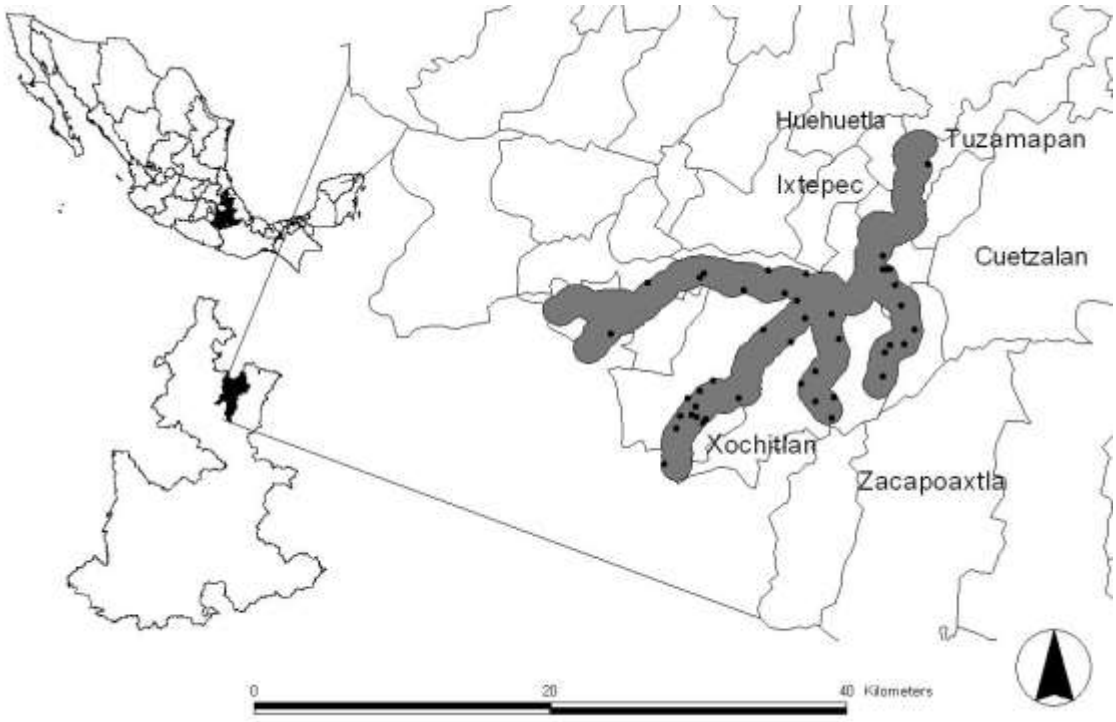

Figure 1. Cozoltepec River Canyon in the State of Puebla, Central Mexico

The interviewees were not able to comment on the otters' reproductive cycle; this is contrary to findings in areas where people depend on fishing (Gallo-Reynoso, 1989). Furthermore, in general interviewees did not differentiate males and females. However, there were two reports of pregnant females, which were declared to be more robust. In addition, interviewees reported observations of young individuals, distinguished by differences in their size, color and calls, between March and July. This information differs from observations of young individuals made in Sierra Madre del Sur, where mating occurs during the dry season (Gallo-Reynoso, 1989). Interviewees reported two cubs were accompanied by adults. In our study area, the main threats to neotropical otters are pollution, prey over-exploitation, habitat destruction, and hunting. All these threats were common in all surveyed communities, as well as in other areas in Mexico (Gallo-Reynoso, 1989; Casariego-Madorell et al., 2006). We found that otters were taken by some locals to be raised as pets (Ramírez-Pulido et al., 2005), but the main uses are as a source of protein (12) and for the skin trade (8). However, most of the interviewees (27) were not aware that otters are under protection and hunting them is prohibited.

The results obtained throughout this work were useful to prioritize areas significant for otter research as well as to propose a project to determine population densities and feeding habits in the region. Given the otters' secretive and solitary nature in Sierra Norte, we found that interviewees had little knowledge of otters. Regardless, the results were enough to determine their presence and distribution. We considered that the use of public participation is useful and necessary, especially in cases of poorly studied species. Furthermore, this information can provide a baseline to select study areas for fieldwork, which can help to save resources. Thus,

researchers should consider communities as a useful source of information in order to determine the best approaches for conservation projects.

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RÉSUMÉ

PARTICIPATION DU PUBLIC A LA CONSERVATION D'ESPÈCES PEU CONNUES: CAS DE LA LOUTRE A LONGUE QUEUE *Lontra longicaudis* (OLFERS, 1818) DANS LE CENTRE DU MEXIQUE

La participation du public est souvent négligée dans les projets de conservation en dépit des avantages potentiels que cela peut apporter notamment dans la détermination des zones prioritaires de conservation dans des paysages très fragmentés mais aussi à accroître les connaissances des espèces peu connues. Quoi qu'il en soit, il n'existe aucune information sur son application potentielle dans le centre du Mexique. Nous avons entrepris une évaluation préliminaire basée sur 30 interviews entre Décembre 2011 et mai 2012 auprès de chasseurs afin de déterminer la présence de la Loutre à longue queue (*Lontra longicaudis*), ses habitudes alimentaires, les périodes de reproduction et les menaces qui pèsent sur elle dans un

habitat fragmenté de la Sierra Madre Oriental. Vingt-trois des chasseurs interrogés ont indiqué que l'espèce est rare et solitaire et qu'ils ont observé des loutrons et des femelles gestantes se nourrissant principalement de poissons et de crustacés. La pollution, la pénurie de proies, les perturbations de l'habitat et la chasse sont les principales menaces pesant sur l'espèce. Nous avons vérifié les témoignages de présence par une enquête de terrain et les informations relatives au cycle de vie ont été validées *via* la littérature. Nous avons finalement conclu que la participation du public peut être intégrée en toute confiance dans les plans de conservation de la Loutre à longue queue dans la Sierra Madre Oriental.

RESUMEN

LA PARTICIPACIÓN PÚBLICA COMO UNA AYUDA PARA CONSERVAR UNA ESPECIE POCO CONOCIDA: EL CASO DE LA NUTRIA NEOTROPICAL *Lontra longicaudis* (OLFERS, 1818) EN EL CENTRO DE MEXICO

En general la participación pública no es tomada en cuenta en proyectos de conservación a pesar de sus beneficios potenciales para identificar áreas prioritarias para la conservación en paisajes fragmentados, o para incrementar el conocimiento de especies poco conocidas. A pesar de esto, no existe información sobre el potencial de aplicación de este método en el Centro de México. Por lo anterior, llevamos a cabo un estudio preliminar basado en 30 encuestas a cazadores para determinar la presencia, hábitos alimenticios, época de reproducción y cacería de la nutria de río (*Lontra longicaudis*) en un paisaje fragmentado en la Sierra Madre Oriental. Veintitrés personas respondieron que la especie es rara y se considera solitaria pero, han llegado a observar cachorros y hembras cargadas además; los entrevistados identifican a peces y crustáceos como los componentes principales de la dieta. La amenaza principal para la especie se considera la contaminación, sobre explotación de las presas, disturbios en el hábitat y cacería. Se verificó la presencia de la especie mediante trabajo de campo y el resto de la información se verificó a través de una revisión bibliográfica. De esta manera, se concluyó que la participación pública puede ser incorporada confiablemente al elaborar planes de conservación en la Sierra Madre Oriental.

A R T I C L E

THE IMPACTS OF ROADS ON EURASIAN OTTERS (*Lutra lutra*)

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Abstract: The Eurasian otter (*Lutra lutra*) has made a dramatic and very welcome recovery to many of the river systems within the UK, following its decline in the 1950s. This new expanding otter population is now seen to be under a threat from a range of anthropogenic causes and one such threat could be the increasing number of otter road casualties found on an ever expanding road network. Although roads kill many tens of otters in this country each year, evidence of otters recolonising new areas would imply that road casualties do not negatively affect the otter population as a whole. Road casualty otters are presumed to be highly visible and many are collected and submitted for post mortem. This data reveals a great deal about these otters but some animals may not be examined, and others missed entirely, due to non-recognition or complete destruction of the carcass by road traffic. Furthermore, data from road traffic casualties may be mis-leading in terms of population dynamics. This paper discusses what impacts these casualties may actually have on the population of otters in the UK. This paper was originally presented at the Mammal Society's Roads and Mammals Symposium, held at the Zoological Society of London in November 2003.

Key Words: road-kills, casualties, population-recovery, population-models, road traffic accident, RTA

INTRODUCTION

The publication of the 4th Otter Survey of England (Crawford, 2003) has confirmed that the Eurasian otter (*Lutra lutra*) is re-colonising much of its former range in England after the decline in population that started in the 1950s. The otter populations of Wales and Scotland have seen a similar, earlier recovery, (Andrews, Howell and Johnson, 1993; Green and Green, 1997) and increases in the geographical range and density of otter signs have been reported over much of Europe, (Conroy and Chanin, 2002; Kranz *et al.*, 2002*;* Reuther, 2002).

Despite this widespread success there are fears that this trend could be reversed. One possible threat is road traffic mortality. A review of causes of non-natural otter deaths highlighted this as a considerable and growing threat to otters in Europe nearly

two decades ago (Green, 1989). Since then road traffic has been more frequently cited as a major killer of otters throughout Europe. This paper discusses some of the existing studies and considers whether road traffic deaths are of an order likely to affect population growth or survival.

ROAD CASUALTY DATA

There is evidence that the number of otter road casualties across the UK is increasing. A study funded by the Highways Agency analysed data from 673 otter road casualties from around the UK recorded between 1971 and 1996 (Philcox *et al.*, 1999) (Figure 1). The analysis of these casualties identified particular trends based on season, distance from water, road type and crossing type. Another analysis has since looked at data collected from England and Wales up to 2003 (Figure 2) (Grogan, 2003). What is striking is the increase in road casualties between these two studies, (see Table 1).

A database of nearly 2000 Scottish otter road casualties, beginning in 1969, shows a rise from less than 10 records per year in the 1970s (average 3.5) to an average of 46.4 per year in the 1980s and 92 per year in the 1990s. The road with the highest recorded death rate, the A75, has had 356 otter deaths since 1985 and has a five yearly rolling average rising from 4.6 to 24.8 deaths per year.

Table 1. Numbers of otters killed by road traffic in Southwest England and Wales.

Years	Southwest England	Wales
1974-1996	147	177
1997-2003	341	245
Total	488	422

European authors (Madsen, 1996; Korbel, 1994; Rosoux and Tournebize, 1995; Heggberget, 1991; Frank *et al.*, 2002) have recorded an increasing toll of otters killed by road traffic in the 1990s, which has continued into the twenty first century (Heggberget, Rosoux, Libois, Madsen, Frank, Kranz, pers.comm.).

RELIABILITY OF DATA

A considerable number of otters are on record as having been killed on roads throughout Europe, but there are a number of factors which make it difficult to compare data or to analyse them. There is no way of knowing how the number of records relates to the number of otters actually killed or whether the distribution of age and sex recorded represents that of the animals killed. In some countries, such as Denmark, there is a mandatory system of sending all corpses and all records to a central institute for analysis, but in Britain there is no such systematic recording. There have been a number of studies funded to collect and analyse corpses and records, but these have all relied on short term and voluntary effort over limited geographical areas. Studies based on animals sent for post mortem examination, or to museums, are biased towards whole bodies, in good condition, which may influence factors such as distribution of age, sex or seasonal records in the sample. Intuitively, it is assumed that studies in parts of England, where otter populations are recovering, where many people are interested in wildlife, there is a strong public awareness of otters and publicity for the study, are likely to collect a higher proportion of the available data than in Scotland, where a dead otter is not particularly noteworthy. A map of the distribution of otter road mortalities in Scotland shows clusters of records which reveal more about the distribution of recorders than of otter deaths.

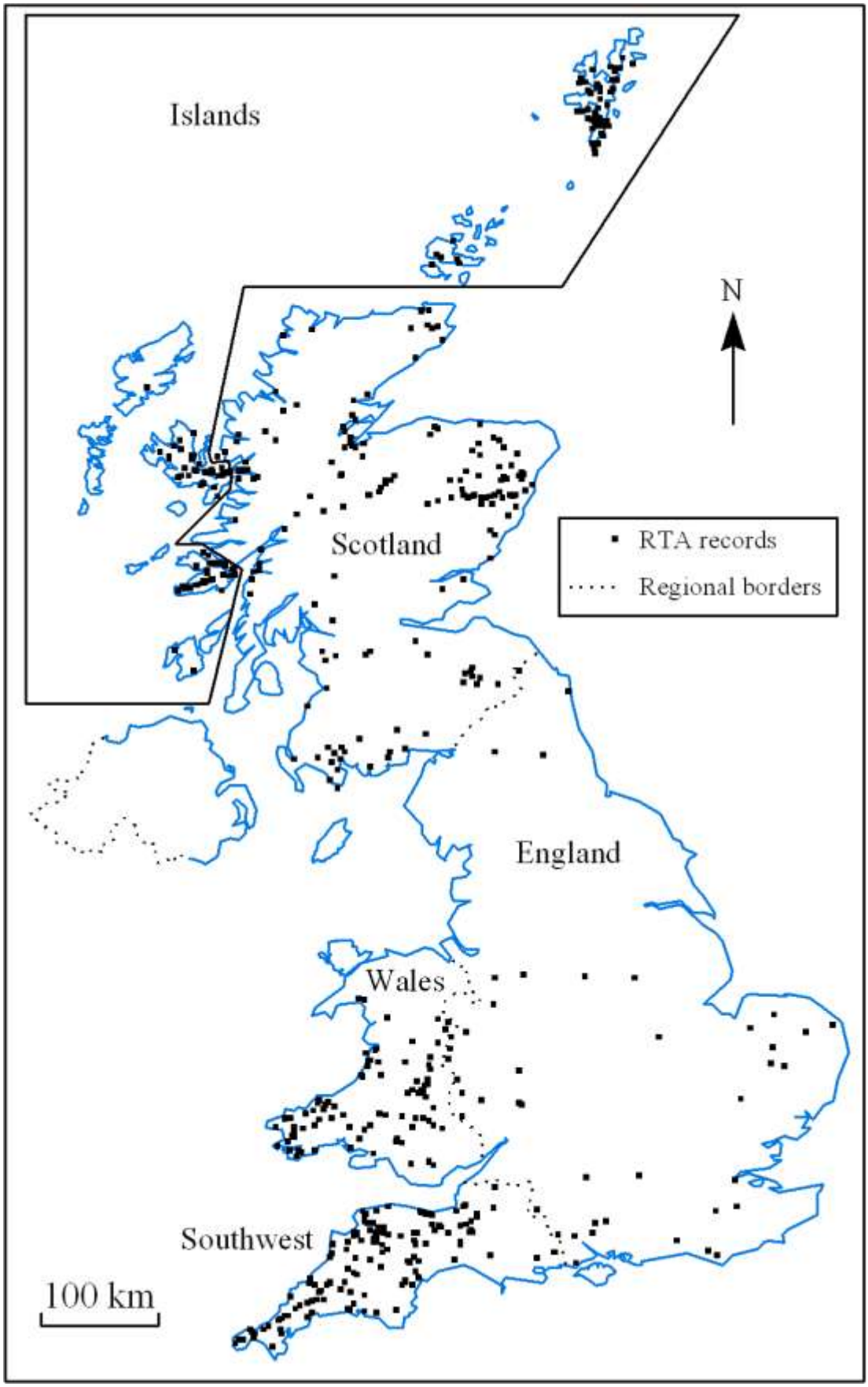

Figure 1. The location of casualty records and regions from Philcox et al., 1999.

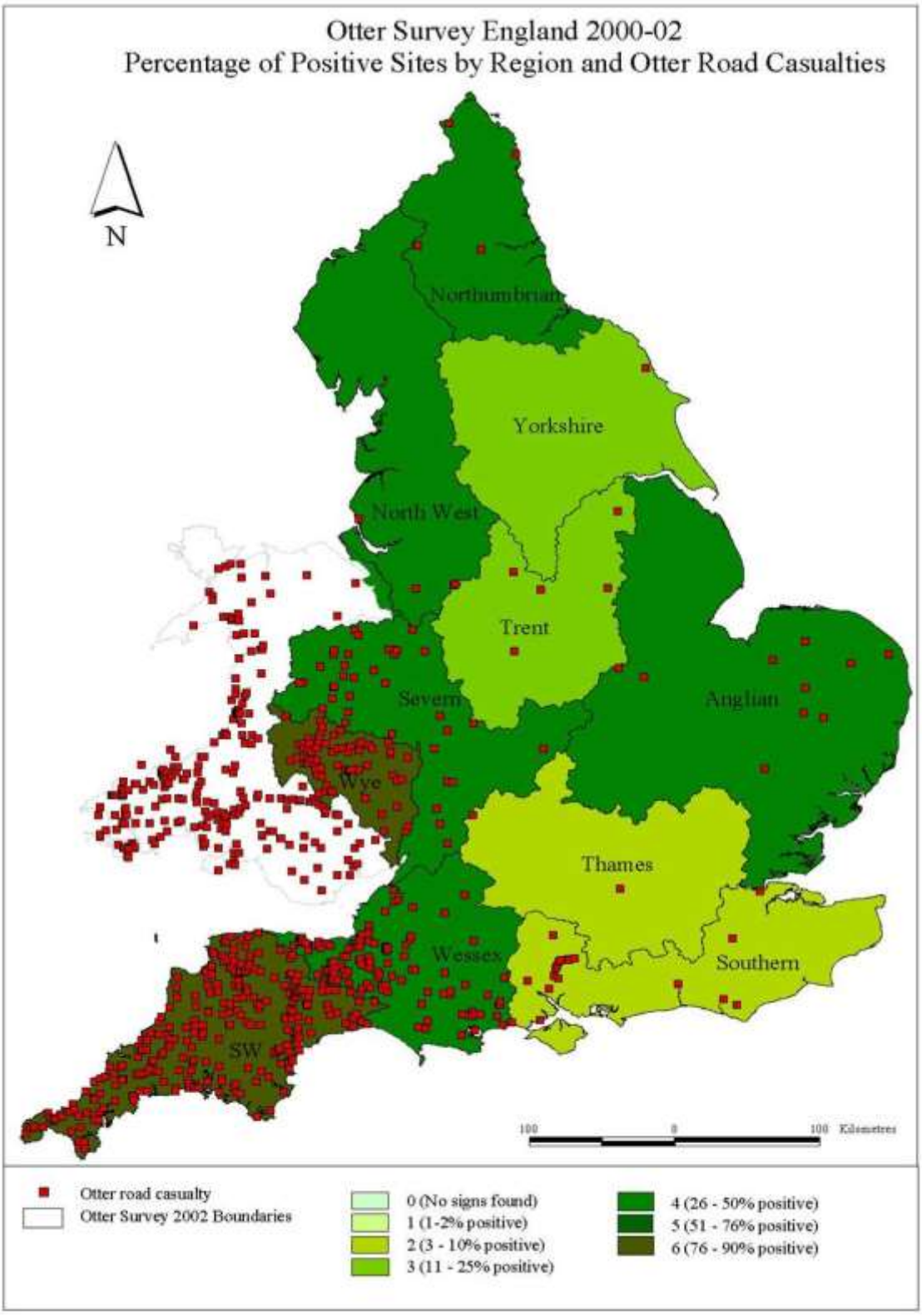

Figure 2. The location of casualty records for England and Wales to Spring 2003.

Within the available samples there is no way of knowing what proportion of the animals hit by vehicles is represented by those found dead on carriageways. Most records come from observers within vehicles, which give a restricted view of the roadside verge and very little beyond that, so it is possible that many more animals are hit, but survive long enough to get clear of the carriageway.

A database which collects records from a number of sources has many inherent problems of reliability. While members of the public may recognise an otter, they may not be accurate on sex, size, or location (and sometimes species). Animals may be reported several times by different people, all giving slightly different locations; unless each can verified it is not possible to tell whether one is dealing with a cluster of deaths or a case of multiple reporting. One otter on the Scottish database was reported six times between November 1995 and the following February, by five different people; it was only because the author (RG) checked it each time that it was known to be a single corpse. Excluding any unverified records, which could be multiple reporting should avoid over recording, but may result in considerable under recording of the true situation.

While all studies appear to show a similar distribution of deaths by season, this may be partly governed by the time of day when traffic is on the road, either killing otters or collecting records of dead otters. In spring and autumn rush hour traffic is around dawn or dusk while in winter the rush hour is after dark and in summer the rush hour is in daylight. Most records come from people travelling the same road regularly. The dip in numbers of records during winter could simply be the result of many recorders travelling in the dark.

A number of factors influence the time a corpse remains recognizable on the carriageway. Small corpses last less time than larger ones, the position on the road influences the time a corpse remains recognizable, corpses last longer in cold, dry weather and least time in hot, wet weather; scavengers or the action of traffic can move a corpse along or off the road, (Green, 2003).

While records of levels of road mortality must be used with care, they are the most readily available source of mortality data and of corpses for autopsy. The relative proportion of road mortality, compared with other causes, is heavily biased by its being by far the most easily observed and recorded.

All of these factors affect the validity of conclusions based on observations of otter road mortality and make it difficult to determine whether road mortality affects the population. Road casualty data cannot be taken as a true sample of the population; it is only representative of some of the otters killed by vehicles. This is not to say that the studies do not have a value in showing trends in mortality, in pinpointing areas where mitigation can usefully be deployed or in testing the effectiveness of mitigation measures.

IMPACT OF ROAD TRAFFIC ON INDIVIDUAL OTTERS

There is no doubt that traffic accidents will affect individual otters and that they are frequently fatal. Of 150 otters sent to a Scottish rehabilitation centre, only 21 had been injured by road traffic, or had injuries consistent with such a cause, of which 12 died or were euthanized and only 4 recovered sufficiently to return to the wild. Over the same time span more than 1000 otters were recorded as being killed by traffic in Scotland.

Autopsies of 67 otters from Scottish roads showed that 10 did not die immediately of their wounds and that 7 had signs of previous collisions with objects hard enough to have broken bones or damaged internal organs, which probably indicated earlier traffic accidents. Some of the animals which died as a result of collisions with vehicles had trauma from earlier bite wounds and some of the animals presenting as victims of intra specific fighting had older wounds from collisions. Simpson (1998) also reports some animals showing signs of earlier traffic accidents. Green and Green (2002) showed that the more impaired an otter is, the greater its

chance of incurring another injury. Even if an otter recovers from the injuries cause by a traffic accident it is at increased risk of a subsequent collision, of damage from other otters or disease and therefore less likely to breed successfully.

The welfare implications can extend beyond the fate of the individual otter in such collisions; if a female is killed dependent cubs are unlikely to survive. Family groups have been recorded as casualties all over Scotland, with mother and cubs dying together or the deaths spread over several days. Even if the cubs do not die with their mother, unweaned cubs will starve in the holt and older cubs are likely to die as they depend on their mothers for many months. It is also not uncommon for pairs of sub-adult otters to be killed together.

Data are sparse, but it appears that pregnant females are particularly at risk from road traffic. Out of 164 autopsies 62 (38%) were adult females and of these 14 (23%) were described as heavily pregnant (R. Green, unpublished data) or as having well formed foetuses *in utero.* If these animals are taken to have been in the second month of their pregnancies (gestation 60-62 days in otters) (Heggberget, 2002) and the breeding cycle is taken to last 14 months from conception to dispersal of offspring, then around 7% of females killed would be expected to be in the second month of pregnancy. This limited sample has more than three times as many such females. Data from the A75 also suggests that lactating females are over represented in the female sample, but numbers are very small.

POTENTIAL IMPACTS ON OTTER POPULATIONS

The impact of road traffic mortality on populations is much harder to assess. There have been many otter surveys throughout Europe, but none of them are designed to give population estimates, so although we know that the geographical range of the species is increasing and we can infer from survey results that population density is increasing, we have no numerical data against which to measure the impact of road mortality. We also have no estimate of the total number of animals killed by road traffic, although it is certainly larger than the data available. The impacts of this cull will also be affected by its geographical distribution, the status of the local otter population, the varying impacts on sex and age classes and the level of other causes of mortality.

Otter road mortality is not evenly distributed, but is affected by local topography as well as the geographical range of the otter population. For otters to be killed on roads they have to be present in the area, but it is not known whether there is a proportional relationship between the level of population shown by surveys and the number of otters killed in the area. The population in a newly recolonised area, or one with a remnant population, may be more severely affected than an established population; it is certainly more vulnerable. The distribution of particular forms of road engineering has a bearing on levels of mortality. The level of mortality varies with road class and traffic volumes, flows and timing. Road traffic mortality does not affect age and sex classes within the otter population equally. Other mortality pressures are not evenly distributed in time or space either and all of these factors interact.

If roads are random killers, unlike predation and disease which target the weak, usually the young and the old (Kruuk and Conroy, 1991), then equal numbers of males and females, (or at least a representation of the true wild ratio) should be killed. However all the studies listed below show a bias towards males in the samples (Table 2). This demonstrates that there must be behavioural traits that make males more vulnerable than females over most of their lifespan. This is possibly due to males

ranging further than females and that young males, in particular, have to travel further to establish home ranges (Heggberget, 1991; Philcox et al., 1999). Behaviour is a significant factor; males are less cautious, less afraid of strange things and more inclined to explore (Green, 1989; 2000). The denser an otter population, the more redundant males there will be, so it might be expected that there are more male deaths in well-established populations. Pregnancy and lactation are times of high energy demand and the added stress of caring for hungry, curious and mobile offspring make adult females vulnerable at the most important time of their reproductive lives.

It is interesting that when wild otters have been studied using other methods of data collection, such as fur trapping, there is a bias towards females in the population (Sidorovich, 1991), which is not explained in the casualty data (Ansorge et al., 1997). To try and understand the otter population structure, Ansorge et al. (1997), created a model by extrapolating from otter casualty data. This model shows a bias towards females in all age groups over one year old, with an average lifespan of around 4.7 years (this is higher than shown by Kruuk and Conroy, 1991). This intuitively makes sense; adult females, surviving to this age, would be able to produce 2 or 3 litters in their lifetime, possibly more. This rate of production would be required for an expanding population and could explain the otter's expansion in the face of an increasing death toll, although the model does have inconsistencies. For instance it indicates that the ratio of males/females killed in their first year is 1:1, while one study of otter carcasses found a ratio of 0.8:1 for this age group (Heggberget, 1991), although the other age groups concur with the model

Table 2. Comparison of sex ratios in otter carcasses from different studies

Study	**total**	**ratio M:F**
All A75 records Adults	110	2.23:1
All A75 records	356	2.1:1
Regular drives	29	2.63:1
All Scottish records	1776	1.65:1
Yoxon 1997	51	2:1
Madsen 1996	115	1.6:1
Korbel 1994	230	1.3:1
Rosoux and Tournebize 1995	50	1.5:1
Kruuk and Conroy1991 all deaths	113	0.95:1
Heggberget 1991 road deaths	185	1.4:1

STUDY OF OTTER MORTALITY ON THE A75

In view of the deficiencies of data listed above, a systematic survey of a single road was undertaken, with the primary aim of obtaining a minimum estimate of the number of otters killed over a known time and distance and of extrapolating from a situation of constant observer effort to one of variable effort to obtain an estimate of total kill.

The A75, a rural trunk road running 156km from the M74 interchange at Gretna to the ferry ports on Loch Ryan in southwest Scotland was chosen. The area has a human population density of 23.2/square km. The road runs east to west along the north shore of the Solway Firth, never more than 20km from the sea. Because the drainage pattern is north/south the road crosses every major and most minor water courses. Traffic flows are dominated by the Northern Ireland ferries plying out of Loch Ryan with convoys of heavy freight vehicles at night, however despite the ferry traffic, overall traffic levels are low. The average volume of traffic on British rural trunk roads is 15,600 per day, whereas the A75 has around 8,000 vehicles on the busiest stretches and only 4,300 in quieter parts.

The A75 also had a substantial number of detailed records of otter road mortality dating from 1985 and has had fairly consistent observer effort for 18 years. There have been fluctuations in mortality levels from year to year, but five yearly rolling averages for the A75 show a depressing upward trend set against a constant high level of otter population.

Data from the Scottish Executive shows that traffic on the A75 has been increasing over winter months and decreasing in summer, but has still remained reasonably constant between 1996 and 2002 (Scottish Executive, 1998 – 2003).

Every month from July 1996 to June 1997 the road was driven in both directions in the second and fourth week, at a steady 45pmh, unless traffic conditions or speed limits dictated a slower speed. All corpses and locations were recorded on a voice-operated tape recorder and otters, badgers or remains, which could possibly be of these species, were checked on foot, aged, sexed and accurately located. The condition of both new corpses and any remaining from previous drives were noted to assess survival rate of bodies of different sizes and in different parts of the road. Colleagues using the road were apprised of the study and asked to pass on data to assess the scale of multiple reporting. When the drives were completed all mortality sites on the A75 was visited and the vicinity checked, measured and described.

Before the study started 103 otter deaths had been recorded from February 1985 to June 1996 on the A75. Thirty eight dead otters were seen on 24 drives, a further 12 were recorded by the author or others during the time span of the study, but had disappeared by the next drive, and 10 were recorded up to the end of 1997. Despite publicity only one death recorded on the regular drives was independently reported. The total recorded death rate was 50 otters over 156 km and one year. Since 1990 the A75 has had an average recorded death rate of 20 per year with a maximum of 41 in 1996 of which 24 were recorded during the study. The highest yearly total, apart from the study was 35 in 2001. Total recorded deaths on the A75 currently stand at 356.

Drives at two weekly intervals were not adequate to pick up all deaths, but, by analysing survival of corpses it was estimated that around 14 may have been missed, (Green, 2003). The extra twelve records collected are therefore considered to bring the results close to the total of animals killed. Comparison with death rates recorded on the A75 in other years show that the year chosen had not an abnormally high number of deaths. Similarly the authors have noted that the variation in recorded death rates on other trunk roads appears to be largely accounted for by the differences in observer effort

The A75 had one death/3.12km/year over the study period, which was estimated to be close to the total kill. If otter deaths occurred at the same rate on all of Scotland's 53,000 km road network, the total death rate would be around 17,000. However otters are not killed at the same rate on all road classes. Extrapolating from the rate on the A75, the other 2793km of trunk roads in Scotland would be expected to have a yearly death rate of 895 otters. Otter deaths on trunk roads, other than the A75 amount to 439, or 24.7% of the total database so if 895 equals 24.7% of the total kill, 100% would be 3623, plus the 50 from the A75, giving an estimate of 3673 otter killed each year on Scotland's roads.

There is little systematic data from mainland roads to check the validity of this estimate, however comparison with data from other Scottish roads suggests that it is in the right order of magnitude (Green, 2003)

What does this mean in population terms for Scottish otters? Harris *et al.* 1995 estimated the Scottish otter population at 6,600 +/- 3,300 adults (class 3 population estimate). Using this method and the results of the most recent published survey of

Scotland (Green and Green, 1997) gives us a figure of between 8 and 10,000 (4,800 – 7,200 on the mainland and 3,000 on the Islands). The adult death rate (31) on the A75 gives a ratio of one death/5.03km/year which would give a figure of 555 adults killed on trunk roads and an annual rate of 2,279 adult otters killed in Scotland. Alternatively, the percentage of adults on the national database (75.4%) can be used with the estimated total death rate, to give a figure of 2,771 adults killed per year.

Taking an estimated population size of around 9,000 otters (mid-point of the estimate), the annual adult death would be 25 to 30 percent of the population. The impact of a cull of this size depends on the levels of other external pressures and also on how the mortality is distributed geographically and among sex and age groups within the otter population. Analysis of deaths on the A75 suggests that road mortality bears more heavily on adult males and young animals than has been reported before, and therefore the estimate of a 25% adult death rate is considered more probable. It is worth noting that this is similar to estimates of adult deaths from road traffic in British badgers (Harris *et al.,* 1995).

MODELLING THE IMPACT OF ROAD TRAFFIC ACCIDENTS ON THE SCOTTISH OTTER POPULATION

One method of determining if such high rates of culling could be affecting the species at a population level is to build a model, using the available data and extrapolating to see if it has any effect. To do this, a Leslie matrix model was used. The population was split into 13 age classes and mortality and fecundity data were derived from the literature (e.g. Kruuk and Conroy, 1991). The RTA mortality data was taken from the A75 study as described above and the starting population was estimated at 8,000 animals.

For this study, a sensitivity analysis (Figure 3) was undertaken, varying the parameters of the regression relating mortality to age (Kruuk and Conroy, 1991), fecundity and RTA mortality. A General Linear Model was used to investigate contribution of each parameter to population size at year 10. To assess the impacts of RTA mortality on population, average demographic parameters were used in the model, such as average age, birth and death rates as derived from Kruuk and Conroy (1991) with RTA mortality varied between 0 and 40%.

TABLE 3. Results of sensitivity analysis

Coefficients:	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	5.06440	0.44956	11.265	< 2e-16 ***
fecundity	1.88031	0.03174	59.239	< 2e-16 ***
gradient mortality	-0.39592	0.06292	-6.293	9.83e-09 ***
constant mortality	-0.08873	0.03198	-2.775	0.00666 **
juvenile mortality	11.29710	0.31089	36.338	< 2e-16 ***
RTA mortality	-12.12120	0.19568	-61.945	< 2e-16 ***

IMPACTS OF RTA ON POPULATION SIZE

The model indicates that with a population of 8,000, RTA mortality in excess of 15% can reduce populations of otters, but this model does not take into account evidence that suggests that only the very old and the very young are the main subjects of RTA mortality. Therefore the model was re-run with an emphasis on RTAs mainly impacting on juveniles and animals greater than five years old.

This revised model suggests that if mortality is concentrated in these two age classes then there is less impact on the population as a whole. Therefore it seems

likely that otter populations can tolerate reasonable levels of road casualties provided that it is the non-productive age classes that are killed.

Road Casualties in the Southwest

The study of the A75 has addressed the problems of data collection by standardising collection effort on a road where speed and traffic density could be measured and accounted for. This in turn could be representative for Scotland, where there are many kilometres of trunk road similar to the A75. But how representative would this be in England? As there has not been a systematic study of road casualties in England like the study described above it is difficult to compare, although there are similarities. For instance, where the Scottish database records 24.7% on trunk roads, 27.6% are killed on trunk roads in Southwest England. But the distribution of trunk roads vary, so that in Cornwall trunk roads account for 40% of road casualties, but Cornwall has a lower percentage of kilometres of trunk road as part of its road network.

Table 4 emphasises the differences. The A75 study demonstrated a death rate of one casualty per 3.12 km of road a year. Trunk roads in Cornwall show a rate of one casualty per 24.18 km a year. This demonstrates the difficulties with the data. The percentage positive sites from Cornwall and Scotland are both reasonably high. So should we expect a similar casualty rate from two such different areas? In Scotland, most deaths could be divided into those largely influenced by topography, those influenced by road engineering and those resulting mostly from otter behaviour. Some were affected by more than one feature. If a certain design of culvert is installed in a certain sort of habitat the result will definitely be road casualty otters. For others, behaviour and topography or engineering feature interacted fatally.

Table 4. Comparison of otter deaths on trunk roads for different regions of the UK from June 1996 to July 1997

	A75	Scotland excl. A75	S. West	Cornwall
% positive sites from surveys	97% (1997)	88% (1997)	66.8% (1996) 83.2% (2003)	59% (1996) 76% (2003)
Trunk road km	156	2793	999	266
% of road network	0.26%	23.4%	15.7%	3.6%
No of casualties on trunk roads	50	468	10	6
No of casualties on database	1360	1360	36	36
% of database	3.7%	24.7%	27.8%	16.7%
casualties /km/year	1/3.12	1/8.31	1/99.9	1/44.34

EFFECTS ON POPULATIONS

There is already good evidence to demonstrate that the otter population in the UK is expanding, but as discussed earlier, the difficulty lies in knowing the size of the population and whether it is increasing, stable or decreasing. The otter surveys may give an indication of density as it is possible to extrapolate a number of otters using

data from these surveys. Harris et al. (1995) suggested that there were 350 adult otters in England with 196 in the Southwest. Using the same calculation as Harris et al. (1995), but with data from the most recent survey gives us figures of 1634 and 373, respectively. With 78 road casualties in SW England in 2002, this equates to 20% of the population, which is less than that for Scotland, using the same technique. Of course it should be remembered that this is for recorded otter casualties only and that there is a bias in terms of recorder effort. As the figures for Scotland are based on a systematic survey of one particular road, then a similar survey in Cornwall could highlight the disparity between the perceived and actual road kill.

It is understandable that an increasing otter population would lead to more deaths on the road. Otters appear not use the whole of their home ranges equally when radio tracked. If they are under greater population pressure they might spend more time in, and exploit more thoroughly, their core areas, at the same time loosening their hold on the sub optimal fringes, so travelling less. If there is one or more road in their range, then they may have to pass it more frequently. Conversely, disruption in the otter population could lead to higher emigration, which again, would result in larger numbers of otters having to cross roads, in order to access new areas.

Data from road casualties is biased due to the method of collection, and this is demonstrated by studies of wild populations caught by other means, such as trapping e.g. Sidorovich (1991). Most studies of dead otters identify roads as being responsible for the greatest number of casualties, although the percentages vary from 42% (Kruuk and Conroy, 1991) to over 80% (Simpson, 2000). Otter carcasses on roads tend to be easily seen (but not for long) and recorded, if not collected. Animals killed by other causes, such as disease, may remain underground, be washed away by currents or tides and so many will not be found and recorded, unless there is a systematic search for carcasses as part of a research program. It is therefore impossible to determine what percentage of otter deaths are caused by roads and what are caused by other causes.

The study of the A75 showed a greater ratio of males, particularly adults, than have been reported in any other study, and this is in a well-established, abundant population. The number, but not the proportion, of old adult males and females found during the regular drives were equal, but in the young adult class only males were found. If all animals killed in those twelve months are considered, the difference is more marked, with 45% of males being young adults, but still no young adult females being found. Numbers of adult females were small, but it is notable that 60% of adult females were aged compared with 16% of adult males. The otter's mating system is thought to be a promiscuous one, being both polyandrous and polygynous and such a system would require fewer males of breeding status than females (Heggberget, 1991). As a result, young independent males need to acquire a higher social status in order to breed and so may be inclined to be less cautious and travel further in order to achieve this. They may also be more inclined to fight and injured animals are at more risk from roads. It could be argued that all road mitigation might achieve is a reduction in the deaths of the least reproductively important part of the population and this could then result in a greater number of otters killed or injured from fighting.

So are road casualties are important in terms of population? The data from the most recent otter survey would imply that the otter population in England is increasing (Crawford 2011). As the otter population appears to be expanding, there must be a greater number of births than deaths (of any cause). In addition, evidence of otters from areas where previously none had been recorded in over 30 years (including some road casualties) would imply that emigration is also occurring. It is

interesting to note that there are consistent and increasing high levels of road casualties recorded in Scotland, with no evidence of population effects. So if otters are restricted by road casualties, it is most likely at a local level, where otters are re-colonising and it is here that such losses need to be avoided. Targeted mitigation can be used to ensure that safe passage is available for otters to move to new areas, allowing them to re-colonise their former haunts. Mitigation can also be targeted at locations where clusters of casualties occur, so called "hot spots". Such hotspots could be the result of particular combinations of engineering and topographical factors and may have less to do with the state of the otter population. This can be demonstrated by the sudden cessation of deaths if the problem is sorted out.

Subsequently, otters have continued to extend their distribution in the UK despite the numbers of road casualties continuing to increase (Chanin 2006) implying that they have yet to have a negative effect on the population. Furthermore, otter carcasses continued to be collected and submitted for post mortems, as part of an ongoing programme investigating heavy metal contamination of the environment. These studies provide a fascinating insight into otter populations, such as the discovery of parasite not before recorded in the UK (Simpson, 2007). Perhaps more important are the numbers of casualties examined from southwest England that showed signs of being bitten by other otters, perhaps indicating that as the density of otters increases, there are more fights between animals (Simpson, 2007). Another study covering most of England and Wales reports that there was a trend towards younger animals in the animals studied (Chadwick, 2007)

In conclusion the evidence appears to suggest that road casualties do not seem to prevent otter populations from expanding although there may well be other effects, such as increased fighting between animals. However all populations have to account for a death toll, and in the absence of predation by any other means, road casualties are one way of limiting otter numbers. This does not mean that mitigation is not required. It should still be encouraged as a conservation tool in areas where otter populations are still low and recovering, and it should be used as a welfare tool to limit the potential injuries to otters and the indirect effects of road casualties, such as orphaned youngsters.

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RÉSUMÉ

IMPACT DU RESEAU ROUTIER SUR LA LOUTRE (*Lutra lutra*)

La Loutre d'Europe (*Lutra lutra*) a fait un retour spectaculaire et bienvenu dans la plupart des réseaux hydrographiques du Royaume-Uni et ce suite à son déclin dans les années 1950. Cette nouvelle population croissante est aujourd'hui confrontée à diverses menaces d'origine anthropique et l'une d'elles pourrait être le nombre croissant de victimes de la route sur un réseau routier en constante expansion.

Alors que dans ce pays les routes tuent plusieurs dizaines de loutres chaque année, les loutres recolonisent de nouveaux domaines sous-entendant que les victimes de la route n'ont pas d'incidence négative sur la population dans son ensemble. Les victimes sont présumées être très visibles et de nombreuses sont prélevées puis autopsiées. Ces données révèlent beaucoup de choses sur ces loutres alors que certains animaux ne peuvent être examinés ou non prélevés car méconnaissables ou totalement détruits par le trafic routier. De plus, les données de victimes de la circulation routière peuvent contribuer à une meilleure compréhension de la dynamique de la population.

Ce document examine les impacts que ces victimes peuvent avoir sur la population de loutres dans le Royaume-Uni. Ce document a été présenté lors du Symposium sur les routes et les mammifères de la Mammal Society qui s'est tenu à la Société Zoologique de Londres en Novembre 2003.

RESUMEN

IMPACTOS DE LAS RUTAS EN LAS NUTRIAS EUROASIÁTICAS (*Lutra lutra*)

La nutria euroasiática (*Lutra lutra*) ha experimentado una dramática y muy bienvenida recuperación en muchos de los sistemas fluviales en el reino unido, luego

de su declinación en la década de los 50s. Esta nueva población de nutrias en expansión, actualmente es vista como bajo amenaza debido a un espectro de causas antropogénicas, y una de tales amenazas podría ser el número creciente de muertes de nutrias en las rutas, que se registra en una red vial en permanente expansión.

Aunque las rutas matan muchas decenas de nutrias por año en éste país, la evidencia de que las nutrias recolonizan nuevas áreas implicaría que las muertes debido a las rutas no afectan negativamente a la población de nutrias como un todo. Es de presumir que las nutrias muertas en las rutas son altamente visibles, y muchas son colectadas y enviadas para examen post mortem. Estos datos revelan mucho acerca de estas nutrias, pero algunos animales puede que no sean examinados, y otros pasados por alto completamente. Debido a que no hayan sido reconocidos, o a la destrucción completa de los restos por el tráfico vial. Más aún, los datos provenientes de muertes en rutas pueden ser engañosos en términos de dinámica poblacional.

Este trabajo discute qué impactos estas mortalidades pueden realmente tener sobre la población de nutrias en el reino unido. Este trabajo fue presentado originalmente en el simposio de la mammal society sobre rutas y mamíferos, llevado a cabo en la zoological society of london en noviembre de 2003.

O S G M E M B E R N E W S

Quadrennial Review

To comply with SSC policy, we have to review our membership every four years, and the Chair must appoint group members and officers for the next four years (Quadrennium). We are currently undergoing this process.

Update 1 Aug 2013: We have finally finished this process, which began on 11th April - it has taken more than three months. Thanks to all of you that responded promptly.

New Members of OSG

Since the last issue, we have welcomed 21 new members to the OSG

Omar Fadhil Al-Sheikhly, Iraq: I'm teaching at the Department of Biology in the University of Baghdad. lecturer and wildlife expert at the Iraq Natural History Research Center and Museum. Also worked as a field team leader and wildlife photographer, CBD and CITES focal point of Nature Iraq. I've trained many Iraqi young biologists working at Iraqi environmental institutes and Iraqi Ministry of Environemnt IMoE on wildlife field methodology. I have photographed most of the birds and mammals of Iraq, and published books and papers on them. I took part in the first Nature Iraq survey to find out if *Lutrogale perspicillata maxwellii* still exists.

Kelly Ashcraft, USA: I am a PhD student in the Marine, Estuarine and Environmental Science Program at the University of Maryland where my research will be focused on assessing the value of river otters as a tool to promote aquatic education and awareness at Yellowstone National Park. In addition to research, I enjoy working with the public on issues related to river otter conservation.

Guido Ayala, Bolivia: I work on the giant otter, the queen of water. The giant otter is an indicator of habitat in good condition. I am working on her distribution in northern Bolivia, which is little known.

Yvonne Black, UK: I am a veterinary surgeon in small animal practice with a longstanding interest in wildlife and conservation. I am currently working towards an MVetSci in Conservation Medicine with University of Edinburgh. I have a keen personal interest in otters and they often feature in my studies!

Alvaro Botelo-Botelo, Colombia: I have been working on the conservation of neotropical otters in the central Andes of Colombia for four years. My areas of interest are diet, habitat use and the conservation of aquatic ecosystems.

George Bouros, Romania: I work for the Romanian Association for Biodiversity Conservation (ABC), surveying and monitoring otters in Romania. I recently surveyed the Natura 2000 protected areas likely to contain otters and found previously unrecorded evidence in five parts of Romania. I am currently surveying

Putna-Vrancea Natural Park using he Standard Method, Spot Check, Snow Tracking, Photo-Trapping and Diet analysis.

David Field, United Kingdom: Owner of the Dartmoor Otter Sanctuary; working on Conservation, education, breeding and rehabilitation of the European otter as well as research and raising public awareness through our visitor centre and website

Melanie Findlay, UK: I run a small ecological consultancy in Scotland, and run otter surveying courses for the Institute of Ecology and Environmental management (IEEM), and myself worked on the latest SCM otter survey. I am particularly interested in the breeding ecology of otters in Scotland.

Tatjana Gregorc, Slovenia: I work at Lutra, the Institute for Conservation of Natural Heritage, in Slovenia. My fields of special interest are semi aquatic mammals (especially otters) and environmental impact assessments. During past 7 years I have gained a lot of experience in field work (otter inventory, monitoring, habitat assessment) and was involved in several projects dealing with otters (researches, public awareness raising and education).

Jimena Guerrero-Flores, Mexico: My name is Jimena Guerrero (PhD student in Glasgow University) and I am interested in using genetic methods to find out how natural landscape and man-made disturbances can affect long-term survival of endangered otter populations.

Meoghan (Meg) Harris, USA: My PhD is on The effect of habitat fragmentation onf the spatial ecology and bioaccumulation of small carnivores in the Lower Kinabatangan Wildlife Sanctuaty, Sabah, Borneo. I am also a Research Assistant for Kinabatangan Carnivore Programme, managing live trapping of Sunda clouded leopard (Neofelis diardi) and small carnivores for spatial ecology research.

Prashant Joshi, India: Zoo educator and curator, working on education/outreach with visitors and in schools. I an in charge of the Wildlife Interpretation Centre at the zoo. I work on husbandry and enrichment programs with our Smooth-Coated Otters, *Lutrogale perspicillata*, which are successfully breeding.

Roohollah Mirzaei, Iran: I work on distribution, ecology and habitat of Eurasian otters in Iran.

Rosemary Moorhouse-Gann, United Kingdom: I am the Assistant Project Manager of the Cardiff University Otter Project and am responsible for the day-to-day management of the project. This includes carrying out post mortem examinations, compiling reports, publicising the project, and developing new avenues of research.

Nicola Okes, South Africa: I am currently doing my PhD on Cape Clawless Otters in urban environments. Prior to this I was a research officer with TRAFFIC working on marine resources, and a Programme Officer for WWF South Africa on sustainable fisheries.

Stephen Powles, United Kingdom: Amateur naturalist and keen wildlife photographer who studies a local otter population in mid Devon (UK) using field

signs, CCTV and camera traps. In the process of setting up a "citizen science" project using camera traps to both study the otters and to engage the local community.

Livia Rodrigues, Brazil: I am a Brazilian biologist and study otters since my graduation. Actually, I work on the National Research Center of Carnivore (CENAP), agency of Brazilian government. The research center's mission is to stimulate research and conservation of mammalian carnivores in Brazil. In 2010 was elaborated a National Action Plan of Giant Otter, which include neotropical otter too. Inside the CENAP, I am responsible for this National Action Plan, which includes coordinating the implementation and monitoring of the actions of the plan.

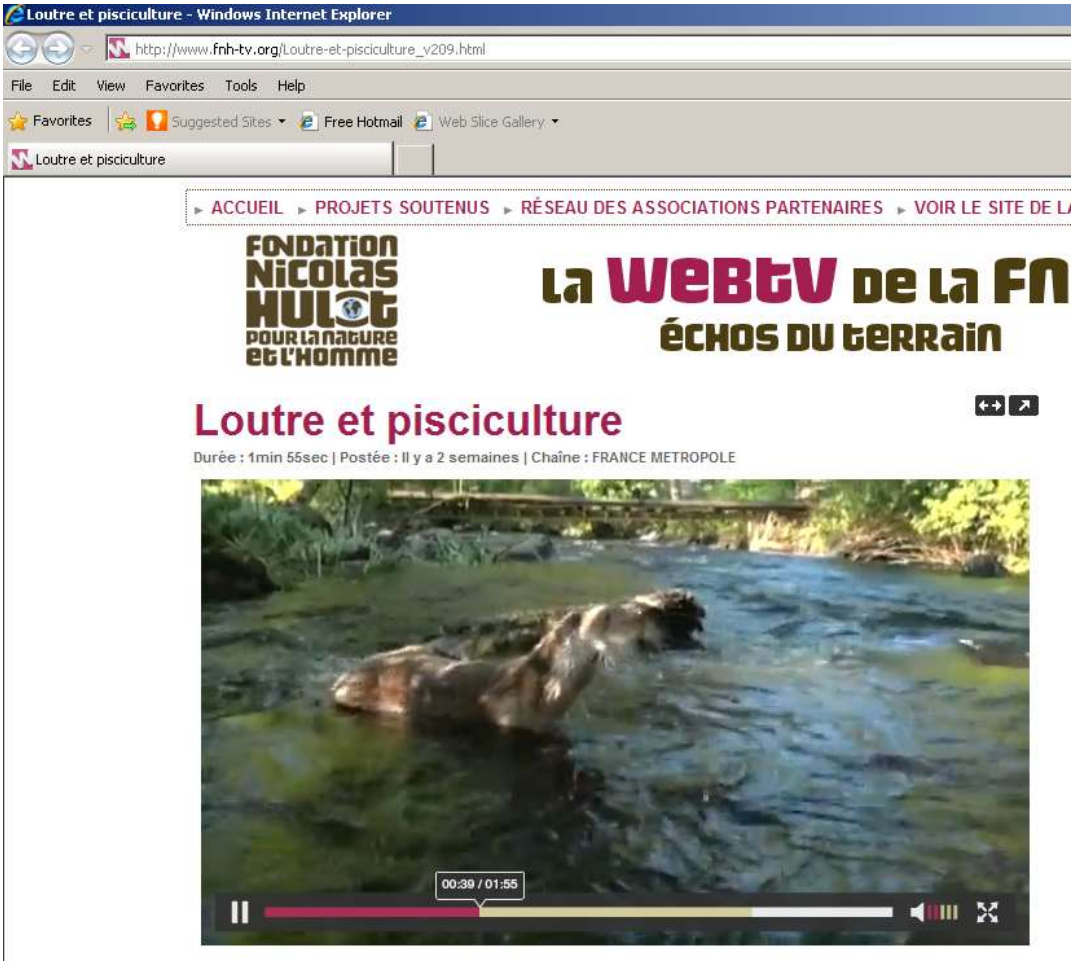
Lizzie Ross, United Kingdom: I actively survey across Northumberland for otter signs and am a co-founder of The Otter Network which is a community group for otter enthusiasts in Northumberland, Newcastle-Upon-Tyne and Durham. Our current collaboration is with the Waterford Institute of Technology investigating DNA analysis of spraint as a monitoring and research tool.

Willow Smallbone, United Kingdom: Currently on professional training year as a research assistant with Cardiff University Otter Project . As part of this, I am assisting in various research projects, post mortems, report writing as well as volunteer recruitment and coordination.

Alejandro Valenzuela, Argentina: Dr. Valenzuela did his dissertation studying the ecology of the southernmost population of the southern river otter (*Lontra provocax*), especially its conservation and relationship with the invasive American mink (*Neovison vison*). Interested in wildlife conservation and management, his current work for the Argentine National Parks Administration focuses particularly on improving our understanding of the social/policy making issues around the conservation of this endangered otter, while coordinating native and exotic fauna research, monitoring and management for the protected areas throughout southern Patagonia.

Nicci Wright, South Africa: Nicci Wright is the Senior Animal Manager for FreeMe Wildlife Rehabilitation Centre based outside Johannesburg, South Africa. Although she works with all Southern African indigenous species, Nicci has gathered much hands-on otter experience with handrearing orphans, rehabilitating compromised adults and formulating monitored release protocols for these cases.

VIRTUAL OTTER



SCREEN SHOT OF THE MONTH

http://www.youtube.com/watch?v=MmkEKxw4l-U

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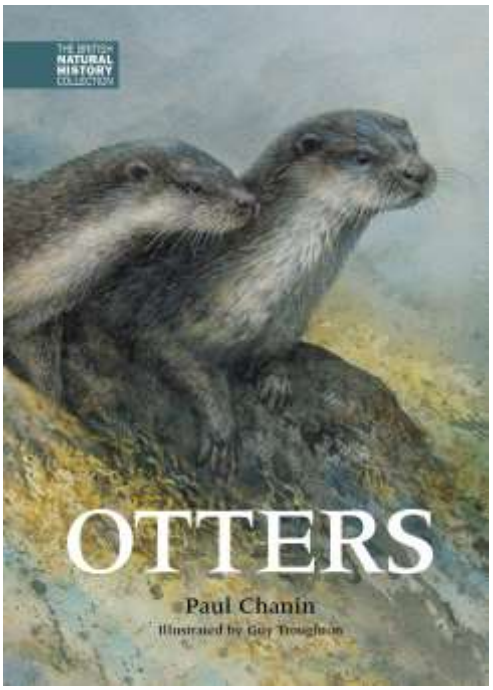

Otters
Paul Chanin
Illustrations by Guy Troughton
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From the lines of the Acknowledgements with which the book starts on page 1 to page 150 with the last lines of the index it is a mere pleasure to read this book. Written in an easy understandable tone lots of valuable information on otter biology (*Lutra lutra*) is given. This book is interesting for the amateur who will learn a lot about otters, ranging from their behavior, threats, feeding habits, the decline and recovery of otters in England to otters and minks and otterhounds. For the experienced and wintered scientist the personal anecdotes that mention the work and life of many otter specialists make it worth reading! Some excellent pictures (Laurie Campbell) and the nice illustrations (Guy Troughton) are absolute eye-catchers. Generally the book has been considerably updated based on recent scientific knowledge and describes the state of the art in a well readable way with a good dose of humor and understatement. Personally I liked the phrase:" The main ´predator` of otters today ….. is the motor car."

Arno

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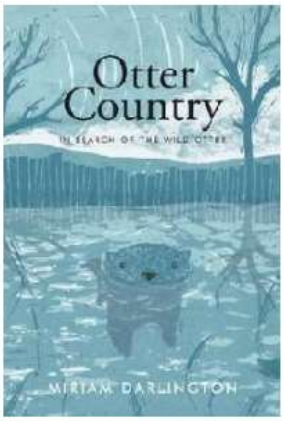

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Synopsis

A mesmerising account of the author's search for wild otters in the remote places of Britain; a beautifully written blend of natural history, memoir, literary history and travel.

Trade review

An account of the author's search for wild otters in the remote places of Britain, which blends natural history, memoir, literary history and travel writing. Darlington, a prize-winning poet, travelled from her home in Devon to the wilds of Scotland, to Cumbria, Wales, Northumberland, Cornwall and Somerset in search of the aquatic mammals. Illustrated with endpapers and line drawings, making it a great gift.

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